

Published Papers (2024-2026) Improved and Extended Using Ram Calculus by Reformulating and Re-solving the Problems Addressed in the Papers

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Overview

This is a catalog of papers published around 2024-2026 and their corresponding technical reports. Each technical report listed after a paper is based on that paper, but reformulates and re-solves the problems addressed in it using the novel Ram Calculus theory, algorithms, tools, and techniques, all invented by the author of this catalog. The resulting solutions often constitute substantial improvements over those in the paper in terms of accuracy, computational speed, transparency of the functions and parameters in the problems, generality, extensibility, adaptability, and theoretical elegance. These technical reports are sold at www.IntegralResearch.net, where more details about Ram Calculus can be found. The papers themselves are not sold; full bibliographic information is included so readers can access them from external sources. The technical reports cover papers in all areas of science, mathematics, and engineering, as well as quantitative finance. More papers and corresponding technical reports will be added to this catalog in the coming months. These reports are useful to researchers in industry and academia and to graduate students in science, mathematics, engineering, and finance. The Ram Calculus theory and algorithms themselves have been thoroughly verified by the author but not the technical reports listed here. The technical reports were generated with the help of AI models and numerous additional technical reports on Ram Calculus (all of them are listed on www.IntegralResearch.Net). In the opinion of the author, these technical reports are not perfect but extremely useful. The technical reports listed here have not yet been reviewed by humans for correctness, but another version of the technical reports that are reviewed and revised by humans are expected to be listed here sometime later (at a higher price). **If you find a substantive error in the core idea described in any item that you buy here, or if you find an alternative approach that is better than the one provided by the Ram Calculus technique in a significant way to solve a relevant problem (without training data that AI systems need), then you can get a full refund plus a small reward.** The correctness of the mathematics and algorithms described in the items below are easily verified using advanced AI chatbots, often both symbolically and numerically. If you skip using the methods described in the items below to solve a problem that can be solved by them but use an alternative approach in the current literature, your results will be improved later by someone who will use the methods described in the items offered here for sale. All technical reports listed here are likely to be submitted as US provisional patent applications before shipping them to purchasers.

Table of Contents

1 6G Integrated Sensing and Communication (ISAC)

92 bibliography items.

1.1 Delay-Doppler, OTFS, AFDM, and Multicarrier Waveforms

- [1] Hai Lin, Jinhong Yuan, Wei Yu, Jingxian Wu, and Lajos Hanzo. “Multi-Carrier Modulation: An Evolution From Time-Frequency Domain to Delay-Doppler Domain.” *IEEE Transactions on Communications*, vol. 74, pp. 7962-7992, 2026. doi:10.1109/tcomm.2026.3686722. (TR214, [Coordinate-Mapped Local Ram Reconstruction for Doubly-Selective Multi-Carrier Waveforms: A Delay-Doppler Operator Formulation of the OFDM to OTFS/AFDM Evolution]).
- [2] Wanchen Hu, Jie Yang, Shuangyang Li, Yu Zhu, Weijie Yuan, Fan Liu, and Giuseppe Caire. “Communication-Centric ISAC Based on Zak-OTFS: A Novel Backpropagation Algorithm for Delay-Doppler Sensing.” *IEEE Transactions on Wireless Communications*, vol. 25, pp. 16480-16495, 2026. doi:10.1109/twc.2026.3689749. (TR215, [A Localized Delay-Doppler Jet Inverse for Zak-OTFS ISAC: The Backpropagation Sensing Estimator as an Adjoint Ram Transform]).
- [3] Kunyi Hua, Chen Song, Yuanyuan Qiu, Wei Liang, and Lingjun Dai. “Integrated Sensing and Communication Based on FBMC-OTFS Waveform.” In *2026 China Aerospace Information Technology Conference (CAIT)*, pp. 1-10, 2026. doi:10.1109/cait70489.2026.11553850. (TR217, [A Local Ram-Transform Inverse for the FBMC-OTFS Doubly-Dispersive Waveform: Windowed Delay-Doppler Jets, a Shift-Variant Sampling Theorem, and an Analytic-Core-plus-Learned-Residual ISAC Receiver]).
- [4] Bruno S. Pompeo, Leandro G. F. Pralon, Marcello L. R. de Campos, and José A. Apolinário. “Generalized OTFS Waveform: Overcoming Fractional Doppler in Delay-Doppler Localization.” *IEEE Wireless Communications Letters*, vol. 15, pp. 1633-1636, 2026. doi:10.1109/lwc.2026.3660125. (TR218, [Fractional-Doppler Delay-Doppler Inversion via a Position-Dependent Factorial-Moment Difference-Jet: An Exact Local Ram Transform for Generalized OTFS ISAC Localization]).
- [5] Kehan Huang, Akram Shafie, Min Qiu, Elias Aboutanios, and Jinhong Yuan. “A Novel ISAC Waveform Based on Orthogonal Delay-Doppler Division Multiplexing with FMCW.” *arXiv preprint arXiv:2602.02248*, 2026. arXiv:2602.02248. (TR219, [A Chirp-Ramlet Invertible Operator for ODDM+FMCW Joint ISAC Waveforms An Analytic-Core-Plus-Learned-Residual Design-Around for Orthogonal Delay-Doppler Division Multiplexing with FMCW Sensing]).
- [6] Kehan Huang, Akram Shafie, Min Qiu, Elias Aboutanios, and Jinhong Yuan. “A Novel ISAC Waveform Based on Orthogonal Delay-Doppler Division Multiplexing With FMCW.” *IEEE Transactions on Wireless Communications*, vol. 25, pp. 11688-11705, 2026. doi:10.1109/twc.2026.3661286. (TR220, [A Ram Transform Framework for ODDM+FMCW ISAC Waveforms: Dechirp Coordinate Mapping Difference-Jet Inversion, and the Known-Channel Ram Sampling Theorem]).
- [7] Kehan Huang, Akram Shafie, Min Qiu, Elias Aboutanios, and Jinhong Yuan. “A Novel ISAC Waveform Based on Orthogonal Delay-Doppler Division Multiplexing with FMCW.” *arXiv preprint arXiv:2602.02248*, 2026. doi:10.48550/arxiv.2602.02248. (TR221, [A Joint ODDM tensor FMCW Delay-Doppler Ram Transform Local Exact Recovery of Data Symbols and Sensing Parameters from $N+1$ Samples of a Known Underspread Doubly-Dispersive Channel]).
- [8] Zhenduo Wang, Fanrong Dong, Menghai Zeng, and Xiaoyan Ning. “Ambiguity Function Analysis and Improvement of Integrated WFRFT-OTFS Waveform.” *IEEE Transactions on Vehicular Technology*, pp. 1-5, 2026. doi:10.1109/tvt.2026.3671279. (TR223, [A Ram-Transform Framework for Ambiguity-Function Design and Symbol Recovery in Integrated WFRFT-OTFS Waveforms Analytic Fractional/Windowed-Exponential Ramlet Core with Hopkins-Bilinear Ambiguity Operator and Learned Residual]).

- [9] Tingjun Lyu and Yunmei Shi. “A Cancellation Mechanism in AFDM Radar Sensing: Exact Fisher Information and Delay-Doppler Decoupling.” *arXiv preprint arXiv:2606.05084*, 2026. [arXiv:2606.05084](#). (**TR224**, [A Cancellation Mechanism in AFDM Radar Sensing: Exact Fisher Information and Delay-Doppler Decoupling via a Local Chirp-Atom Ram Transform]).
- [10] Tingjun Lyu and Yunmei Shi. “A Cancellation Mechanism in AFDM Radar Sensing: Exact Fisher Information and Delay-Doppler Decoupling.” *arXiv preprint arXiv:2606.05084*, 2026. [doi:10.48550/arxiv.2606.05084](#). (**TR227**, [A Coordinate-Map Ram Transform for AFDM Radar Sensing: Analytic Block-Diagonalization, Exact Fisher Information and Certified Delay-Doppler Decoupling]).
- [11] Mats Viberg, Daniele Gerosa, Tomas McKelvey, Patrik Dammert, and Thomas Eriksson. “Separable Delay And Doppler Estimation In Passive Radar.” *arXiv preprint arXiv:2601.15821*, 2026. [doi:10.48550/arxiv.2601.15821](#). (**TR228**, [A Separable Delay-Doppler Ram Transform for Passive Radar and 6G ISAC Exact Local Reflectivity Recovery Beyond Ambiguity-Peak Resolution via Per-Axis Local Jets, Multimodal Lobe Decomposition, and an Analytic-Core-plus-Learned-Residual Umbrella]).
- [12] Mats Viberg, Daniele Gerosa, Tomas McKelvey, Patrik Dammert, and Thomas Eriksson. “Separable Delay and Doppler Estimation in Passive Radar.” In *ICASSP 2026 - 2026 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 111-115, 2026. [doi:10.1109/icassp55912.2026.11463498](#). (**TR229**, [Separable Delay-Doppler Ram Transform for Passive Radar: A Kronecker-Structured Local-Jet Inverse of the Cross-Ambiguity Operator]).
- [13] Shiqi Cui, Fan Zhang, Yuanshuo Gang, Zeping Sui, Tianqi Mao, and Zhaocheng Wang. “Adaptive c₂-Perturbed AFDM Waveform Design for Integrated Sensing and Communication.” *arXiv preprint arXiv:2606.04698*, 2026. [arXiv:2606.04698](#). (**TR230**, [Adaptive c₂-Perturbed AFDM Waveform Design for Integrated Sensing and Communication: A Ram-Transform Identification and Inversion Framework]).
- [14] Jun Tong, Jinhong Yuan, Akram Shafie, and Jiangtao Xi. “Ambiguity Function Analysis of Delay-Doppler Domain Multicarrier Modulation (DDMC).” *IEEE Transactions on Vehicular Technology*, pp. 1-19, 2026. [doi:10.1109/tvt.2026.3703563](#). (**TR232**, [A Ram Transform Analysis of the Delay-Doppler Multicarrier (DDMC) Ambiguity Function: Ramlet Cross-Correlation Form, Difference-Jet Channel Inverse, and Super-Geometric Reconstruction Bounds]).
- [15] Cheng Luo, Luping Xiang, Hankun Zhang, Yi Luo, Chen Huang, Yi Zhang, Cheng-Xiang Wang, and Kun Yang. “DBU-OFDM: A Trainable Deep Block-Unitary OFDM Waveform for Integrated Sensing and Communication.” *arXiv preprint arXiv:2604.10296*, 2026. [arXiv:2604.10296](#). (**TR234**, [A Ram-Transform Analytic Core for Deep Block-Unitary OFDM Waveforms in 6G Integrated Sensing and Communication (Analytic-Core-plus-Learned-Residual Treatment of DBU-OFDM)]).
- [16] Fangqing Xiao, Zunqi Li, and Dirk T. M. Slock. “Multipath Component Power Delay Profile-Based Joint Range and Doppler Estimation for AFDM-ISAC Systems.” *IEEE Transactions on Communications*, vol. 74, pp. 7993-8007, 2026. [doi:10.1109/tcomm.2026.3686728](#). (**TR235**, [A Multimodal Difference-Jet Ram Transform for PDP-Based Joint Range and Doppler Estimation in AFDM-ISAC Systems Analytic-Core-plus-Learned-Residual Inversion of the AFDM Chirp-Domain Doubly-Selective Channel]).
- [17] Wei Hong, Zhenyu Zhang, Chenggang Li, Jingcheng Shi, Wei Xi, Yingyang Li, Qun Zhao, Juejia Zhou, and Yong Li. “Orthogonal Time Frequency Space (OTFS) Waveform Toward 6G ISAC: Fundamentals, Standardizations, and Prototypes.” *IEEE Communications Standards Magazine*, pp. 1-8, 2026. [doi:10.1109/mcomstd.2026.3676458](#). (**TR236**, [A Discrete Delay-Doppler Difference-Jet Ram Equalizer for OTFS Waveforms in 6G ISAC Forward/Inverse Operator Derivation, Multimodal Path Decomposition and a Certified Super-Geometric Underspread Bound]).
- [18] Yuan Liu, Yilin Qi, Caiqin Li, Haoran Yin, Yanqun Tang, and Yao Ge. “Flag-Preamble-Based Delay-Doppler Channel Estimation for Next-Evolution Waveforms.” *arXiv preprint arXiv:2603.14875*, 2026. [arXiv:2603.14875](#). (**TR237**, [Flag-Preamble-Based Delay-Doppler Channel Estimation for Next-Evolution Waveforms via Discrete Shift-Variant Ram Transforms]).

- [19] Yujie Liu, Yong Liang Guan, David González G., and Halim Yanikomeroglu. “DFT-s-OFDM with Chirping for Integrated Sensing and Communications in 6G and Beyond.” *arXiv preprint arXiv:2605.17612*, 2026. [arXiv:2605.17612](#). (**TR405**, [A Factored Oscillatory Ram Transform for DFT-Spread OFDM with Chirp Precoding: Joint Symbol and Delay-Doppler Recovery for 6G ISAC]).
- [20] Huacheng Zeng, Kunzhe Song, Geo Jie Zhou, and Ruxin Lin. “OFDM Waveform for Monostatic ISAC in 6G: Vision, Approach, and Research Directions.” *arXiv preprint arXiv:2603.12641*, 2026. [arXiv:2603.12641](#). (**TR408**, [Delay-Doppler Moment-Jet Inversion for Monostatic OFDM ISAC Channels in 6G: A Ram-Transform Restatement and Screening Report]).
- [21] Abed Doosti Aref, Xu Zhu, Miaowen Wen, Christos Masouros, and Ioannis Krikidis. “OTSM With Delay-Doppler Alignment Modulation Meets mmWave mMIMO ISCAP: Waveform Optimization by Deep Reinforcement Learning.” *IEEE Internet of Things Journal*, vol. 12, no. 17, pp. 35799-35816, 2025. [doi:10.1109/jiot.2025.3582031](#). (**TR619**, [Acceptance-Gated Local Reconstruction for OTSM-DDAM ISCAP]).
- [22] Dong Fu, Honglei Lin, Yinan Meng, Jing Peng, Gang Ou, and Shaojing Wang. “Delay-Doppler Block Division Multiplexing: An Integrated Navigation and Communication Waveform for LEO PNT.” *Remote Sensing*, vol. 17, no. 7, art. 1270, 2025. [doi:10.3390/rs17071270](#). (**TR620**, [Conditioned Local-Jet Equalization for Delay-Doppler Block Division Multiplexing in LEO Navigation and Communication Exactness Classes, Block Coupling, Error Budgets, and Uncertainty]).
- [23] Pavel Karpovich and Tomasz P. Zielinski. “Integrated Sensing and Communication Using Random Padded OTFS with Reduced Interferences.” *Sensors*, vol. 25, no. 15, art. 4816, 2025. [doi:10.3390/s25154816](#). (**TR622**, [Condition-Aware Local Processing for Random-Padded OTFS ISAC Affine Pilot Separation, Exact Difference Jets, Coupling, Adjoints, Error Budgets, and UQ]).
- [24] Shivani Singh, Amudheesan Nakkeeran, Prem Singh, Ekant Sharma, and Jyotsna Bapat. “Target Detection for OTFS-Aided Cell-Free MIMO ISAC System.” *IEEE Transactions on Vehicular Technology*, vol. 74, no. 7, pp. 11568-11573, 2025. [doi:10.1109/tvt.2025.3550135](#). (**TR623**, [Rank-Gated Local Analytic Processing for OTFS-Aided Cell-Free MIMO ISAC Exact Difference Jets, Adjoint Tests, Multi-AP Information Fusion, Error Budgets, and Uncertainty Quantification]).
- [25] Muhammad Nauman, Lukasz Lopacinski, Nebojsa Maletic, Matthias Scheide, Jesús Gutiérrez, Milos Krstic, and Eckhard Grass. “OTFS Sensing with SDR: Experimental Results and Analysis.” In *2025 IEEE 101st Vehicular Technology Conference (VTC2025-Spring)*, pp. 1-6, 2025. [doi:10.1109/vtc2025-spring65109.2025.11174294](#). (**TR625**, [Calibrated Finite Local Reconstruction for OTFS SDR Sensing Typed Delay-Doppler Operators, Two-Dimensional Jets, Rank Gating, Error Bounds, and UQ]).
- [26] Hugo Hawkins, Chao Xu, Lie-Liang Yang, and Lajos Hanzo. “CDMA/OTFS Sensing Outperforms Pure OTFS at the Same Communication Throughput.” *IEEE Open Journal of Vehicular Technology*, vol. 6, pp. 502-519, 2025. [doi:10.1109/ojvt.2025.3532848](#). (**TR627**, [Conditioning-Gated Code-Domain Reconstruction for CDMA/OTFS Sensing]).
- [27] Kailong Wang and Athina Petropulu. “ISAC MIMO Systems With OTFS Waveforms and Virtual Arrays.” *IEEE Journal on Selected Areas in Communications*, vol. 44, pp. 229-244, 2026. [doi:10.1109/jsac.2025.3608761](#). (**TR629**, [Conditioned Delay-Doppler-Angle Local Inversion for OTFS-MIMO Integrated Sensing and Communication with Virtual Arrays]).
- [28] Yirui Luo, Yong Liang Guan, Yao Ge, and Chau Yuen. “Target Sensing With Off-grid Sparse Bayesian Learning for AFDM-ISAC System.” In *2025 IEEE International Conference on Communications Workshops (ICC Workshops)*, pp. 881-886, 2025. [doi:10.1109/iccworkshops67674.2025.11162379](#). (**TR631**, [Conditioned Local-Atom Refinement for Off-Grid Delay-Doppler Sensing in AFDM-ISAC]).
- [29] Mingyan Qi, Yuelong Su, Zhaoyi Wang, and Kun Lu. “Research on the Integration of Sensing and Communication Based on Fractional-Order Fourier Transform.” *Sensors*, vol. 25, no. 10, art. 2956, 2025. [doi:10.3390/s25102956](#). (**TR633**, [Fractional-Fourier ISAC Waveforms as Unitary Chirp Operators with Conditioned Local Channel Equalization]).

- [30] H. Hawkins. “Transceivers for integrated sensing and communication.” *Dissertation, ePrints Soton (University of Southampton)*, 2025. [online record](#). (TR637, [A Conditioned Local-Operator Synthesis of OFDM, OTFS, AFDM and Index-Modulated ISAC Transceivers]).
- [31] Zhou Lu, Mohammed El-Hajjar, and Lie-liang Yang. “Augmented Affine Frequency Division Multiplexing for Both Low PAPR Signaling and Diversity Gain Protection.” *arXiv preprint arXiv:2512.17679*, 2025. [arXiv:2512.17679](#). (TR638, [Augmented AFDM as Unitary Subblock Precoding with Conditioned Equalization and Diversity-Collision Checks]).
- [32] Bruno Felipe Costa, Anup Mishra, Israel Leyva-Mayorga, Taufik Abrão, and Petar Popovski. “Tunable Gaussian Pulse for Delay-Doppler ISAC.” *arXiv preprint arXiv:2512.14637*, 2025. [doi:10.48550/arxiv.2512.14637](#). (TR641, [Tunable Gaussian Pulse Design for Delay-Doppler ISAC Correct operator model, sensing bounds, communication covariance, conditioning, uncertainty, and reproducible evaluation]).
- [33] Weijie Yuan, Lin Zhou, Saeid K. Dehkordi, Shuangyang Li, Pingzhi Fan, Giuseppe Caire, and H. Vincent Poor. “From OTFS to DD-ISAC: Integrating Sensing and Communications in the Delay Doppler Domain.” *IEEE Wireless Communications*, vol. 31, no. 6, pp. 152-160, 2024. [doi:10.1109/mwc.018.2300607](#). (TR953, [Delay-Doppler ISAC: Verified Source Review and a Condition-Aware Local Moment-Jet Receiver]).
- [34] Musa Furkan Keskin, Carina Marcus, Olof Eriksson, Alex Alvarado, Joerg Widmer, and Henk Wymeersch. “Integrated Sensing and Communications With MIMO-OTFS: ISI/ICI Exploitation and Delay-Doppler Multiplexing.” *IEEE Transactions on Wireless Communications*, vol. 23, no. 8, pp. 10229-10246, 2024. [doi:10.1109/twc.2024.3370501](#). (TR955, [MIMO-OTFS ISAC Beyond the Standard Ambiguity Region: Verified GLRT Model and Conditioned Local Off-Grid Refinement]).
- [35] Jiale Wang, Zhongxin Bai, Jie Lian, Yifan Guo, Guolei Zhu, and Yingmin Wang. “A Power-Domain Non-Orthogonal Integrated Sensing and Communication Waveform Design Using OFDM.” *IEEE Wireless Communications Letters*, vol. 13, no. 4, pp. 984-988, 2024. [doi:10.1109/lwc.2024.3355244](#). (TR956, [Quantized FMCW-OFDM Power-Domain ISAC: Verified Source Scope and Condition-Aware Local Reconstruction]).
- [36] Buyi Li, Weijie Yuan, Fan Liu, Nan Wu, and Shi Jin. “OTFS-Based ISAC: How Delay Doppler Channel Estimation Assists Environment Sensing?.” *IEEE Wireless Communications Letters*, vol. 13, no. 12, pp. 3563-3567, 2024. [doi:10.1109/lwc.2024.3478744](#). (TR957, [OTFS Delay-Doppler Measurements for Joint Target-State and Transmitter-Location Estimation: Verified Scope, Calibrated Local Operators, Identifiability, and Reproducible Validation]).
- [37] Dazhuo Wang, Yonghong Zeng, Yuhong Wang, Francois Chin, Yugang Ma, and Sumei Sun. “Pilot Design, Channel Estimation, and Target Detection for Integrated Sensing and Communication with OTFS.” In *2024 IEEE VTS Asia Pacific Wireless Communications Symposium (APWCS)*, pp. 1-5, 2024. [doi:10.1109/apwcs61586.2024.10679290](#). (TR960, [OTFS Pilot Design, Channel Estimation, and Target Detection: Verified Fast Cyclic Correlation, Rank-Tested Gain Estimation, and Off-Grid Local Refinement]).
- [38] Hugo Hawkins, Chao Xu, Lie-Liang Yang, and Lajos Hanzo. “IM-OFDM ISAC Outperforms OFDM ISAC by Combining Multiple Sensing Observations.” *IEEE Open Journal of Vehicular Technology*, vol. 5, pp. 312-329, 2024. [doi:10.1109/ojvt.2024.3366772](#). (TR966, [Coverage-Aware Multi-Frame Reconstruction for IM-OFDM ISAC]).
- [39] Kuranage Roche Rayan Ranasinghe, Hyeon Seok Rou, Giuseppe Thadeu Freitas de Abreu, Takumi Takahashi, and Kenta Ito. “Joint Channel, Data, and Radar Parameter Estimation for AFDM Systems in Doubly-Dispersive Channels.” *arXiv preprint arXiv:2405.16945*, 2024. [doi:10.48550/arxiv.2405.16945](#). (TR968, [A Coordinate-Mapped Ram Transform for Joint Channel, Data, and Radar Parameter Estimation in AFDM / Doubly-Dispersive ISAC Systems]).
- [40] Kai Zheng, Miaowen Wen, Tianqi Mao, Lixia Xiao, and Zhaocheng Wang. “Channel Estimation for AFDM With Superimposed Pilots.” *arXiv preprint arXiv:2404.10232*, 2024. [doi:10.48550/arxiv.2404.10232](#). (TR969, [An Analytic Ram-Transform Derivation for AFDM Channel Estimation with Superimposed Pilots]).

- [41] Xingyao Zhang, Haoran Yin, Yanqun Tang, Yu Zhou, Yuqing Liu, Jinming Du, and Yipeng Ding. “A DAFT Based Unified Waveform Design Framework for High-Mobility Communications.” *arXiv preprint arXiv:2406.02262*, 2024. doi:10.48550/arxiv.2406.02262. (TR971, [A Ram Transform Derivation for DAFT/AFDM Unified Waveforms on Doubly-Dispersive High-Mobility Channels Coordinate-Mapped Chirp Analysis, Conjugate-Chirp Inversion and a Known-Channel Ram Sampling Bound]).

1.2 Networked, Multiuser, and Backscatter ISAC

- [42] Zeming Yang, Bingbing Wang, Fengyuan Zhu, Linling Zhong, Wenhui Li, Yuanming Shi, Yunlong Lu, Haiming Jin, and Xiaohua Tian. “DDScatter: Enabling Delay-Doppler Modulation for Mmwave Radar-Backscatter Communication.” *IEEE Transactions on Mobile Computing*, pp. 1-17, 2026. doi:10.1109/tmc.2026.3696949. (TR222, [A Backscatter-Specific Doubly-Dispersive Channel-Identification Ram Transform for mmWave Radar-Backscatter Delay-Doppler Links Analytic-Core-plus-Learned-Residual Framing of the DDScatter Problem]).
- [43] Henglin Pu, Xuefeng Wang, Lu Su, and Husheng Li. “Space-Time-Frequency Synthetic Integrated Sensing and Communication Networks.” *IEEE Transactions on Wireless Communications*, vol. 25, pp. 15004-15020, 2026. doi:10.1109/twc.2026.3681132. (TR226, [Graph-Coupled Space-Time-Frequency Synthetic Ram Transforms for Distributed 6G ISAC Networks A Network-Level Ram Sampling Theorem for Doubly-Dispersive Synthetic-Aperture Sensing and Communication]).
- [44] Marouan Mizmizi, Mattia G. Polissano, Stefano Tebaldini, and Umberto Spagnolini. “Communication by Sensing: A Coherent Backscatter Framework with Space-Time RIS.” In *2026 IEEE 6th International Symposium on Joint Communications & Sensing (JC&S)*, pp. 1-6, 2026. doi:10.1109/jcs69321.2026.11366010. (TR231, [A Known-Channel Ram Sampling Operator for Communication-by-Sensing with Space-Time RIS Coherent Backscatter]).
- [45] Rang Liu, Ming Li, A. Lee Swindlehurst, Norman Franchi, and Robert Schober. “Multiuser MIMO-AFDM Beamforming for ISAC in Doubly Dispersive Channels.” *arXiv preprint arXiv:2607.05119*, 2026. arXiv:2607.05119. (TR238, [Block-Bilinear Ram Transform Inversion for Multiuser MIMO-AFDM Beamforming in Doubly-Dispersive ISAC Channels]).
- [46] Xuehan Wang, Jintao Wang, Hai Lin, Jinhong Yuan, Xu Shi, Hengyu Zhang, and Jian Song. “Doppler Shift Keying Modulation for Uplink Multiple Access over Doubly-Dispersive Channels.” *arXiv preprint arXiv:2603.02721*, 2026. arXiv:2603.02721. (TR240, [Multimodal Ram Transform for Doppler Shift Keying (DSK) Uplink Multiple Access over Doubly-Dispersive Channels A Per-User Doppler-Lobe Local-Jet Inverse with Analytic Core plus Learned Residual]).
- [47] Hyeon Seok Rou, Giuseppe Thadeu Freitas de Abreu, Emil Björnson, Sunwoo Kim, and Marios Kountouris. “The Resurrection of Spectrum Spreading for 6G and Beyond: From Sinusoids to Chirps.” *arXiv preprint arXiv:2605.00249*, 2026. arXiv:2605.00249. (TR241, [Local Ram Inversion for Chirp-Spread and Affine-Frequency ISAC Receivers over Known Underspread Time-Variant Channels A Derivation Report Referencing the Ram Sampling Theorem (TR167) and the Discrete Shift-Variant Ram Transform (TR166)]).
- [48] Sai Pradeep Muppaneni and Ananthanarayanan Chockalingam. “Multiuser Zak-OTFS on the Uplink with Superimposed Spread-Pilots.” *arXiv preprint arXiv:2607.08247*, 2026. doi:10.48550/arxiv.2607.08247. (TR378, [Coupled Multiuser Ram Transforms for Zak-OTFS Uplink with Superimposed Spread-Pilots: Exact-Local Per-User Delay-Doppler Channel Reconstruction plus Block-Panel Bilinear Inversion]).
- [49] Diluka Galappaththige and Chintha Tellambura. “Cell-free Integrated Sensing and Communication.” *Foundations and Trends® in Networking*, vol. 16, no. 1-2, pp. 1-170, 2025. doi:10.1561/13000000079. (TR624, [Calibrated Local Finite Models for Cell-Free Integrated Sensing and Communication Typed Communication/Sensing Operators, Warp Adjoint, Heterogeneous Graph Solves, Conditioning, Error Bounds, and UQ]).
- [50] Haoran Yin, Yanqun Tang, Ali Bermani, Marios Kountouris, Yu Zhou, Xingyao Zhang, Yuqing Liu, Gaojie Chen, Kai Yang, Fan Liu, Christos Masouros, Shuangyang Li, Giuseppe Caire, and Pei Xiao. “Affine

Frequency Division Multiplexing: Extending OFDM for Scenario-Flexibility and Resilience.” *arXiv preprint arXiv:2502.04735*, 2025. doi:10.48550/arxiv.2502.04735. (TR635, [Affine Frequency Division Multiplexing as a Unitary Chirp Transform with Conditioned Local Equalization in Doubly Dispersive Channels]).

- [51] Zeping Sui, Qu Luo, Zilong Liu, Murat Temiz, Leila Musavian, Christos Masouros, Yong Liang Guan, Pei Xiao, and Lajos Hanzo. “Multi-Functional Chirp Signalling for Next-Generation Multi-Carrier Wireless Networks: Communications, Sensing and ISAC Perspectives.” *arXiv preprint arXiv:2508.06022*, 2025. doi:10.48550/arxiv.2508.06022. (TR639, [Multi-Functional Chirp Signalling for Communication, Sensing, and ISAC Operator conventions, conditional local models, conditioning, and reproducible validation]).
- [52] Zhuoran Li, Shufeng Tan, Zhen Gao, Yi Tao, Zhonghuai Wu, Zhongxiang Li, Chun Hu, and Dezhi Zheng. “Chirp Delay-Doppler Domain Modulation: A New Paradigm of Integrated Sensing and Communication for Autonomous Vehicles.” *arXiv preprint arXiv:2505.16807*, 2025. doi:10.48550/arxiv.2505.16807. (TR741, [Chirp Delay-Doppler Modulation for Automotive ISAC: Operator Audit and Ram Local Demodulation]).
- [53] Ali Bemani, Nassar Ksairi, and Marios Kountouris. “Integrated Sensing and Communications With Affine Frequency Division Multiplexing.” *IEEE Wireless Communications Letters*, vol. 13, no. 5, pp. 1255-1259, 2024. doi:10.1109/lwc.2024.3367178. (TR954, [AFDM-ISAC with One-Pilot Sensing: Verified Source Analysis and Conditioned Local Off-Grid Refinement]).
- [54] Fan Zhang, Tianqi Mao, Ruiqi Liu, Zhu Han, Octavia A. Dobre, Sheng Chen, and Zhaocheng Wang. “Cross-Domain Multicarrier Waveform Design for Integrated Sensing and Communication.” In *2024 IEEE Wireless Communications and Networking Conference (WCNC)*, pp. 1-6, 2024. doi:10.1109/wcnc57260.2024.10571317. (TR959, [Cross-Domain OFDM Waveform Design for Integrated Sensing and Communication: Verified Ambiguity-Region Constraints, Resource Allocation, and Calibrated Moment Sensitivity]).
- [55] Haiying Zhang, Shuyi Chen, Weixiao Meng, Jinhong Yuan, and Cheng Li. “Multiuser Association and Localization Over Doubly Dispersive Multipath Channels for Integrated Sensing and Communications.” *IEEE Journal on Selected Areas in Communications*, vol. 42, no. 10, pp. 2847-2862, 2024. doi:10.1109/jsac.2024.3414627. (TR961, [Rank-Aware Local Derivative Cores for Multiuser Association and Localization over Doubly Dispersive Channels]).
- [56] Nan Wu, Xinyi Wang, Zesong Fei, Fanghao Xia, Jingxuan Huang, and Arumugam Nallanathan. “RIS-Assisted Integrated Sensing and Backscatter Communications for Future IoT Networks.” *IEEE Internet of Things Magazine*, vol. 7, no. 4, pp. 44-50, 2024. doi:10.1109/iotm.001.2300184. (TR962, [Calibrated and Observable RIS-Assisted Integrated Sensing and Backscatter Communications]).
- [57] Enrique T. R. Pinto and Markku Juntti. “Sequential MAP Parametric OFDM Channel Estimation for Joint Sensing and Communication.” In *2024 Joint European Conference on Networks and Communications & 6G Summit (EuCNC/6G Summit)*, pp. 1-6, 2024. doi:10.1109/eucnc/6gsummit60053.2024.10597100. (TR963, [Rank-Aware Local Derivative Analysis for Sequential MAP Parametric OFDM Channel Estimation]).
- [58] Hyeon Seok Rou, Giuseppe Thadeu Freitas de Abreu, David González G., and Osvaldo Gonsa. “Integrated Sensing and Communications for 3D Object Imaging via Bilinear Inference.” *IEEE Transactions on Wireless Communications*, vol. 23, no. 8, pp. 8636-8653, 2024. doi:10.1109/twc.2024.3352975. (TR965, [Conditioned Local Bilinear Inference for Voxelized Uplink ISAC]).
- [59] Mahmut Kemal Ercan, Musa Furkan Keskin, Sinan Gezici, and Henk Wymeersch. “RIS-Aided NLoS Monostatic Sensing Under Mobility and Angle-Doppler Coupling.” In *2024 IEEE Wireless Communications and Networking Conference (WCNC)*, pp. 1-6, 2024. doi:10.1109/wcnc57260.2024.10571183. (TR967, [Conditioned Local Refinement for RIS-Aided NLoS Monostatic Sensing Under Mobility]).
- [60] Tong Wei, Linlong Wu, Kumar Vijay Mishra, and Bhavani Shankar M. R.. “RIS-Aided Wideband Holographic DFRC.” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 60, no. 4, pp. 4241-4256, 2024. doi:10.1109/taes.2024.3374272. (TR972, [Ram Transform Derivation A Local Analytic Inverse Operator for the RIS-Aided Wideband Holographic DFRC Channel]).

1.3 Atomic, Near-Field, Metasurface, and Array Systems

- [61] Yiyue Xiang, Neng Ye, Qihao Peng, Pei Xiao, and Jianping An. “Unified Analytical Model for Atomic Receivers Under Typical Quantum Interference Paths.” *arXiv preprint arXiv:2607.08118*, 2026. doi:10.48550/arxiv.2607.08118. (TR242, [Analytic Field Estimation for Rydberg Atomic Receivers: A Liouville-Space Nilpotent-Jet Ram Inversion Under Typical Quantum-Interference Paths]).
- [62] Ruoxiao Cao, Wentao Yu, Yi Gong, and Khaled B. Letaief. “Low-Complexity Gridless Single-Snapshot DoA Estimation via Truncated Hankel Newton-MUSIC.” *arXiv preprint arXiv:2607.08108*, 2026. doi:10.48550/arxiv.2607.08108. (TR243, [Analytically-Certified Local Root Maps for Structured-Covariance Null-Spectrum Inversion: A Multimodal Ram-Jet Newton-MUSIC for Gridless Single-Snapshot DoA Estimation]).
- [63] Pin-Han Ho, Limei Peng, Yiming Miao, Xu Fan, Kairan Liang, Haoran Mei, and Wei Duan. “Frequency as Aperture: Enabling Embeddable Near-Field Sensing for 6G Wireless Radios.” *arXiv preprint arXiv:2601.21584*, 2026. arXiv:2601.21584. (TR244, [Frequency as Aperture: A Coordinate-Mapped Local-Jet Ram Transform for Embeddable Near-Field ISAC Sensing in 6G Radios]).
- [64] Ryota Kaide, Yoshiki Kamiura, Shenghong Ye, Yiqing Wang, Yuya Mikami, Yuta Ueda, and Kazutoshi Kato. “Terahertz ISAC with Simultaneous Fast-Swept FMCW Radar and High-Speed Wireless Link Using a Single UTC-PD.” *Electronics*, vol. 15, no. 8, art. 1608, 2026. doi:10.3390/electronics15081608. (TR245, [Ram Transform Analysis of Terahertz ISAC with Simultaneous Fast-Swept FMCW Radar and High-Speed Wireless Link Using a Single UTC-PD: A Prior-Art-Adjacent Screening Report]).
- [65] Hong-Bae Jeon, Hyung-Joo Moon, and Yong Wook Kim. “Toward Quantum-Enhanced ISAC: Active-RIS-Aided Integrated Sensing and Communication with Rydberg Atomic Receivers.” *arXiv preprint arXiv:2606.17641*, 2026. arXiv:2606.17641. (TR246, [Ram-Transform Inversion of the Composite Active-RIS Near-Field Channel and Rydberg Atomic Receiver Map for Quantum-Enhanced ISAC A Two-Stage Analytic-Core-plus-Nonlinear-Jet Operator with Super-Geometric Sampling Bound]).
- [66] Bang Huang, Sajid Ahmed, Wenkai Jia, Mohamed-Slim Alouini, and Wen-Qin Wang. “Frequency Diverse Arrays: Fundamentals, Key Insights, and Future Directions.” *arXiv preprint arXiv:2605.02559*, 2026. arXiv:2605.02559. (TR248, [Analytic Local Inversion of the Range-Angle-Time-Coupled Frequency-Diverse-Array (FDA) Transmit Operator: A Coordinate-Mapped Ram Transform with an FDA Reconstructibility Theorem for 6G ISAC]).
- [67] Yiyue Xiang, Jianxiong Pan, Qiaolin Ouyang, Bichen Kang, Bin Qi, and Neng Ye. “Doppler-Resilient Rydberg Atomic Receiver for High-Dynamic Communication Networks via Adaptive Local Oscillator Tracking.” *arXiv preprint arXiv:2607.08145*, 2026. doi:10.48550/arxiv.2607.08145. (TR249, [A Composite Ram Transform for Doppler-Resilient Rydberg Atomic Receivers: Analytic Inversion of a Nonlinear Atomic Measurement Functional Composed with a Known Time-Variant Channel]).
- [68] Chenfeng Yang, Si Ran Wang, Jia Chen Du, Man Ting Wang, Zheng Xing Wang, Ka Fai Chan, Dong-Ze Zheng, and Geng-Bo Wu. “High-dimensional multiplexing through vortex electromagnetic wave manipulation by space-time-coding metasurfaces.” *Light: Science & Applications*, vol. 15, no. 1, art. 160, 2026. doi:10.1038/s41377-026-02232-6. (TR250, [Analytic Mode-Domain Demultiplexing for Space-Time-Coding-Metasurface Vortex-EM (OAM) High-Dimensional Multiplexing: A Ramlet + Shift-Variant Sampling Derivation]).
- [69] Zizhen Zhang, Zirui Zhang, Ziqi Ren, and Zhirun Hu. “Decoupling in a joint communication and sensing system with metasurface.” *Scientific Reports*, vol. 16, no. 1, art. 14526, 2026. doi:10.1038/s41598-026-44469-6. (TR251, [Analytic Two-Channel Decoupling of a Metasurface-Enabled Joint Communication and Sensing System via a Discrete Shift-Variant Ram Transform A Core-plus-Residual Ram Operator for Shared-Aperture RIS/ISAC Channel Separation]).
- [70] Filippo Pepe, Ivan Iudice, Giuseppe Castaldi, Marco Di Renzo, and Vincenzo Galdi. “Conformal Reconfigurable Intelligent Surfaces: A Cylindrical Geometry Perspective.” *Advanced Electronic Materials*, art. e00550, 2026. doi:10.1002/aelm.202500550. (TR252, [A Coordinate-Mapped Shift-Variant Ram Transform for Conformal Cylindrical RIS Beamforming Synthesis and Near-Field Channel Recovery]).

- [71] Yirui Luo, Yong Liang Guan, Yao Ge, David González G, and Chau Yuen. “A Novel Angle-Delay-Doppler Estimation Scheme for AFDM-ISAC System in Mixed Near-Field and Far-Field Scenarios.” *IEEE Internet of Things Journal*, vol. 12, no. 13, pp. 22669-22682, 2025. doi:10.1109/jiot.2025.3559924. (TR621, [Rank-Aware Local Refinement for Mixed Near-/Far-Field Angle-Delay-Doppler Estimation in AFDM-ISAC Correct Fresnel Geometry, Multi-Index Dimensions, Adjoints, and UQ]).
- [72] Hanem I. Hegazy, AbdelFatah Mohamed, Ibrahim Al-Nahhal, and Octavia A. Dobre. “A Low-Complexity Framework for Enhanced Sensing and Communication in Terahertz ISAC Systems.” In *2025 IEEE International Conference on Communications Workshops (ICC Workshops)*, pp. 875-880, 2025. doi:10.1109/iccworkshops67674.2025.11162290. (TR628, [Acceptance-Gated Embedded-Pilot Reconstruction for Terahertz OTFS-ISAC]).
- [73] Kuranage Roche Rayan Ranasinghe, Iván Alexander Morales Sandoval, Hyeon Seok Rou, Giuseppe Thadeu Freitas de Abreu, and George C. Alexandropoulos. “Doubly-Dispersive MIMO Channels with Stacked Intelligent Metasurfaces: Modeling, Parametrization, and Receiver Design.” *arXiv preprint arXiv:2501.07724*, 2025. doi:10.48550/arxiv.2501.07724. (TR636, [Conditioned Inversion of Doubly Dispersive MIMO Channels Parametrized by Stacked Intelligent Metasurfaces]).
- [74] Xiao Qing Chen, Lei Zhang, Yi Ning Zheng, Shuo Liu, Zhuo Ran Huang, Jing Cheng Liang, Marco Di Renzo, Vincenzo Galdi, and Tie Jun Cui. “Integrated sensing and communication based on space-time-coding metasurfaces.” *Nature Communications*, vol. 16, no. 1, art. 1836, 2025. doi:10.1038/s41467-025-57137-6. (TR643, [Space-Time-Coding Metasurface ISAC Harmonic fingerprints, beam control, calibrated operators, adjoints, conditioning, uncertainty, and validation]).
- [75] Guanchao Chen, Xiaolong Su, Lida He, Dongfang Guan, and Zhen Liu. “Coherent Signal DOA Estimation Method Based on Space-Time-Coding Metasurface.” *Remote Sensing*, vol. 17, no. 2, art. 218, 2025. doi:10.3390/rs17020218. (TR644, [Coherent-Source DOA Estimation with a Space-Time-Coding Metasurface Correct harmonic operators, sparse recovery, adjoints, identifiability, conditioning, uncertainty, and validation]).
- [76] Tianyu Ma, Liming Si, Chenyang Dang, Rong Niu, Genhao Wu, Xiue Bao, Houjun Sun, and Weiren Zhu. “Graphene spatiotemporal reconfigurable intelligent surface (GSRIS) for terahertz polarization-state manipulation and holographic imaging.” *Nanoscale Advances*, vol. 7, no. 7, pp. 1825-1837, 2025. doi:10.1039/d4na00750f. (TR645, [Graphene Spatiotemporal RIS for Terahertz Polarization, Multibeam Control, and Holography Correct harmonic synthesis, Jones domains, adjoints, quantization error, conditioning, uncertainty, and validation]).

1.4 Integrated Sensing, Imaging, and Waveform Design

- [77] Marco Manzoni, Francesco Linsalata, Maurizio Magarini, and Stefano Tebaldini. “Integrated Communication and Imaging: Design, Analysis, and Performances of COSMIC Waveforms.” In *2026 Global Conference on Wireless and Optical Technologies (GCWOT)*, pp. 1-6, 2026. doi:10.1109/gcwot69191.2026.11499569. (TR216, [A Ram-Transform Inversion Framework for COSMIC Joint Communication-and-Imaging Waveforms An Analytic-Core-plus-Learned-Residual Instantiation for 6G ISAC]).
- [78] Mats Viberg, Daniele Gerosa, Tomas McKelvey, Patrik Dammert, and Thomas Eriksson. “Separable Delay And Doppler Estimation In Passive Radar.” *arXiv preprint arXiv:2601.15821*, 2026. arXiv:2601.15821. (TR225, [Separable Delay and Doppler Estimation in Passive Radar via a Factorized Ram Transform with Semi-Blind Reference Calibration Analytic-Core-plus-Learned-Residual Umbrella (TR165) to ISAC / PCL target]).
- [79] Zheming Guo and Baixiao Chen. “Ambiguity Function Optimization Based on Joint Communication and Sensing Waveform.” *Electronics Letters*, vol. 62, no. 1, art. e70546, 2026. doi:10.1049/ell2.70546. (TR233, [Analytic Bilinear (Hopkins/Ram) Ambiguity-Function Inverse Design with Learned Residual for 6G JCAS / ISAC Waveforms]).

- [80] Seyyed Erfan Fatemi, Wafa Hedhly, Leila Musavian, and Nikolaos Thomos. “Adaptive Wavelet Division Multiplexing for Heterogeneous Mobility Users.” *arXiv preprint arXiv:2607.08611*, 2026. doi:10.48550/arxiv.2607.08611. (TR239, [A Ram-Transform Core for Adaptive Wavelet Division Multiplexing over Doubly-Dispersive Channels for Heterogeneous-Mobility Users Multimodal Jet Factorization of $H W$, Coordinate-Mapped Local Shift-Invariance, and a Specialized Ram Sampling Theorem]).
- [81] Chen Miao, Zhenpeng Sun, Yue Ma, and Wen Wu. “Three-Parameter Agile Anti-Interference Waveform Design and Corresponding MUSIC-Based Signal Processing Algorithm.” *Electronics*, vol. 15, no. 2, p. 303, 2026. doi:10.3390/electronics15020303. (TR247, [Local-Jet Ram Transform Inversion for Three-Parameter Agile Anti-Interference ISAC Waveforms, with a Ram-vs-MUSIC Estimator]).
- [82] Rang Liu, Peishi Li, Ming Li, and A. Lee Swindlehurst. “Clutter-Aware Integrated Sensing and Communication: Models, Methods, and Future Directions.” *arXiv preprint arXiv:2602.10537*, 2026. arXiv:2602.10537. (TR413, [A Ram-Transform Clutter-Separation Operator for Clutter-Aware Integrated Sensing and Communication: Difference-Jet Inversion under a Known-Clutter Sampling Theorem]).
- [83] Boxiao Shen, Yongpeng Wu, Wenjun Zhang, Symeon Chatzinotas, and Björn Ottersten. “LEO Satellite-Enabled Random Access With Large Differential Delay and Doppler Shift.” *IEEE Transactions on Wireless Communications*, vol. 24, no. 4, pp. 2876-2893, 2025. doi:10.1109/twc.2025.3525738. (TR626, [Calibration-Gated Local Linearization for LEO Random Access]).
- [84] Yi Tao, Zhuoran Li, Zhen Gao, and De Mi. “TDM-MIMO Radar-Based Low-Altitude UAV Sensing and Communication.” In *2025 International Conference on Metaverse Computing, Networking and Applications (MetaCom)*, pp. 298-302, 2025. doi:10.1109/metacom65502.2025.00054. (TR630, [Local Angle-Doppler Decoupling and Conditioned Jet Refinement for TDM-MIMO Low-Altitude UAV Sensing and Communication]).
- [85] Ahmad Bazzi and Marwa Chaffi. “Mutual Information Based Pilot Design for ISAC.” *IEEE Transactions on Communications*, vol. 73, no. 9, pp. 7914-7930, 2025. doi:10.1109/tcomm.2025.3545658. (TR634, [Mutual-Information Pilot Design and Conditioning-Aware Local Inversion for Integrated Sensing and Communication]).
- [86] Nishant Mehrotra, Sandesh Rao Mattu, and Robert Calderbank. “A Design Framework that Unifies 6G Modulation Schemes for Double Selectivity.” *arXiv preprint arXiv:2511.09418*, 2025. doi:10.48550/arxiv.2511.09418. (TR640, [Complex-Hadamard Pulse-Train Modulation for Doubly Selective Channels Correct family membership, support conditions, adjoints, equalization, conditioning, and validation]).
- [87] Delong Xing, Chi Zhang, and Yongwei Zhang. “A Phase-Coded FMCW-Based Integrated Sensing and Communication System Design for Maritime Search and Rescue.” *Sensors*, vol. 25, no. 17, art. 5403, 2025. doi:10.3390/s25175403. (TR642, [Phase-Coded FMCW ISAC for Maritime Search and Rescue Correct signal branches, MIMO code separation, clutter model, adjoints, conditioning, uncertainty, and validation]).
- [88] Jacopo Pegoraro, Jesus O. Lacruz, Tommy Azzino, Marco Mezzavilla, Michele Rossi, Joerg Widmer, and Sundeep Rangan. “JUMP: Joint Communication and Sensing With Unsynchronized Transceivers Made Practical.” *IEEE Transactions on Wireless Communications*, vol. 23, no. 8, pp. 9759-9775, 2024. doi:10.1109/twc.2024.3365853. (TR958, [JUMP with Unsynchronized Transceivers: Verified 60-GHz Packet Synchronization, Static-Path Phase Referencing, and Calibrated Local-Operator Extensions]).
- [89] Li You, Xiaoyu Qiang, Yongxiang Zhu, Fan Jiang, Christos G. Tsinos, Wenjin Wang, Henk Wymeersch, Xiqi Gao, and Björn Ottersten. “Integrated Communications and Localization for Massive MIMO LEO Satellite Systems.” *IEEE Transactions on Wireless Communications*, vol. 23, no. 9, pp. 11061-11075, 2024. doi:10.1109/twc.2024.3378305. (TR964, [Position-Sensitivity-Gated Wideband Hybrid Precoding for Integrated Communications and Localization in Massive-MIMO LEO Systems]).
- [90] J. Andrew Zhang, Hongyang Zhang, Kai Wu, Xiaojing Huang, Jinhong Yuan, and Y. Jay Guo. “Wireless Communications in Doubly Selective Channels with Domain Adaptivity.” *arXiv preprint arXiv:2407.21514*, 2024. doi:10.48550/arxiv.2407.21514. (TR970, [A Coordinate-Mapped Ram Transform for Wireless Communication in Doubly-Selective Channels with Domain Adaptivity]).

- [91] Davide Tornielli Bellini, Dario Tagliaferri, Marouan Mizmizi, Stefano Tebaldini, and Umberto Spagnolini. “Multi-View Integrated Imaging and Communication.” *arXiv preprint arXiv:2410.02576*, 2024. [doi:10.48550/arxiv.2410.02576](https://doi.org/10.48550/arxiv.2410.02576). (**TR973**, [A Multi-View Panel-Jet Ram Transform for Joint Scene Reconstruction in 6G Integrated Sensing and Communication (ISAC)]).
- [92] Mengjiang Sun, Peng Chen, and Zhenxin Cao. “Range-Angle Estimation for FDA-MIMO System With Frequency Offset.” *arXiv preprint arXiv:2403.14978*, 2024. [doi:10.48550/arxiv.2403.14978](https://doi.org/10.48550/arxiv.2403.14978). (**TR974**, [A Coordinate-Mapped Local-Jet Ram Transform for Range-Angle Estimation in FDA-MIMO Systems with Carrier Frequency Offset]).

2 Neural Operators and Scientific Machine Learning

78 bibliography items.

2.1 Neural Operators and Operator Learning

- [93] Nadim Ahmed, Md. Ashraful Babu, Muhammad Sajjad Hossain, Md. Fayz-Al- Asad, Md. Awlad Hossain, Md. Mortuza Ahmmed, M. Mostafizur Rahman, and Mufti Mahmud. “Reinforcement Operator Learning (ROL): A hybrid DeepONet-guided reinforcement learning framework for stabilizing the Kuramoto-Sivashinsky equation.” *PLOS One*, vol. 21, no. 1, art. e0341161, 2026. [doi:10.1371/journal.pone.0341161](https://doi.org/10.1371/journal.pone.0341161). (**TR256**, [An Analytic Ram Panel-Jet Core for Kuramoto-Sivashinsky Stabilization A Design-Around and Benchmark Instance of the Analytic-Core-plus-Learned-Residual Umbrella (TR165) Targeting ROL-KS-2026 (DeepONet-Guided Reinforcement Learning)]).
- [94] Branden Frieden, James M. Ferguson, Alan Kuntz, and Varun Shankar. “Neural Operators for Design-Space Surrogate Modeling of Tendon-Actuated Continuum Robots.” *arXiv preprint arXiv:2605.19104*, 2026. [doi:10.48550/arxiv.2605.19104](https://doi.org/10.48550/arxiv.2605.19104). (**TR259**, [Analytic-Core-Plus-Learned-Residual Ram Transforms for Tendon-Actuated Continuum-Robot Design-Space Surrogates A Cosserat Variable-Coefficient Panel-Jet Core with Bounded Neural-Operator Correction]).
- [95] Ryan Bausback, Jingqiao Tang, Lu Lu, Feng Bao, and Phuoc-Toan Huynh. “Stochastic Operator Network: A Stochastic Maximum Principle Based Approach to Operator Learning.” *Journal of Machine Learning*, vol. 5, no. 1, pp. 71-96, 2026. [doi:10.4208/jml.250709](https://doi.org/10.4208/jml.250709). (**TR264**, [A Ram-Transform Analytic-Core Approach to the Stochastic Operator Network: Kramers-Moyal Identification of the FBSDE Generator with a Learned Adjoint Residual]).
- [96] Hrishikesh Viswanath, Md Ashiqur Rahman, Abhijeet Vyas, Andrey Shor, Beatriz Medeiros, Stephanie Hernandez, Suhas Eswarappa Pameela, and Aniket Bera. “Neural Operator: Is Data All You Need to Model the World? An Insight Into the Paradigm of Data-Driven Scientific ML.” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 48, no. 8, pp. 10097-10111, 2026. [doi:10.1109/tpami.2026.3682604](https://doi.org/10.1109/tpami.2026.3682604). (**TR267**, [Positioning Report: The Neural-Operator Data-vs-Physics Thesis as an Instance of the Analytic-Core-plus-Learned-Residual Umbrella (TR165)]).
- [97] Riccardo Saporiti and Fabio Nobile. “Neural Galerkin Normalizing Flows for Bayesian Inference of Diffusions with Inaccessible Boundaries.” *arXiv preprint arXiv:2606.04324*, 2026. [arXiv:2606.04324](https://arxiv.org/abs/2606.04324). (**TR283**, [Boundary-Constrained Fokker-Planck-Ram Identification: An Analytic-Core-plus-Learned-Residual Transform for Bayesian Inference of Diffusions with Inaccessible Boundaries]).
- [98] Mingyu Han, Daniel Zhengyu Huang, Yuhan Wang, Zhang Yanshu, and Jiayi Zhou. “Geometric Generalization of Neural Operators from Kernel Integral Perspective.” *arXiv preprint arXiv:2602.01498*, 2026. [arXiv:2602.01498](https://arxiv.org/abs/2602.01498). (**TR301**, [A Ram-Transform Reading of the Geometric Generalization of Neural Operators: Analytic Local-Jet / Graph-Global Core plus Learned Residual]).

- [99] Carlo Marcati, Mario Marić, Christoph Schwab, and Jakob Zech. “Neural and Spectral Operator Surrogates on Gaussian Spaces.” *arXiv preprint arXiv:2607.08492*, 2026. doi:10.48550/arxiv.2607.08492. (TR351, [Spectral-Ramlet Core plus Learned Residual for Operator Surrogates on Gaussian Spaces: A Wiener-Chaos Ram Transform]).
- [100] Arth Sojitra, Mrigank Dhingra, and Omer San. “FEDONet: Fourier-embedded DeepONet for spectrally accurate operator learning.” *Journal of Computational Physics*, vol. 559, p. 114931, 2026. doi:10.1016/j.jcp.2026.114931. (TR573, [An Analytic Ram Master-Atom Spectral Core with Learned Residual for Fourier-Embedded Operator Learning A Re-Application of the Analytic-Core-Plus-Learned-Residual Umbrella (TR165) to FEDONet-Class Neural Operators]).
- [101] Xu-Hui Zhou, Jiequn Han, Muhammad I. Zafar, Eric M. Wolf, Christopher R. Schrock, Christopher J. Roy, and Heng Xiao. “Neural operator-based super-fidelity: A warm-start approach for accelerating steady-state simulations.” *Journal of Computational Physics*, vol. 529, p. 113871, 2025. doi:10.1016/j.jcp.2025.113871. (TR646, [Neural-Operator Super-Fidelity as a Residual-Certified Warm Start for Steady CFD Correct operator domains, derivative adjoints, conditional convergence, error budgets, uncertainty, and reproducible validation]).
- [102] Rishikesh Ranade, Mohammad Amin Nabian, Kaustubh Tangsali, Alexey Kamenev, Oliver Hennigh, Ram Cherukuri, and Sanjay Choudhry. “DoMINO: A Decomposable Multi-scale Iterative Neural Operator for Modeling Large Scale Engineering Simulations.” *arXiv preprint arXiv:2501.13350*, 2025. doi:10.48550/arxiv.2501.13350. (TR648, [DoMINO as a Typed Global-Local Point-Cloud Operator Architecture, dimensions, finite exactness, adjoints, conditioning, error bounds, uncertainty, and reproducible validation]).
- [103] Binghang Lu, ZhaoPeng Hao, Christian Moya, and Guang Lin. “FPINN-deeponet: A physics-informed operator learning framework for multi-term time-fractional mixed diffusion-wave equations.” *Journal of Computational Physics*, vol. 538, p. 114184, 2025. doi:10.1016/j.jcp.2025.114184. (TR655, [Verified Causal Cores for Fractional Operator Learning L1/L2 history discretization, rank-tested local jets, adjoints, error, and uncertainty]).
- [104] Waleed Diab and Mohammed Al Kobaisi. “Temporal neural operator for modeling time-dependent physical phenomena.” *Scientific Reports*, vol. 15, no. 1, art. 32791, 2025. doi:10.1038/s41598-025-16922-5. (TR656, [Verification-Conditioned Temporal Neural Operators Faithful TNO architecture, moment-audited propagator cores, adjoints, rollout error, and uncertainty]).
- [105] Zhiwei Zhao, Changqing Liu, Yingguang Li, Zhibin Chen, and Xu Liu. “Diffeomorphism neural operator for various domains and parameters of partial differential equations.” *Communications Physics*, vol. 8, no. 1, art. 15, 2025. doi:10.1038/s42005-024-01911-3. (TR657, [Verified Diffeomorphic Operator Learning on Varying Domains Faithful DNO mapping, Piola pullbacks, rank-complete local cores, adjoints, error, and uncertainty]).
- [106] Nafisa Mehtaj and Sourav Banerjee. “Scientific Machine Learning for Elastic and Acoustic Wave Propagation: Neural Operator and Physics-Guided Neural Network.” *Sensors*, vol. 25, no. 12, art. 3588, 2025. doi:10.3390/s25123588. (TR666, [Conditioned Scientific Machine Learning for Elastic and Acoustic Waves]).
- [107] T. Ye and Y. Xiao. “Surrogate Reservoir Simulation for Waterflooding Production based on Fourier Neural Operator.” In *85th EAGE Annual Conference & Exhibition*, pp. 1-5, 2024. doi:10.3997/2214-4609.202410972. (TR982, [Ram Transform Surrogate for Two-Phase Waterflooding: An Analytic Spectral+Panel Core with Learned Residual (TR982)]).

2.2 Industrial Digital Twins and Engineering Surrogates

- [108] Maximilian Kannapinn, Fabian Roth, and Oliver Weeger. “Digital Twin Inference from Multi-physical Simulation Data of DED Additive Manufacturing Processes with Neural ODEs.” *In Lecture Notes in Computational Science and Engineering*, pp. 121-142, Springer Nature Switzerland, 2026. doi:10.1007/978-3-032-16253-3_8. (TR253, [Analytic-Core Ram-Jet Digital Twins for Directed-Energy-Deposition Additive Manufacturing: Fokker-Planck-Ram Identification and Panelized Variable-Coefficient PDE Inversion as a Certified Alternative to Neural-ODE Surrogates]).
- [109] Fuad Hasan, Abderrachid Hamrani, Tyler Dolmetsch, Somnath Somadder, Md Munim Rayhan, Arvind Agarwal, and Dwayne McDaniel. “Inverse Thermal Process Design for Interlayer Temperature Control in Wire-Directed Energy Deposition Using Physics-Informed Neural Networks.” *Journal of Manufacturing and Materials Processing*, vol. 10, no. 2, p. 52, 2026. doi:10.3390/jmmp10020052. (TR255, [Inverse Thermal Process Design for Interlayer Temperature Control in Wire-Directed Energy Deposition via a Variable-Coefficient Ram Transform with Analytic-Core-plus-Learned-Residual Inversion]).
- [110] Aswin Karkadakattil. “A Physics-Stabilized Self-Updating Digital Twin Framework Using Physics-Informed Neural Networks for Thermal Field Prediction.” *Applied Computer Systems*, vol. 31, no. 1, pp. 30-40, 2026. doi:10.2478/acss-2026-0003. (TR261, [A Ram-Transform Analytic-Core Formulation of Physics-Stabilized Self-Updating Thermal Digital Twins (Re-derivation and coverage analysis of , ACSS 2026)]).
- [111] Raghab Singh. “Neural Network-Based Surrogate Modeling for Fast Solid Mechanics Simulations.” *TechRxiv preprint*, 2026. doi:10.36227/techrxiv.176116524.49178396/v2. (TR274, [Panel-Jet Analytic Core plus Learned Residual for Fast Solid-Mechanics Surrogates: A Ram Transform Derivation]).
- [112] Tyler E. Maltba, Ben S. Southworth, Jeffrey R. Haack, and Marc L. Klasky. “Causal multi-fidelity surrogate forward and inverse models for ICF implosions.” *Scientific Reports*, 2026. doi:10.1038/s41598-026-57115-y. (TR277, [Causal Multi-Fidelity Ram-Transform Surrogates for ICF Implosions: Analytic Core, Learned Residual, and Inverse-Source Recovery of Drive/Hohlraum Parameters]).
- [113] E. Javier Olucha, Valentin Preda, Amritam Das, and Roland Tóth. “Data-driven Learning of LPV Surrogate Models of Fuel Sloshing.” *arXiv preprint arXiv:2604.12505*, 2026. arXiv:2604.12505. (TR278, [Analytic-Core-Plus-Learned-Residual LPV Surrogates for Fuel Sloshing: A Panel-Jet Ram Transform Derivation]).
- [114] Ivan Buntic and Bernd Flemisch. “Augmenting a Pure and Hybrid Vertical Equilibrium Scheme Via Data-Driven Surrogate Modelling.” *Transport in Porous Media*, vol. 153, no. 6, art. 79, 2026. doi:10.1007/s11242-026-02325-1. (TR280, [An Analytic-Core-Plus-Learned-Residual Ram Transform for Vertical-Equilibrium Multiphase-Flow Surrogate Modeling A Panelized Parametrix for the Vertically Integrated Flow Operator with a Calibrated Closure Residual]).
- [115] Raúl Rubio Serrano. “Development and application of an EIFEM-based surrogate model for structural modelling, preconditioning and optimization.” *Dissertation, Universitat Politècnica de Catalunya*, 2026. doi:10.5821/dissertation-2117-465713. (TR281, [An Analytic Ram-Panel Core with Learned Residual for EIFEM Structural Surrogates, Preconditioning, and Optimization]).
- [116] João Quaresma, Renato Cotta, Gianfranco Stieven, Felipe Eler, and Paulo Couto. “Hybrid Integral Transform Solution of a Nonlinear Core-Flooding Model with Capillary Pressure and End Effects.” *Research Square preprint*, 2026. doi:10.21203/rs.3.rs-9555718/v1. (TR284, [A Panel-Jet Ram Transform for a Nonlinear Core-Flooding Model with Capillary Pressure and End Effects Analytic Variable-Coefficient Core plus Learned Residual as an Alternative to Hybrid Integral Transforms]).
- [117] Chawit Kaewnuratchadasorn, Jiaji Wang, Chul-Woo Kim, and Xiaowei Deng. “Geometry physics neural operator solver for solid mechanics.” *Computer-Aided Civil and Infrastructure Engineering*, vol. 40, no. 10, pp. 1388-1404, 2025. doi:10.1111/mice.13405. (TR662, [Geometry-Aware Neural Operators with Coercive Elasticity Cores]).

2.3 Differential and Integral Equation Solvers

- [118] Benjamin M. Kent, Lorenzo Tamellini, Matteo Giacomini, and Antonio Huerta. “Noise-robust multi-fidelity surrogate modelling for parametric partial differential equations.” *Journal of Computational Physics*, vol. 554, p. 114761, 2026. doi:10.1016/j.jcp.2026.114761. (TR254, [A Noise-Robust Multi-Fidelity Surrogate for Parametric PDEs via a Ram Analytic-Core-Plus-Learned-Residual Cascade]).
- [119] Benedikt Klein and Mario Ohlberger. “Multi-fidelity learning of reduced order models for parabolic PDE constrained optimization.” *Advances in Computational Mathematics*, vol. 52, no. 2, art. 19, 2026. doi:10.1007/s10444-026-10296-6. (TR263, [A Panel-Jet Analytic Core with Learned Residual for Multi-Fidelity Reduced-Order Models of Parabolic PDE-Constrained Optimization]).
- [120] Zongjia Long, Qi Zhou, Aiqing Zhu, Dong Dai, and Yiqun Liu. “Deep neural operator for free boundary problems.” *Nature Machine Intelligence*, vol. 8, no. 5, pp. 806-817, 2026. doi:10.1038/s42256-026-01233-9. (TR269, [Coordinate-Mapped Panel-Jet Ram Transforms for Moving Free-Boundary PDEs: An Analytic-Core-plus-Learned-Residual Operator for Stefan, Obstacle, and Optimal-Stopping Problems]).
- [121] Alexander Keller, Frances Kuo, Dirk Nuyens, and Ian Sloan. “Regularity and tailored regularization of deep neural networks, with application to parametric PDEs in uncertainty quantification.” *Mathematics of Computation*, 2026. doi:10.1090/mcom/4220. (TR271, [Analytic-Core + Regularity-Tailored Residual Regularization for Parametric-PDE Uncertainty Quantification A Ram-Transform Derivation Complementing the Analytic-Core-plus-Learned-Residual Umbrella (TR165)]).
- [122] Jae Yong Lee, Gwang Jae Jung, Byungchan Lim, and Hyung Ju Hwang. “FourierSpecNet: Neural collision operator approximation inspired by the Fourier spectral method for solving the Boltzmann equation.” *Kinetic and Related Models*, vol. 21, no. 0, pp. 69-103, 2026. doi:10.3934/krm.2026004. (TR272, [A Hermitian-Bilinear Ram Core plus Learned Residual for Fourier-Spectral Approximation of the Boltzmann Collision Operator A Design-Around of Fully-Neural Collision Surrogates (FourierSpecNet)]).
- [123] Lennon Shikhman. “One Operator to Rule Them All? On Boundary-Indexed Operator Families in Neural PDE Solvers.” *arXiv preprint arXiv:2603.01406*, 2026. arXiv:2603.01406. (TR275, [Boundary-Indexed Ram Operator Families: An Analytic-Core-plus-Learned-Residual Alternative to “One Operator” Neural PDE Solvers]).
- [124] Pengyu Zhang, Arnaud Vadeboncoeur, Alex Glyn-Davies, and Mark Girolami. “Hierarchical Inference and Closure Learning via Adaptive Surrogates for ODEs and PDEs.” *arXiv preprint arXiv:2603.03922*, 2026. arXiv:2603.03922. (TR279, [Hierarchical Inference and Closure Learning via Adaptive Ram Surrogates for ODEs and PDEs A TR182/TR165 Analytic-Core-plus-Learned-Residual Formulation]).
- [125] Qinghua Wu. “Machine-precision solution of Fredholm integral equations via barycentric physics-informed method.” *Results in Applied Mathematics*, vol. 29, p. 100689, 2026. doi:10.1016/j.rinam.2026.100689. (TR290, [Analytic Ram Core plus Collocation Residual for Machine-Precision Fredholm Integral-Equation Solving: A Benchmark-Oriented]).
- [126] Jashwanth Reddy Kadaru and Vaishnavi Gujjula. “A fast direct solver based neural network for solving PDEs.” *arXiv preprint arXiv:2606.19895*, 2026. doi:10.48550/arxiv.2606.19895. (TR293, [Fast-Direct-Solver Neural Networks for PDEs as Analytic-Core-plus-Learned-Residual Ram Panel Operators A Derivation-Stage Technical Report]).
- [127] Francesca R. Crucinio and Adam M. Johansen. “Solving Fredholm Integral Equations of the Second Kind via Wasserstein Gradient Flows.” *Electronic Journal of Statistics*, vol. 20, no. 1, pp. 811-861, 2026. doi:10.1214/26-ejs2504. (TR295, [A Ram-Transform Local-Jet / Neumann Inversion of Fredholm Integral Equations of the Second Kind and its Contrast with a Wasserstein Gradient-Flow Solver]).
- [128] Mohsen Didgar and Farzan Ekhlesi. “A new application of Taylor expansion for approximate solution of systems of Fredholm integral equations.” *International Journal of Mathematics and Computer in Engineering*, vol. 4, no. 1, pp. 127-144, 2026. doi:10.2478/ijmce-2026-0008. (TR296, [A Block-Local Ram Transform for Systems of Fredholm Integral Equations: Coupled Moment-Matrix Inversion and Panel Coupling]).

- [129] Jie Jiang and Yuesheng Xu. “Adaptive Multi-Grade Deep Learning for Highly Oscillatory Fredholm Integral Equations of the Second Kind.” *arXiv preprint arXiv:2601.04496*, 2026. [arXiv:2601.04496](#). (**TR298**, [Phase-Adapted Ramlet Panels with Adaptive Multi-Grade Learned Residuals for Highly Oscillatory Fredholm Integral Equations of the Second Kind]).
- [130] Jie Jiang and Yuesheng Xu. “Adaptive Multi-Grade Deep Learning for Highly Oscillatory Fredholm Integral Equations of the Second Kind.” *Journal of Scientific Computing*, vol. 106, no. 3, art. 64, 2026. [doi:10.1007/s10915-026-03189-9](#). (**TR299**, [Oscillatory-Panel Ram Transform for Highly Oscillatory Fredholm Integral Equations of the Second Kind: A Multi-Grade Deep Learning Scheme as an Analytic-Core-plus-Learned-Residual Instance]).
- [131] Ali Karim Lelo Alobaidi. “Advancing Solutions for Fractional Volterra-Fredholm Integro-Differential Equations: A Comprehensive Review of Recent Numerical Methods.” *International Journal of Research and Innovation in Applied Science*, vol. 11, no. 6, pp. 1604-1620, 2026. [doi:10.51584/ijrias.2026.11060125](#). (**TR300**, [Ram Transform Methods for Fractional Volterra-Fredholm Integro-Differential Equations: An Analytic-Jet, Panelized-Fredholm, and Fractional-Ramlet Formulation A]).
- [132] Dong Liu, Bin Zhang, Qi Luo, Heng Zhang, Yong Jiang, Xian-Tao Cui, and Chen Zhao. “Multi-antiderivative transformation alternating iterative deep learning method for solving anisotropic scattering neutron transport equations.” *Nuclear Science and Techniques*, vol. 37, no. 5, art. 83, 2026. [doi:10.1007/s41365-026-01888-4](#). (**TR303**, [A Multi-Antiderivative Ram Transform with Alternating Analytic-Core / Learned-Residual Iteration for Anisotropic-Scattering Neutron Transport]).
- [133] Igor A. R. Oliveira, Daniel A. S. Mendes, Haroldo F. Campos Velho, and Eduardo S. Pereira. “Solving backward heat transfer by physics-informed machine learning.” *Computational and Applied Mathematics*, vol. 45, no. 10, art. 421, 2026. [doi:10.1007/s40314-026-03818-x](#). (**TR308**, [A Mollified Composite Panel Ram Transform with Learned Residual for the Ill-Posed Backward Heat Problem]).
- [134] Jingmin Sun, Yuxuan Liu, Zecheng Zhang, and Hayden Schaeffer. “Towards a foundation model for partial differential equations: Multioperator learning and extrapolation.” *Physical Review E*, vol. 111, no. 3, art. 035304, 2025. [doi:10.1103/physreve.111.035304](#). (**TR654**, [Verification-Conditioned Multioperator PDE Foundation Models Symbolic-data fusion, boundary-complete local cores, adjoints, error, and uncertainty]).
- [135] Abu Bucker Siddik, Diane Oyen, Alexander Most, Michal Kucer, and Ayan Biswas. “SPUS: A Lightweight and Parameter-Efficient Foundation Model for PDEs.” *arXiv preprint arXiv:2510.01370*, 2025. [doi:10.48550/arxiv.2510.01370](#). (**TR658**, [Verified Lightweight PDE Foundation Models Faithful SPUS formulation, convolution moments, rank-aware local audits, rollout error, adjoints, and uncertainty]).
- [136] Anran Jiao, Haiyang He, Rishikesh Ranade, Jay Pathak, and Lu Lu. “One-shot learning for solution operators of partial differential equations.” *Nature Communications*, vol. 16, no. 1, art. 8386, 2025. [doi:10.1038/s41467-025-63076-z](#). (**TR659**, [Identifiable Local Cores and Residual-Certified Iteration for One-Shot PDE Operator Learning]).
- [137] Shuo Ling, Liwei Tan, and Wenjun Ying. “A hybrid kernel-free boundary integral method with operator learning for solving parametric partial differential equations in irregular domains.” *Communications in Nonlinear Science and Numerical Simulation*, vol. 147, p. 108816, 2025. [doi:10.1016/j.cnsns.2025.108816](#). (**TR660**, [Conditioned Hybrid Acceleration for Kernel-Free Boundary Integral Solvers]).
- [138] Lizuo Liu and Wei Cai. “DeepPropNet - A recursive deep neural network propagator for learning evolutionary PDE operators.” *Beijing Journal of Pure and Applied Mathematics*, vol. 2, no. 1, pp. 259-284, 2025. [doi:10.4310/bpam.250414235900](#). (**TR661**, [Stable Recursive Propagation with Reduced Neural Defect Correction]).
- [139] Zhiyuan Ren, Shijie Zhou, Dong Liu, and Qihe Liu. “EPINN: Enhanced Physics-Informed Neural Network for Solving Continuous Integral Equations.” *Journal of Artificial Intelligence Research*, vol. 84, 2025. [doi:10.1613/jair.1.20161](#). (**TR667**, [Residual-Certified Primitive-Network Solvers for Multidimensional Integral Equations]).

- [140] Yan Ma and Wei LI. “Efficient solution of second-kind Fredholm integral equations using L1 space discrete coordinates and physics-informed neural networks.” *Next Research*, vol. 2, no. 3, p. 100534, 2025. doi:10.1016/j.nexres.2025.100534. (TR668, [L1-Conditioned Discrete-Coordinate Neural Solvers for Fredholm Equations]).
- [141] Kawthar Alsa’di, Nik Mohd Asri B. Nik Long, Norazak Senu, and Z.K. Eshkuvatov. “Polynomial neural network for solving Caputo-conformable fractional Volterra-Fredholm integro-differential equation with three-point non-local boundary conditions.” *Alexandria Engineering Journal*, vol. 130, pp. 1075-1100, 2025. doi:10.1016/j.aej.2025.09.022. (TR669, [A Coordinate-Exact, Memory-Preserving Panel Method for Caputo-Conformable Volterra-Fredholm Problems with Nonlocal Integral Boundary Data]).
- [142] Sudarshan Santra, Pratibhamoy Das, and Palle Jorgensen. “A Unified Multifaceted Space-Time Wavelet Framework and Its Singularity Analysis for Weakly Singular Non-local Partial Integro-Differential Equations in High Dimensions.” *Acta Applicandae Mathematicae*, vol. 200, no. 1, art. 6, 2025. doi:10.1007/s10440-025-00756-4. (TR672, [Wavelet-Detected, Singularity-Flattened Panel Methods for Weakly Singular Space-Time Integro-Differential Equations]).
- [143] Jingmin Sun, Yuxuan Liu, Zecheng Zhang, and Hayden Schaeffer. “Towards a Foundation Model for Partial Differential Equations: Multi-Operator Learning and Extrapolation.” *arXiv preprint arXiv:2404.12355*, 2024. doi:10.48550/arxiv.2404.12355. (TR979, [A Ram Transform Re-derivation of Multi-Operator PDE Foundation Models: Analytic Local-Jet Core plus Learned Residual]).
- [144] Emanuele Zappala, Antonio Henrique de Oliveira Fonseca, Josue Ortega Caro, Andrew Henry Moberly, Michael James Higley, Jessica Cardin, and David van Dijk. “Learning integral operators via neural integral equations.” *Nature Machine Intelligence*, vol. 6, no. 9, pp. 1046-1062, 2024. doi:10.1038/s42256-024-00886-8. (TR980, [Ram Transform Analytic-Core Derivation for Neural Integral Equations]).
- [145] Tianyu Chen, Haoyi Zhou, Ying Li, Hao Wang, Zhenzhe Zhang, Tianchen Zhu, Shanghang Zhang, and Jianxin Li. “FreqMoE: Dynamic Frequency Enhancement for Neural PDE Solvers.” In *Proceedings of the Thirty-Third International Joint Conference on Artificial Intelligence*, pp. 7356-7364, 2024. doi:10.24963/ijcai.2024/818. (TR981, [Ram Transform Analysis of FreqMoE: A Spectral Analytic-Core-plus-Learned-Residual Formulation of Dynamic Frequency-Enhanced Neural PDE Solvers]).
- [146] Shira Morosohk, Zibo Wang, Sai Tej Paruchuri, Tariq Rafiq, and Eugenio Schuster. “Optimal control of the electron temperature profile in DIII-D using machine learning surrogate models.” *Fusion Engineering and Design*, vol. 206, p. 114615, 2024. doi:10.1016/j.fusengdes.2024.114615. (TR985, [Analytic Ram-Jet Core with Certified Sensitivities for Optimal Electron-Temperature-Profile Control in Tokamaks A Variable-Coefficient Transport-PDE Design-Around of ML-Surrogate Profile Control (DIII-D)]).
- [147] Pawan Negi, Maggie Cheng, Mahesh Krishnamurthy, Wenjun Ying, and Shuwang Li. “Learning domain-independent Green’s function for elliptic partial differential equations.” *Computer Methods in Applied Mechanics and Engineering*, vol. 421, p. 116779, 2024. doi:10.1016/j.cma.2024.116779. (TR987, [A Ram Transform Reframing of Domain-Independent Green’s Functions for Elliptic PDEs: Analytic Core Inversion plus Learned Residual]).

2.4 Inverse Problems, Reconstruction, and Experimental Design

- [148] Branden Frieden, James M. Ferguson, Alan Kuntz, and Varun Shankar. “Neural Operators for Design-Space Surrogate Modeling of Tendon-Actuated Continuum Robots.” *arXiv preprint arXiv:2605.19104*, 2026. arXiv:2605.19104. (TR258, [Analytic-Core-plus-Learned-Residual Ram Transforms for Design-Space Surrogate Modeling and Inverse Design of Tendon-Actuated Continuum Robots]).
- [149] Dibakar Roy Sarkar, Vijay Kag, Birupaksha Pal, and Somdatta Goswami. “Learning hidden physics and system parameters with deep operator networks.” *Computer Methods in Applied Mechanics and Engineering*, vol. 456, p. 118926, 2026. doi:10.1016/j.cma.2026.118926. (TR262, [A Ram-Transform Reduction of Hidden-Physics DeepONet]).

- [150] Jashwanth Reddy Kadaru and Vaishnavi Gujjula. “A fast direct solver based neural network for solving PDEs.” *arXiv preprint arXiv:2606.19895*, 2026. [arXiv:2606.19895](#). (**TR291**, [Fast Direct Solvers as Certified Ram-Transform Panel Inverses: A Panel/Block-Tridiagonal Analytic Core with a Learned Off-Diagonal Residual for Neural PDE Surrogates]).
- [151] Yusif Gasimov, Abdeljalil Nachaoui, and Aynura Aliyeva. “Reduction to a Fredholm integral equation and numerical solution of the inverse Cauchy problem for the Schrödinger-Pauli equation.” *International Journal of Mathematics and Computer in Engineering*, vol. 4, no. 2, pp. 261-280, 2026. [doi:10.2478/ijmce-2026-0015](#). (**TR297**, [A Local Ram-Transform Inverse for the Inverse Cauchy Problem of the Schrödinger-Pauli Equation: Fredholm Reduction, Analytic-Core Jet Inversion, and Mollified Fredholm-NN Residual Correction]).
- [152] Benjamin Walker. “Advances in Neural Controlled Differential Equations.” *arXiv preprint arXiv:2607.05280*, 2026. [arXiv:2607.05280](#). (**TR356**, [Analytic-Core Ram Transforms for Neural Controlled Differential Equations: A Certified Forward/Inverse Jet Kernel with Exact Sensitivities]).
- [153] Steven Maio, Alen Alexanderian, Karina Koval, and Ruanui Nicholson. “Multi-type Sensor Placement for PDE-based Bayesian Inverse Problems.” *arXiv preprint arXiv:2607.08074*, 2026. [doi:10.48550/arxiv.2607.08074](#). (**TR404**, [Jet-Based Fisher-Information Sensor Placement for PDE-Based Bayesian Inverse Problems: An Analytic Ram-Transform Core for Multi-Type Optimal Experimental Design]).
- [154] Xuezi Gong and Yuanyuan Zha. “Physics-Informed Neural Network With Enhanced Parameter-State Coupling for Inverse Modeling of Unsaturated Flow in Heterogeneous Soils.” *Water Resources Research*, vol. 61, no. 9, art. e2025WR040040, 2025. [doi:10.1029/2025wr040040](#). (**TR671**, [Identifiability-Aware KLE Inversion of One-Dimensional Unsaturated Flow: A Conservative Panel Core with Parameter-State Residual Learning]).
- [155] Kyriakos C. Georgiou, Constantinos Siettos, and Athanasios N. Yannacopoulos. “Fredholm Neural Networks for inverse problems in elliptic PDEs.” *arXiv preprint arXiv:2507.06038*, 2025. [doi:10.48550/arxiv.2507.06038](#). (**TR674**, [Panel Potential Operators and Regularized Source Recovery: A Ram-Calculus Companion to Potential Fredholm Neural Networks]).

2.5 Stochastic, Geometric, and Hybrid Scientific Learning

- [156] Yuan Gao, Qunjun Lang, and Fei Lu. “Self-Test Loss Functions for Learning Weak-Form Operators and Gradient Flows.” *Journal of Scientific Computing*, vol. 108, no. 1, art. 28, 2026. [doi:10.1007/s10915-026-03348-y](#). (**TR265**, [Self-Test Loss Functions for Learning Weak-Form Operators and Gradient Flows: A Ram-Transform Calibration Reading]).
- [157] Zhihao Xiong and Pengyang Zhao. “Attaining physics-driven convolutional operators by architecture design.” *Communications Physics*, vol. 9, no. 1, art. 207, 2026. [doi:10.1038/s42005-026-02613-8](#). (**TR268**, [Exactly-Invertible Physics-Constrained Convolutional Operators via Local Ram Jets: An Analytic-Core-plus-Learned-Residual Formulation]).
- [158] Han Wan, Qi Wang, Yuan Mi, Rui Zhang, and Hao Sun. “PIMRL: Physics-Informed Multi-Scale Recurrent Learning for Burst-Sampled Spatiotemporal Dynamics.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, no. 2, pp. 1096-1104, 2026. [doi:10.1609/aaai.v40i2.37080](#). (**TR273**, [A Ram-Transform Analytic-Core-plus-Learned-Residual Framework for Burst-Sampled Multiscale Spatiotemporal Dynamics A]).
- [159] Bingran Wang, Seongha Jeong, Sebastiaan P. C. van Schie, Dongyeon Han, Jaeho Min, and John T. Hwang. “Knowledge-Guided Generative Surrogate Modeling for High-Dimensional Design Optimization Under Scarce Data.” *Journal of Computing and Information Science in Engineering*, vol. 26, no. 7, art. 071005, 2026. [doi:10.1115/1.4070934](#). (**TR282**, [A Certified-Sensitivity Local-Jet Analytic Core for Generative Surrogate Modeling in High-Dimensional Design Optimization Under Scarce Data]).

- [160] Alireza Afzal Aghaei, Mahdi Movahedian Moghaddam, and Kourosh Parand. “PINNIES: An efficient physics-informed neural network framework for integral operator problems.” *Computer Physics Communications*, vol. 327, p. 110255, 2026. doi:10.1016/j.cpc.2026.110255. (TR287, [Benchmarking and Design-Around Report: Analytic Local Moment-Jet Inversion and the Analytic-Core-Plus-Learned-Residual Umbrella versus PINNIES for Integral-Operator Problems]).
- [161] Andrew Qing He and Wei Cai. “Neural Pushforward Samplers for the Fokker-Planck Equation on Embedded Riemannian Manifolds.” *arXiv preprint arXiv:2603.16239*, 2026. arXiv:2603.16239. (TR306, [Chart-Panel Ram Transforms for the Fokker-Planck Equation on Embedded Riemannian Manifolds: An Analytic Core with Learned Residual]).
- [162] Giovanni Catalani, Jean Fesquet, Xavier Bertrand, Frédéric Tost, Michael Bauerheim, and Joseph Morlier. “Towards scalable surrogate models based on neural fields for large scale aerodynamic simulations.” *Computers & Fluids*, vol. 306, p. 106929, 2026. doi:10.1016/j.compfluid.2025.106929. (TR647, [MARIO Neural-Field Surrogates for Large-Scale Aerodynamics Typed geometry and query operators, resolution limits, weighted adjoints, conditioning, error budgets, uncertainty, and validation]).
- [163] Giovanni Catalani, Jean Fesquet, Xavier Bertrand, Frédéric Tost, Michael Bauerheim, and Joseph Morlier. “Towards scalable surrogate models based on neural fields for large scale aerodynamic simulations.” *Computers & Fluids*, vol. 306, p. 106929, 2026. doi:10.1016/j.compfluid.2025.106929. (TR650, [Verification-Conditioned Physics Cores for Resolution-Invariant Aerodynamic Neural Fields]).
- [164] Boyang Chen, Amin Nadimy, Claire E. Heaney, Mohammad Kazem Sharifian, Lluís Via Estrem, Ludovico Nicotina, Arno Hilberts, and Christopher C. Pain. “Solving the discretised shallow water equations using neural networks.” *Advances in Water Resources*, vol. 197, p. 104903, 2025. doi:10.1016/j.advwatres.2025.104903. (TR651, [Verified Fixed-Weight ConvFEM Shallow-Water Solvers with Learned-Defect and Adjoint Controls]).
- [165] Yanjia Wang, Dong Yang, Ye Yuan, Jing Zhang, and Francis T.K. Au. “Hybrid physics-informed neural network with parametric identification for modeling bridge temperature distribution.” *Computer-Aided Civil and Infrastructure Engineering*, vol. 40, no. 22, pp. 3503-3524, 2025. doi:10.1111/mice.13436. (TR652, [Verification-Conditioned Hybrid Thermal Solvers for Composite Bridge-Deck Parameter Calibration]).
- [166] Nikhil Dadheech, Tai-Long He, and Alexander J. Turner. “High-resolution greenhouse gas flux inversions using a machine learning surrogate model for atmospheric transport.” *Atmospheric Chemistry and Physics*, vol. 25, no. 10, pp. 5159-5174, 2025. doi:10.5194/acp-25-5159-2025. (TR663, [Conditioned Bayesian Flux Inversion with Learned Atmospheric Footprints]).
- [167] Matheus L. Peres, Elisa D. Sotelino, and Leonardo C. Mesquita. “ANN-Based Green’s Function Approach for Reservoir Geomechanics.” *International Journal for Numerical and Analytical Methods in Geomechanics*, vol. 49, no. 12, pp. 2820-2831, 2025. doi:10.1002/nag.4012. (TR664, [Reciprocity-Preserving Neural Green Functions for Stratified Reservoir Geomechanics]).
- [168] Kapil Khanal, Carlos A. Michelén Ströfer, Matthieu Ancellin, and Maha N. Haji. “Fully differentiable boundary element solver for hydrodynamic sensitivity analysis of wave-structure interactions.” *Applied Ocean Research*, vol. 163, p. 104707, 2025. doi:10.1016/j.apor.2025.104707. (TR665, [Conditioned Differentiable Boundary Elements for Hydrodynamic Design]).
- [169] Philipp Weder, Mariella Kast, Fernando Henríquez, and Jan S. Hesthaven. “Galerkin neural network-POD for acoustic and electromagnetic wave propagation in parametric domains.” *Advances in Computational Mathematics*, vol. 51, no. 4, art. 37, 2025. doi:10.1007/s10444-025-10245-9. (TR670, [Inf-Sup Certified, Coordinate-Mapped Reduced Wave Solvers: A Panel-Ram Preconditioner with POD and Learned Coefficient Residuals]).
- [170] Ruslan Rytov. “Artificial Neural Network for Downward Continuation of Anomalous Magnetic Fields.” *Russian Journal of Earth Sciences*, pp. 1-5, 2025. doi:10.2205/2025es000996. (TR673, [Regularized Ram-Spectral Downward Continuation of Anomalous Magnetic Fields with Noise and Geometry Diagnostics]).

3 Computational Lithography and Nanophotonic Inverse Design

29 bibliography items.

3.1 EUV Lithography, Source Modeling, and Mask Optimization

- [171] Hiroyoshi Tanabe, Moe Sugiyama, Masayuki Shimoda, and Atsushi Takahashi. “STCC formula including polarization and M3D effects in high-NA EUV lithography.” *In Optical and EUV Nanolithography XXXIX*, vol. 13979, art. 139790G, 2026. doi:10.1117/12.3086632. (TR201, [Vectorial Hopkins-Ram Local Inverse for High-NA EUV Source Transmission Cross-Coefficients (STCC) with Polarization and Mask-3D Effects]).
- [172] Yuting Hu, Lei Zhuang, Chen Chia Wang, Ruiyang Qin, Hua Xiang, Gi-Joon Nam, and Jinjun Xiong. “MorphOPC: Advancing Mask Optimization with Multi-scale Hierarchical Morphological Learning.” *arXiv preprint arXiv:2605.12528*, 2026. arXiv:2605.12528. (TR311, [An Analytic Hopkins/Panel Ram Core with a Learned Multi-Scale Morphological Residual for Shift-Variant Mask Optimization A Ram-Transform Design-Around of Multi-Scale Hierarchical Morphological Mask Learning]).
- [173] Hiroyoshi Tanabe, Moe Sugiyama, Masayuki Shimoda, and Atsushi Takahashi. “Source-position-dependent transmission cross coefficient formula including polarization and mask three-dimensional effects in high-numerical-aperture extreme ultraviolet lithography.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 25, no. 03, art. 031604, 2026. doi:10.1117/1.jmm.25.3.031604. (TR312, [Source-Position-Dependent, Polarization-Vectorial, Mask-3D Transmission Cross-Coefficient Inversion for High-NA EUV Lithography A Bilinear (Hopkins) Ram-Transform Instance under the Analytic-Core-plus-Learned-Residual Umbrella]).
- [174] Hiroyoshi Tanabe, Moe Sugiyama, Masayuki Shimoda, and Atsushi Takahashi. “Source-position-dependent transmission cross coefficient formula including polarization and mask three-dimensional effects in high-numerical-aperture extreme ultraviolet lithography.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 25, no. 03, art. 031604, 2026. doi:10.1117/1.jmm.25.3.031604. (TR313, [Source-Position-Dependent Transmission Cross Coefficient as a Hermitian-Bilinear Ram Operator: Analytic Local Inversion with Polarization and Mask-3D Effects for High-NA EUV Computational Lithography]).
- [175] Haoyu Yang and Haoxing Ren. “GPU-Accelerated Inverse Lithography Towards High Quality Curvy Mask Generation.” *In Proceedings of the 2025 International Symposium on Physical Design*, pp. 42-50, 2025. doi:10.1145/3698364.3705343. (TR675, [Conditioned Panelized Hopkins-Ram Surrogates for GPU Curvilinear Inverse Lithography A Corrected Ram Calculus Reformulation of CurvyILT with Trust-Region Solves, Error Budgets, and Uncertainty Diagnostics]).
- [176] Haoxiang Jiang, Junqi Yang, Rui Xu, Ming Fang, and Dean Liu. “BBDM-ILT: Brownian bridge diffusion model for inverse lithography technology.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 24, no. 02, 2025. doi:10.1117/1.jmm.24.2.023202. (TR676, [Physics-Gated Ram Local-Jet Refinement for Brownian-Bridge Diffusion Inverse Lithography A Corrected Reformulation of BBDM-ILT with Conditioning, Uncertainty, and Reproducible Verification]).
- [177] Xiaodong Meng, Cai Chen, and Jie Ni. “Inverse Lithography Technology (ILT) Under Chip Manufacture Context.” *Micromachines*, vol. 17, no. 1, art. 117, 2026. doi:10.3390/mi17010117. (TR677, [Condition-Audited Process-Window Inverse Lithography with Curvilinear Edge Variables and Local Optical Moments]).
- [178] Jie Zhou, Qingyan Zhang, Haifeng Sun, Chuan Jin, Ji Zhou, and Junbo Liu. “Frequency-Decoupled Dual-Stage Inverse Lithography Optimization via Hierarchical Sampling and Morphological Enhancement.” *Micromachines*, vol. 16, no. 5, art. 515, 2025. doi:10.3390/mi16050515. (TR679, [Frequency-Decoupled Dual-Stage Inverse Lithography: Rank-Tested Ram Preconditioning, Hierarchical Sampling and Full-Model Acceptance]).
- [179] Hiroyoshi Tanabe, Masayuki Shimoda, and Atsushi Takahashi. “Rigorous electromagnetic simulator for extreme ultraviolet lithography and convolutional neural network reproducing electromagnetic simulations.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 24, no. 02, 2025.

- [doi:10.1117/1.jmm.24.2.024201](https://doi.org/10.1117/1.jmm.24.2.024201). (**TR680**, [*Singularity-Aware Ram Panel Preconditioning and Physics-Guided Residual Learning for Rigorous Three-Dimensional EUV Mask Electromagnetics*]).
- [180] Hiroyoshi Tanabe, Masayuki Shimoda, and Atsushi Takahashi. “Rigorous electromagnetic simulator for extreme ultraviolet lithography and convolutional neural network reproducing electromagnetic simulations.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 24, no. 02, 2025. [doi:10.1117/1.jmm.24.2.024201](https://doi.org/10.1117/1.jmm.24.2.024201). (**TR681**, [*Branch-Aware Ram Phase Retrieval for the Hopkins Imaging Tier of Rigorous EUV Simulation: Quadratic Jets, Diversity, Rank Tests, and Physics-Guided Electromagnetic Surrogates*]).
 - [181] Ke Wang and Kun Ren. “EAAUnet-ILT: A Lightweight and Iterative Mask Optimization Resolution with SRAF Constraint Scheme.” *Micromachines*, vol. 16, no. 10, art. 1162, 2025. [doi:10.3390/mi16101162](https://doi.org/10.3390/mi16101162). (**TR682**, [*Verified Ram-Calculus Formulation of Lightweight Iterative Inverse Lithography with SRAF Constraints Exact Forward Quadratic Jets, Matrix-Free Derivatives, Trust-Region Refinement, Identifiability, and Uncertainty*]).
 - [182] Ziqi Li, Lisong Dong, Xu Ma, and Yayi Wei. “Fast source mask co-optimization method for high-NA EUV lithography.” *Opto-Electronic Advances*, vol. 7, no. 4, art. 230235, 2024. [doi:10.29026/oea.2024.230235](https://doi.org/10.29026/oea.2024.230235). (**TR988**, [*A Ram-Transform Re-Derivation of Fast Source-Mask Co-Optimization for High-NA EUV Lithography A Hopkins-Bilinear Local Inverse (TR138) with a Source-Weight Wrapper and a High-NA Vector / Mask-3D Learned Residual (TR165)*]).
 - [183] Shuo Yin, Wenqian Zhao, Li Xie, Hong Chen, Yuzhe Ma, Tsung-Yi Ho, and Bei Yu. “FuILT: Full Chip ILT System With Boundary Healing.” In *Proceedings of the 2024 International Symposium on Physical Design*, pp. 13-20, 2024. [doi:10.1145/3626184.3633315](https://doi.org/10.1145/3626184.3633315). (**TR989**, [*Certified Analytic Boundary Healing for Full-Chip Inverse Lithography: A Panel-Jet Ram Transform with Block-Tridiagonal Interface Coupling*]).
 - [184] Haoyu Yang and Haoxing Ren. “GPU-Accelerated Inverse Lithography Towards High Quality Curvy Mask Generation.” *arXiv preprint arXiv:2411.07311*, 2024. [doi:10.48550/arxiv.2411.07311](https://doi.org/10.48550/arxiv.2411.07311). (**TR990**, [*Ram Transform Analysis of GPU-Accelerated Curvilinear Inverse Lithography: Local Inversion of the Hopkins Bilinear Imaging Functional*]).
 - [185] Mohamed Habib, Hossam A. H. Fahmy, and Mohamed F. Abu-ElYazeed. “Novel End-to-End Production-Ready Machine Learning Flow for Nanolithography Modeling and Correction.” *Advances in Artificial Intelligence and Machine Learning*, vol. 04, no. 01, pp. 1925-1942, 2024. [doi:10.54364/aaaiml.2024.41110](https://doi.org/10.54364/aaaiml.2024.41110). (**TR991**, [*A Ram Transform Derivation for Nanolithography Modeling and Correction: Analytic Hopkins Core plus Learned Residual*]).
 - [186] Haoyu Yang and Haoxing Ren. “ILILT: Implicit Learning of Inverse Lithography Technologies.” *arXiv preprint arXiv:2405.03574*, 2024. [doi:10.48550/arxiv.2405.03574](https://doi.org/10.48550/arxiv.2405.03574). (**TR992**, [*A Bilinear (Hopkins) Ram-Transform Core with an Implicit Learned Residual for Inverse Lithography: Derivation, Algorithm, and Screening Assessment*]).
 - [187] Wang Futian, Wei Juan, Wang Cuixiang, Jiang Miao, Mu Yu, Yu Chunlong, Liu Ruihua, Li Fu, Fan Jingjing, Liu Jinlai, Qin Jingkan, Tian Enqiang, Sun Song, Wang Chong, Liu Xiaonan, Yang Hao, Liang Di, Yan Binbin, Li Liang, Cao Qingchen, and Shi Jiangliu. “Progress in Inverse Lithography Technology.” *Laser & Optoelectronics Progress*, vol. 61, no. 21, art. 2100001, 2024. [doi:10.3788/lop241676](https://doi.org/10.3788/lop241676). (**TR993**, [*Local Bilinear (Hopkins) Ram Transform for Inverse Lithography: A Panel-Decomposed Analytic Inverse of the Partially-Coherent Imaging Functional*]).
 - [188] Mohamed S. E. Habib, Hossam A. H. Fahmy, and Mohamed F. Abu-ElYazeed. “Novel End-to-End Production-Ready Machine Learning Flow for Nanolithography Modeling and Correction.” *arXiv preprint arXiv:2401.02536*, 2024. [doi:10.48550/arxiv.2401.02536](https://doi.org/10.48550/arxiv.2401.02536). (**TR995**, [*A Local Hopkins (Hermitian-Bilinear) Ram Transform for Inverse Lithography, with an Analytic-Core-plus-Learned-Residual Wrapper*]).
 - [189] Hiroyoshi Tanabe, Akira Jinguji, and Atsushi Takahashi. “Accelerating extreme ultraviolet lithography simulation with weakly guiding approximation and source position dependent transmission cross coefficient formula.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 23, no. 01, 2024.

- [doi:10.1117/1.jmm.23.1.014201](https://doi.org/10.1117/1.jmm.23.1.014201). (**TR996**, [Ram Transform Analysis of a Source-Position-Dependent Hopkins Transmission-Cross-Coefficient Operator for EUV Lithography Simulation A Shift-Variant Hermitian-Bilinear Forward/Inverse Derivation]).
- [190] Ruixiang Chen, Yang Zhao, Haoqin Li, and Rui Chen. “Fast inverse lithography based on a model-driven block stacking convolutional neural network.” *arXiv preprint arXiv:2412.14599*, 2024. [doi:10.48550/arxiv.2412.14599](https://doi.org/10.48550/arxiv.2412.14599). (**TR997**, [Model-Driven Inverse Lithography via the Bilinear (Hopkins) Ram Operator with an Analytic-Core-plus-Learned-Residual Decomposition A Ram Transform Derivation Report]).
- [191] Guojin Chen, Hao Geng, Bei Yu, and David Z. Pan. “Open-Source Differentiable Lithography Imaging Framework.” *arXiv preprint arXiv:2409.15306*, 2024. [doi:10.48550/arxiv.2409.15306](https://doi.org/10.48550/arxiv.2409.15306). (**TR1000**, [A Local Analytic (Ram) Inverse for the Partially-Coherent Hopkins/SOCS Bilinear Imaging Operator in Inverse Lithography]).
- [192] Hiroyoshi Tanabe, Akira Jinguji, and Atsushi Takahashi. “Accelerating extreme ultraviolet lithography simulation with weakly guiding approximation and source position dependent transmission cross coefficient formula.” *Journal of Micro/Nanopatterning, Materials, and Metrology*, vol. 23, no. 01, 2024. [doi:10.1117/1.jmm.23.1.014201](https://doi.org/10.1117/1.jmm.23.1.014201). (**TR1001**, [A Bilinear (Hopkins) Ram-Transform Design-Around for Accelerated EUV Aerial-Image Simulation: Source-Position-Dependent TCC with a Weakly-Guiding Correction]).

3.2 Nanophotonic and Electromagnetic Inverse Design

- [193] Jui-Hung Sun, Mohamed Elsawaf, Yifei Zheng, Ho-Chun Lin, Chia Wei Hsu, and Constantine Sideris. “Near real-time full-wave inverse design of electromagnetic devices.” *Nature Communications*, vol. 17, no. 1, art. 2372, 2026. [doi:10.1038/s41467-026-69477-y](https://doi.org/10.1038/s41467-026-69477-y). (**TR276**, [A Variable-Coefficient Helmholtz Ram Jet with Analytic Core and Learned Residual for Near Real-Time Full-Wave Inverse Design of Electromagnetic Devices]).
- [194] Amirhossein Fallah and Constantine Sideris. “Fast 3D Nanophotonic Inverse Design Using Volume Integral Equations.” *ACS Photonics*, vol. 13, no. 9, pp. 2358-2366, 2026. [doi:10.1021/acsphotonics.5c02232](https://doi.org/10.1021/acsphotonics.5c02232). (**TR304**, [A Panelized Ram Transform for Fast 3D Nanophotonic Inverse Design via Volumetric Dyadic-Green’s Bilinear Local Inversion]).
- [195] Mingyu Park, Owen D. Miller, and Haejun Chung. “Nyquist-Sampled Time-Domain Adjoint FDTD for Memory-Efficient Broadband Nanophotonic Inverse Design.” *arXiv preprint arXiv:2607.08159*, 2026. [doi:10.48550/arxiv.2607.08159](https://doi.org/10.48550/arxiv.2607.08159). (**TR310**, [Nyquist-Sampled Time-Domain Adjoint FDTD via Panel-Jet Ram Transforms for Memory-Efficient Broadband Nanophotonic Inverse Design]).
- [196] Andrei F. Moskovtsev, Evgeny S. Gornev, Ekaterina L. Klochkova, and Vladimir V. Ivanov. “Data-Driven Model-Based Optical Proximity Correction with Image-to-Image Translation.” *TechRxiv preprint*, 2025. [doi:10.36227/techrxiv.176704477.75290918/v1](https://doi.org/10.36227/techrxiv.176704477.75290918/v1). (**TR678**, [Data-Initialized, Rank-Audited Optical Proximity Correction with Local SOCS Moment Refinement]).
- [197] Pengyu Fu, Zimeng Xu, Tiankuang Zhou, Hao Li, Jiamin Wu, Qionghai Dai, and Yue Li. “Reconfigurable metamaterial processing units that solve arbitrary linear calculus equations.” *Nature Communications*, vol. 15, no. 1, art. 6258, 2024. [doi:10.1038/s41467-024-50483-x](https://doi.org/10.1038/s41467-024-50483-x). (**TR986**, [A Ram-Transform Variable-Coefficient Jet Operator Realized on a Reconfigurable Metamaterial Substrate: Hardware Co-Design and Design-Around of TR182]).
- [198] Guojin Chen, Haoyu Yang, Haoxing Ren, Bei Yu, and David Z. Pan. “Differentiable Edge-based OPC.” *arXiv preprint arXiv:2408.08969*, 2024. [doi:10.48550/arxiv.2408.08969](https://doi.org/10.48550/arxiv.2408.08969). (**TR994**, [Analytic Edge-Perturbation Jacobian for Edge-Based OPC: A Ram-Transform Shape-Derivative of the Hopkins-SOCS Aerial Image with a Closed-Form Implicit-Contour EPE Map]).

- [199] Mahdi Derayatifar, Mohsen Habibi, Rama Bhat, and Muthukumaran Packirisamy. “Holographic direct sound printing.” *Nature Communications*, vol. 15, no. 1, art. 6691, 2024. doi:10.1038/s41467-024-50923-8. (TR998, [A Ram Transform Inverse-Source Operator for Shift-Variant Acoustic-Holographic Volumetric Printing in Aberrating Media]).

4 Batteries and Electrochemical Impedance

34 bibliography items.

4.1 Battery State Estimation and Hybrid Models

- [200] Prajakth N. Kumar, Praneeth R. Upadhy, S. Nischay, G. Pavan Kumar, Shobana T. S., and Rashmi K. B.. “A temperature- and impedance-aware LSTM-PINN framework for physically consistent battery SOH prediction.” *Scientific Reports*, vol. 16, no. 1, art. 7568, 2026. doi:10.1038/s41598-026-37850-y. (TR314, [A Ram-Transform Reading of Temperature- and Impedance-Aware LSTM-PINN Battery SOH Prediction Analytic DRT-Core Inversion plus Learned Temperature-Dependent Residual under the TR165 Analytic-Core-plus-Learned-Residual Umbrella]).
- [201] SHI Hongsi, SUN Xinwei, and WANG Kai. “Health State Estimation of Lithium-Ion Batteries Based on Electrochemical Impedance Spectroscopy.” *Power Generation Technology*, vol. 47, no. 1, p. 133, 2026. doi:10.12096/j.2096-4528.pgt.260112. (TR315, [Mollified Local Ram Inversion of the Distribution of Relaxation Times for Electrochemical Impedance Spectroscopy-Based State-of-Health Estimation of Lithium-Ion Batteries]).
- [202] Yunhong Che, Yusheng Zheng, Jinwook Rhyu, Jia Guo, Shimin Wang, Remus Teodorescu, and Richard D. Braatz. “Mechanistically guided residual learning for battery state monitoring throughout life.” *Nature Communications*, vol. 17, no. 1, art. 855, 2026. doi:10.1038/s41467-025-67565-z. (TR317, [A Mechanistically-Guided Ram Transform for Battery State Monitoring Throughout Life: Analytically-Invertible DRT/ECM Core plus Learned Aging-Drift Residual]).
- [203] Xueqi Xing, Tongtong Yan, and Min Xia. “An Interpretable Graph Modeling Approach of Electrochemical Impedance Spectroscopy for Battery State-of-Health Estimation.” *IEEE Transactions on Transportation Electrification*, pp. 1-1, 2026. doi:10.1109/tte.2026.3697235. (TR318, [A Graph-Local Ram Transform for Interpretable EIS-Based Battery State-of-Health Estimation Analytic DRT Inversion on the Equivalent-Circuit Graph with a Learned Residual]).
- [204] Muhammad Sohaib, Abdul Shakoor Akram, and Woojin Choi. “Identifying Failure Conditions in Li-Ion Batteries Using Distribution of Relaxation Time Method.” *Applied Sciences*, vol. 16, no. 5, art. 2469, 2026. doi:10.3390/app16052469. (TR322, [A Mollified Local Ram Transform for Distribution-of-Relaxation-Time Recovery and Failure-Condition Identification in Li-Ion Batteries]).
- [205] Anis Allagui, Sohaib Majzoub, and Ahmed Elwakil. “Inversion of Electrochemical Immittance Spectra based on the Mellin Transform.” *arXiv preprint arXiv:2606.17066*, 2026. arXiv:2606.17066. (TR325, [Mellin-Ram Inversion of Electrochemical Immittance Spectra: A Scale-Convolution Analytic Core with Mollified Local Moment Inversion]).
- [206] Liang Zhang, Bilong Yang, Ling Lyu, Sihan Che, Haoqiang Li, and Weifei Wang. “A Battery State-of-Charge Prediction Method Based on a Hammerstein Model Integrated with a Hippopotamus Optimization Algorithm and Neural Network.” *Electronics*, vol. 15, no. 3, art. 698, 2026. doi:10.3390/electronics15030698. (TR502, [Analytic Ram Inversion of the Hammerstein Battery Model for State-of-Charge Estimation: An Analytic-Core-plus-Learned-Residual Alternative to Hammerstein-HHO-NN]).

- [207] Nemanja Mišljenović, Matej Žnidarec, Sanja Kelemen, and Goran Knežević. “Advanced Battery Modeling Framework for Enhanced Power and Energy State Estimation with Experimental Validation.” *Batteries*, vol. 12, no. 1, art. 33, 2026. doi:10.3390/batteries12010033. (TR519, [Ram Transform Analysis of an Advanced Battery Modeling Framework for Power and Energy State (SOC/SOE) Estimation]).
- [208] Spyridon Giazitzis, Jack Ferrari, Antoni J. Woss, Susheel Badha, Filippo Rosetti, and Emanuele Ogliari. “Embedded strategy for battery module states estimation using tiny machine learning models.” *Journal of Energy Storage*, vol. 152, p. 120673, 2026. doi:10.1016/j.est.2026.120673. (TR520, [Analytic-Core-Plus-Learned-Residual Ram Transform for Embedded Battery Module State Estimation (SoC/SoH) under tinyML Deployment Constraints]).
- [209] Yupeng Liu, Lijun Yang, Ruijin Liao, Chengyu Hu, Yanlin Xiao, Chunwang He, Xu Wu, Yuan Zhang, and Siqian Li. “Degradation mechanism of sodium-ion batteries and state of health estimation via electrochemical impedance spectroscopy under temperature disturbances.” *Energy*, vol. 332, p. 137064, 2025. doi:10.1016/j.energy.2025.137064. (TR683, [Robust Ram DRT Inversion and State-of-Health Estimation for Sodium-Ion Batteries Log-Coordinate Physics, Semi-Blind Thermal Alignment, Regularized Panel Solves, Interpretable Features, and Uncertainty]).
- [210] Guangjun Qian, Yuejiu Zheng, Xinyu Li, Yuedong Sun, Xuebing Han, and Minggao Ouyang. “State of health estimation for lithium-ion batteries using impedance-based simplified timescale information.” *Applied Energy*, vol. 382, p. 125272, 2025. doi:10.1016/j.apenergy.2025.125272. (TR684, [Ram-Calculus Fast/Accurate Architecture for Impedance-Based Battery State-of-Health Estimation Simplified Timescale Features, Information-Directed Acquisition, Optional DRT Escalation, and Calibrated Uncertainty]).
- [211] Kwangrae Kim, Kwanghum Park, Kwanwoong Yoon, Hyosik Moon, Hyeonjang Pyeon, Jungsoo Kim, and Soohee Han. “A light-weight electrochemical impedance spectroscopy-based SOH estimation method for lithium-ion batteries using the distribution of relaxation times with Grad-CAM analysis.” *Journal of Power Sources*, vol. 631, p. 236169, 2025. doi:10.1016/j.jpowsour.2025.236169. (TR686, [Aware Ram DRT-CNN for Lightweight Lithium-Ion-Battery State-of-Health Estimation Correct Coordinate Mapping, Regularized Inversion, Uncertainty Channels, Attribution Tests, and Embedded Deployment]).
- [212] Limei Jin, Franz Philipp Bereck, Josef Granwehr, and Christoph Scheurer. “Extending Equivalent Circuit Models for State of Charge and Lifetime Estimation.” *Electrochemical Science Advances*, vol. 5, no. 2, art. e202400024, 2025. doi:10.1002/elsa.202400024. (TR805, [Chebyshev-Ram Local Operators for State-of-Charge and Lifetime-Dependent Equivalent-Circuit Battery Models Corrected, Extended, and Reproducibly Verified Formulation]).
- [213] Bizhong Xia, Zhanpeng Qin, and Hongye Fu. “Rapid estimation of battery state of health using partial electrochemical impedance spectra and interpretable machine learning.” *Journal of Power Sources*, vol. 603, p. 234413, 2024. doi:10.1016/j.jpowsour.2024.234413. (TR1002, [A Certified Partial-Band DRT Parametric and Analytic-Core-plus-Learned-Residual Ram Transform for Rapid Battery State-of-Health Estimation]).
- [214] Xiaoyu Zhao, Shiyu Liu, Eric Li, Zuolu Wang, Fengshou Gu, and Andrew D. Ball. “A hybrid intelligent model using the distribution of relaxation time analysis of electrochemical impedance spectroscopy for lithium-ion battery state of health estimation.” *Journal of Energy Storage*, vol. 84, p. 110814, 2024. doi:10.1016/j.est.2024.110814. (TR1003, [A Ram Transform Derivation for Distribution-of-Relaxation-Times Recovery from Electrochemical Impedance Spectroscopy, with an Analytic-Core-plus-Learned-Residual Pipeline for Li-ion State-of-Health]).
- [215] Zhipeng Su, Jidong Lai, Jianhui Su, Chenguang Zhou, Yong Shi, and Bao Xie. “Modeling and health feature extraction method for lithium-ion batteries state of health estimation by distribution of relaxation times.” *Journal of Energy Storage*, vol. 90, p. 111770, 2024. doi:10.1016/j.est.2024.111770. (TR1008, [A Coordinate-Mapped Local Ram Transform for Distribution-of-Relaxation-Times Inversion in Lithium-Ion Battery State-of-Health Estimation revision A]).
- [216] Bingxiang Sun, Junfeng Pang, Liying Zhu, Xinze Zhao, Weige Zhang, Shichang Ma, and Xiaopeng Liu. “A Novel State of Charge Estimation Method Based on Electrochemical Impedance Spectroscopy for Solid-State Batteries of Next-Generation Space Power Sources under Different States of Health.” *Space: Science &*

Technology, vol. 5, art. 0198, 2025. doi:10.34133/space.0198. (TR1009, [A Local Ram-Transform Analytic Core for EIS to DRT Inversion and State-of-Charge Readout of Solid-State Space-Power Cells under State-of-Health Drift]).

4.2 Electrochemical Impedance and Distribution of Relaxation Times

- [217] Xiaoxuan Chen, Dmitri L. Danilov, Tobias Frahm, Florian Rittweger, Thorben Schütte, Karl-Ragnar Riemschneider, Yonggang Hu, Tim-Andy Benning, Johannes Thielmann, Luc H.J. Raijmakers, and Rüdiger-A. Eichel. “Distortion-aware physics-based impedance modeling of commercial Li-ion batteries under non-ideal excitation signals.” *Electrochemistry Communications*, vol. 186, p. 108156, 2026. doi:10.1016/j.elecom.2026.108156. (TR319, [Distortion-Aware Ram Transform Inversion for Physics-Based Impedance Modeling of Li-ion Batteries under Non-Ideal Excitation Analytic DRT Core plus Calibrated Nonlinear Harmonic-Distortion Residual]).
- [218] Aguilar Isabel, Zulueta Ekaitz, Fernandez Unai, Olarte Javier, and Jose Manuel Lopez-Guede. “Application of the Distribution of Relaxation Times in Lithium Iron Phosphate Battery Analysis.” *JOM*, 2026. doi:10.1007/s11837-026-08217-5. (TR320, [A Mollified Local Ram Inverse for the Distribution of Relaxation Times in Lithium Iron Phosphate (LFP) Battery Impedance Diagnostics]).
- [219] Ziyun Li. “Advanced Characterization of Solid-State Batteries: Deconvoluting Interfacial Impedance by Distribution of Relaxation Times.” *Applied and Computational Engineering*, vol. 244, no. 1, pp. 251-257, 2026. doi:10.54254/2755-2721/2026.34855. (TR321, [Mollified Coordinate-Mapped Ram Transform for Distribution-of-Relaxation-Times Deconvolution of Solid-State Battery Interfacial Impedance]).
- [220] Wenmiao Chen, Guoqing Liu, Fuqiang Xi, Yangyang Shen, Xiaohui Liu, Yuhang Hu, Siwu Yi, and Yuehua Li. “Understanding Challenges of Optimization-Based Distribution of Relaxation Times of Electrochemical Impedance Spectroscopy for Commercial Fuel Cell Stack.” *Fuel Cells*, vol. 26, no. 1, art. e70051, 2026. doi:10.1002/fuce.70051. (TR323, [A Mollified Log-Domain Ram Transform for Distribution-of-Relaxation-Times Inversion of Fuel-Cell-Stack Electrochemical Impedance Spectroscopy]).
- [221] Elisabetta Campedelli, Enrico Squizzato, Marzio Rancan, and Christian Durante. “Tracking polarization and passivation in anion exchange membrane electrolyzers via current-dependent distribution of relaxation times of electrochemical impedance spectroscopy.” *Sustainable Energy & Fuels*, vol. 10, no. 13, pp. 3310-3318, 2026. doi:10.1039/d6se00452k. (TR326, [Current-Dependent Distribution of Relaxation Times via Coordinate-Mapped Multimodal Ram Transforms: An Analytic-Core-plus-Learned-Residual Inverse Operator for AEM Water-Electrolyzer Impedance Diagnostics]).
- [222] Slater Twain Bakenhaster and Howard D. Dewald. “Electrochemical impedance spectroscopy and battery systems: past work, current research, and future opportunities.” *Journal of Applied Electrochemistry*, vol. 55, no. 7, pp. 1657-1681, 2025. doi:10.1007/s10800-025-02273-6. (TR685, [Verified Ram-Calculus Architecture for Advanced Electrochemical Impedance Analysis of Battery Systems Distribution of Relaxation Times, Nonlinear Harmonics, Localized Measurements, Physics-Guided Learning, and Uncertainty]).
- [223] Luigi Mattia, Brian Ospina Agudelo, Hamzeh Beiranvand, Marco Liserre, and Walter Zamboni. “Lithium-ion battery impedance as a battery temperature indicator.” *Journal of Energy Storage*, vol. 132, p. 117879, 2025. doi:10.1016/j.est.2025.117879. (TR687, [Calibrated Impedance Thermometry for Lithium-Ion Batteries Reactance-Based Local Operators, Nuisance Separation, Thermal-State Fusion, Optional DRT Escalation, and Uncertainty]).
- [224] Bansidhar Patel, Antonio Sorrentino, and Tanja Vidakovic-Koch. “Data-driven analysis of electrochemical impedance spectroscopy using the Loewner framework.” *iScience*, vol. 28, no. 3, p. 111987, 2025. doi:10.1016/j.isci.2025.111987. (TR689, [Condition-Aware Ram and Loewner Analysis of Electrochemical Impedance Discrete Relaxation Spectra, Localized Log-Time Panels, Adjoints, Rank, and Reproducible Model Discrimination]).
- [225] Adeleke Maradesa, Baptiste Py, Jake Huang, Yang Lu, Pietro Iurilli, Aleksander Mrozinski, Ho Mei Law, Yuhao Wang, Zilong Wang, Jingwei Li, Shengjun Xu, Quentin Meyer, Jiapeng Liu, Claudio Brivio, Alexander Gavriluk, Kiyoshi Kobayashi, Antonio Bertei, Nicholas J. Williams, Chuan Zhao, Michael Danzer,

- Mark Zic, Phillip Wu, Ville Yrjänä, Sergei Pereverzyev, Yuhui Chen, André Weber, Sergei V. Kalinin, Jan Philipp Schmidt, Yoed Tsur, Bernard A. Boukamp, Qiang Zhang, Miran Gaberšček, Ryan O’Hayre, and Francesco Ciucci. “Advancing electrochemical impedance analysis through innovations in the distribution of relaxation times method.” *Joule*, vol. 8, no. 7, pp. 1958-1981, 2024. doi:10.1016/j.joule.2024.05.008. (TR983, [Local Ram Inversion of the Debye Relaxation Operator for the Distribution-of-Relaxation-Times Problem in Electrochemical Impedance Spectroscopy]).
- [226] Shunli Wang, Haiying Gao, Paul Takyi-Aninakwa, Josep M. Guerrero, Carlos Fernandez, and Qi Huang. “Improved Multiple Feature-Electrochemical Thermal Coupling Modeling of Lithium-Ion Batteries at Low-Temperature with Real-Time Coefficient Correction.” *Protection and Control of Modern Power Systems*, vol. 9, no. 3, pp. 157-173, 2024. doi:10.23919/pcmp.2023.000257. (TR1004, [A Panel-Jet Ram Transform for Real-Time Coefficient Correction in Low-Temperature Electrochemical-Thermal Battery Models]).
- [227] Hugo Nunes, João Martinho, João Fermeiro, José Pombo, Sílvia Mariano, and Maria do Rosário Calado. “Impedance Analysis and Parameter Estimation of Lithium-Ion Batteries Using the EIS Technique.” *IEEE Transactions on Industry Applications*, vol. 60, no. 3, pp. 5048-5060, 2024. doi:10.1109/tia.2024.3365451. (TR1005, [Ram Transform Analysis of Electrochemical Impedance Spectra: A Log-Coordinate Localized-Jet Inversion Operator for Distribution-of-Relaxation-Times and Equivalent-Circuit Parameter Estimation in Lithium-Ion Batteries]).
- [228] Yan Li, Min Ye, Qiao Wang, Gaoqi Lian, Martin Kemény, Baozhou Xia, and Binrui Zhang. “Capacity estimation of lithium-ion battery through interpretation of electrochemical impedance spectroscopy combined with machine learning.” *Measurement*, vol. 243, p. 116374, 2025. doi:10.1016/j.measurement.2024.116374. (TR1006, [Localized-Jet Ram Transform Inversion of the Debye Distribution-of-Relaxation-Times Operator for EIS-Based Lithium-Ion Capacity Estimation A Derivation Report]).
- [229] Kateřina Nováková, Václav Papež, Jindřich Sadil, and Václav Knap. “Review of electrochemical impedance spectroscopy methods for lithium-ion battery diagnostics and their limitations.” *Monatshefte für Chemie - Chemical Monthly*, vol. 155, no. 3-4, pp. 227-232, 2024. doi:10.1007/s00706-023-03165-1. (TR1007, [A Log-Domain Panel/Multimodal Ram Transform for Distribution-of-Relaxation-Times Inversion of Electrochemical Impedance Spectra]).
- [230] Baptiste Py and Francesco Ciucci. “Beyond Ridge Regression: Enhancing Distribution of Relaxation Times Deconvolution.” *American Chemical Society (ACS)*, 2024. doi:10.26434/chemrxiv-2024-470n4. (TR1010, [An Analytic Local-Jet Ram Transform for Distribution-of-Relaxation-Times Deconvolution: A Parametric Alternative to Ridge/Tikhonov Regularization]).

4.3 Electrochemical and Relaxation Diagnostics

- [231] Shafayeth Jamil and Rehan Kapadia. “Lie Generator Networks Extract EIS-Grade Battery Diagnostics from Pulse Relaxation Data.” *arXiv preprint arXiv:2605.15351*, 2026. arXiv:2605.15351. (TR324, [Time-Domain Pulse-Relaxation to EIS-Grade Diagnostics via a Windowed-Exponential Ramlet Core with a Lie-Generator Learned Residual]).
- [232] Marc Tudela-Pi and Ivano Colombaro. “Passive two-plateau relaxation from Tricomi confluent hypergeometric kernels.” *arXiv preprint arXiv:2604.11464*, 2026. arXiv:2604.11464. (TR327, [Multimodal Ram Transform Inversion of Tricomi Confluent-Hypergeometric Two-Plateau Relaxation Kernels for Passive Battery Diagnostics]).
- [233] Pierfrancesco Ombrini, Qidi Wang, Alexandros Vasileiadis, Fangting Wu, Ziyao Gao, Xia Hu, Martijn van Hulzen, Baohua Li, Chenglong Zhao, and Marnix Wagemaker. “Kinetically induced memory effect in Li-ion batteries.” *EES Batteries*, vol. 1, no. 3, pp. 437-449, 2025. doi:10.1039/d5eb00014a. (TR688, [Causal Operators for Kinetically Induced Memory in Phase-Separating Battery Electrodes Write-Rest-Read Identification, Particle-Population States, Regularized Volterra Kernels, Protocol Design, and Control]).

5 Quantitative Finance

92 bibliography items.

5.1 Rough Volatility, VIX, and Forward-Variance Models

- [234] Biak Hlei Cung Zathang. “Rough Volatility and the Short-Maturity SPX Skew: Fourier Pricing and Calibration under Rough Heston, Heston, and Variance Gamma.” *Master’s thesis, Aalborg University, 2026. [online record](#)*. (TR328, [Rough Volatility and the Short-Maturity SPX Skew: Fourier Pricing and Calibration under Rough Heston, Heston, and Variance Gamma]).
- [235] Roberto Daluiso, Héctor Folgar-Cameán, Andrea Pallavicini, and Carlos Vázquez. “Rough volatility dynamics in commodity markets.” *arXiv preprint arXiv:2603.26514, 2026. [arXiv:2603.26514](#)*. (TR329, [A Fractional-Volterra Ram Transform for Commodity Rough-Volatility Calibration Localized Moment/Jet Inversion of a Seasonal, Convenience-Yield, Spike-Jump Rough-Volatility Kernel under the Analytic-Core-plus-Learned-Residual Umbrella]).
- [236] Carlos Vázquez Cendón, Roberto Daluiso, Héctor Folgar-Cameán, and Andrea Pallavicini. “Rough volatility dynamics in commodity markets.” *SSRN working paper, 2026. [doi:10.2139/ssrn.6430179](#)*. (TR330, [Fractional-Ramlet Forward Pricing and Inverse-Consistency Calibration for Rough Volatility in Commodity Markets: A Seasonal / Multi-Lobe Multimodal Specialization]).
- [237] Roberto Daluiso, Héctor Folgar-Cameán, Andrea Pallavicini, and Carlos Vázquez. “Rough volatility dynamics in commodity markets.” *arXiv preprint arXiv:2603.26514, 2026. [doi:10.48550/arxiv.2603.26514](#)*. (TR331, [A Local Ram Transform Formulation of Rough-Volatility Dynamics in Commodity Markets A Fractional-Volterra Kernel Operator with Semi-Blind Roughness Calibration]).
- [238] Kareem Fareed. “Information Content of the Implied Volatility Surface for Rough Volatility Models.” *SSRN working paper, 2026. [doi:10.2139/ssrn.6411118](#)*. (TR332, [Information Content of the Implied Volatility Surface for Rough Volatility Models – A Ram-Transform Identifiability Analysis]).
- [239] Rasmus Larsen. “Rough Volatility and Barrier Options: Barrier Pricing under Rough Volatility.” *Master’s thesis, University of Copenhagen, 2026. [online record](#)*. (TR333, [Barrier-Adapted Panel Ram Transforms for Exotic-Option Pricing under Rough Volatility A Boundary-Panel Domain-Decomposition Approach to the Fractional-Volterra Feynman-Kac PIDE]).
- [240] Othmane Zarhali, Emmanuel Bacry, and Jean-François Muzy. “From rough to multifractal multidimensional volatility: A multidimensional Log S-fBM model.” *arXiv preprint arXiv:2601.10517, 2026. [doi:10.48550/arxiv.2601.10517](#)*. (TR334, [A Multimodal-Multiscale Ram Transform for the Multidimensional Multifractal Log S-fBM Volatility Model: Cross-Asset Covariance Inversion and Semi-Blind Calibration]).
- [241] Ying Liao, Ankush Agarwal, and Florian Bourgey. “Implied Volatility Expansions for VIX Options in Forward Variance Models.” *arXiv preprint arXiv:2604.25123, 2026. [arXiv:2604.25123](#)*. (TR335, [Local Ram Moment Expansions for VIX-Option Implied Volatility in Forward-Variance Models A Unit-Triangular Analytic Core with Inverse-Consistency Calibration]).
- [242] Florian Bourgey, Patrick Noble, Ingi Petursson, Mathieu Rosenbaum, and Grégoire Szymanski. “The Quadratic Rough Heston+ Model for Short-Dated Options.” *SSRN working paper, 2026. [doi:10.2139/ssrn.6072928](#)*. (TR336, [A Panel Ram Transform for the Singular Short-Time Volterra Kernel of the Quadratic Rough Heston+ Model Short-Dated Option Pricing and Semi-Blind Calibration via Boundary-Layer Panel Decomposition]).
- [243] Othmane Zarhali, Emmanuel Bacry, and Jean-François Muzy. “From Rough to Multifractal Multidimensional Volatility: A Multidimensional Log S-Fbm Model.” *SSRN working paper, 2026. [doi:10.2139/ssrn.6076070](#)*. (TR337, [A Multidimensional Multifractal Cross-Covariance Ram Transform

for Log S-fBm Volatility Calibration An Analytic-Core-plus-Learned-Residual Instance under the TR165 Umbrella]).

- [244] Yifan Ye, Zheqi Fan, and Yue Kuen Kwok. “VIX Term Structure in the Rough Heston Model via Markovian Approximation.” *Journal of Futures Markets*, vol. 46, no. 5, pp. 799-823, 2026. doi:10.1002/fut.70082. (TR338, [VIX Term Structure in the Rough Heston Model via a Markovian-Ramlet Panel Calibration and Local Jet Inversion]).
- [245] Ying Liao, Ankush Agarwal, and Florian Bourgey. “Implied Volatility Expansions for VIX Options in Forward Variance Models.” *arXiv preprint arXiv:2604.25123*, 2026. doi:10.48550/arxiv.2604.25123. (TR339, [Ram Moment Expansions for VIX-Option Implied Volatilities in Forward-Variance Models A Local-Jet Recast of the Nested VIX² Functional with Semi-Blind Kernel Calibration]).
- [246] Òscar Burés and Rafael de Santiago. “Signature-based identification of volatility models from path geometry.” *arXiv preprint arXiv:2607.06340*, 2026. arXiv:2607.06340. (TR340, [Signature-to-Moment Ram Identification of Rough-Volatility Models from Path Geometry A Ram-Transform Derivation of an Analytic-Core-Plus-Signature-Residual Calibration Operator]).
- [247] Paul P. Hager and Dörte Kreher. “Expanding the rough Heston model in H.” *arXiv preprint arXiv:2606.16619*, 2026. arXiv:2606.16619. (TR346, [A Fractional-Ramlet Analytic-Core Formulation of the Small-H Expansion of the Rough Heston Model Ram Transform Applied to (2026)]).
- [248] Rajit Chatterjea and Sehyeok Park. “Multi-Dimensional g-Pricing under Rough Volatility.” *figshare repository record*, 2026. doi:10.6084/m9.figshare.32087031.v1. (TR353, [A Panelized Ram-Transform Solver for Multi-Dimensional g-Pricing under Rough Volatility Analytic Fractional-Volterra Core plus Learned Nonlinear-Driver Residual]).
- [249] Rajit Chatterjea and Sehyeok Park. “Multi-Dimensional g-Pricing under Rough Volatility.” *figshare repository record*, 2026. doi:10.6084/m9.figshare.32087031. (TR354, [A Multi-Panel Ram Transform for Multi-Dimensional g-Pricing under Rough Volatility Panelized Volterra Jet Inversion with Block-Newton Nonlinear Coupling]).
- [250] Emmanuel Gnabeyeu, Gilles Pagès, and Mathieu Rosenbaum. “Fake stationary rough Heston volatility: Microstructure-inspired foundations.” *arXiv preprint arXiv:2602.11032*, 2026. arXiv:2602.11032. (TR355, [A Localized Ram-Transform Treatment of Fake-Stationary Rough-Heston Volatility Microstructure-Inspired Fractional Kernels, Forward Pricing Operator, and Inverse-Consistency Calibration]).
- [251] E. Abi Jaber, S. Bruneau, N. de Carvalho, D. Sotnikov, and L. Tur. “Heath-Jarrow-Morton meet lifted Heston in energy markets for joint historical and implied calibration.” *Quantitative Finance*, pp. 1-29, 2026. doi:10.1080/14697688.2026.2667872. (TR371, [A Ram-Transform Formulation of Joint Historical and Implied Calibration for HJM Forward Curves with a Lifted-Heston Rough Volatility Kernel in Energy Markets]).
- [252] Desen Guo, Dan Pirjol, and Lingjiong Zhu. “VIX options in Bergomi models.” *arXiv preprint arXiv:2606.02336*, 2026. arXiv:2606.02336. (TR377, [A Joint SPX-VIX Forward-Variance Ram Transform for Bergomi and Rough-Bergomi Option Pricing and Calibration: Analytic Ram/Ramlet Core plus Learned Residual under TR165]).
- [253] Lukas Krain, Xiaorui ZUO, and Wolfgang Karl Härdle. “Cryptos have rough volatility and correlated jumps.” *Digital Finance*, vol. 7, no. 2, pp. 275-294, 2025. doi:10.1007/s42521-025-00125-8. (TR690, [Ram-Calculus Estimation of Rough Crypto Volatility and Self-Exciting Jumps Multiscale Volatility Inference, Hawkes-Kernel Identification, Forecast Calibration, and Uncertainty]).
- [254] Keyuan Wu, Tengan Zhong, and Yuxuan Ouyang. “An Efficient Calibration Framework for Volatility Derivatives under Rough Volatility with Jumps.” *arXiv preprint arXiv:2510.19126*, 2025. doi:10.48550/arxiv.2510.19126. (TR691, [Certified Ram-Panel Surrogates for Calibration of Rough-Jump Volatility Derivatives Structure-Preserving Pricing, Adaptive Residual Approximation, Identifiability, and Uncertainty]).

- [255] Zen Revista and 10 MATH. “Rough Stochastic Volatility with Jumps: An Inverse Problem for Volatility Surface Calibration.” *Zenodo repository record*, 2025. doi:10.5281/zenodo.17798819. (**TR692**, [Certified Ram-Panel Calibration for Rough Stochastic Volatility with Jumps Correct Model Semantics, Local Surrogates, Identifiability, Adjoint Verification, and Uncertainty Quantification]).
- [256] Zen Revista and 10 MATH. “Rough Stochastic Volatility with Jumps: An Inverse Problem for Volatility Surface Calibration.” *Zenodo repository record*, 2025. doi:10.5281/zenodo.17798819. (**TR693**, [Evidence-Gated Ram-Panel Model Selection for Roughness and Jumps Identifiability, Principal-Angle Diagnostics, Nested Calibration, and Reference-Pricer Certification]).
- [257] Lukas Gonon and Wolfgang Stockinger. “Leveraging Deep Learning Optimization for Monte Carlo Calibration of (Rough) Stochastic Volatility Models.” In *Proceedings of the 6th ACM International Conference on AI in Finance*, pp. 779-787, 2025. doi:10.1145/3768292.3771250. (**TR696**, [Certified Ram-Panel Acceleration of Automatic Monte Carlo Calibration for Rough and Classical Stochastic-Volatility Models Differentiable Simulation, Singular Memory Panels, Multi-Fidelity Residuals, Error Budgets, and Identifiability Gates]).
- [258] Zen Revista and 10 MATH. “Rough Heston-Kou: Calibration and Hedging with Signature Methods.” *Zenodo repository record*, 2025. doi:10.5281/zenodo.17707581. (**TR700**, [Rough Heston-Kou Calibration and Hedging with Conditioned Ram Panels and Signature Residuals]).
- [259] Svetlana I. Boyarchenko, Marco de Innocentis, and Sergei Z. Levendorskii. “Fast Reliable Pricing and Calibration of the Rough Heston Model.” *SSRN working paper*, 2025. doi:10.2139/ssrn.5399128. (**TR701**, [Certified Rough-Heston Pricing and Calibration with SINH Quadrature and Conditioned Ram Response Panels]).
- [260] Changqing Teng and Guanglian Li. “Efficient Simulation and Calibration of the Rough Bergomi Model via Wasserstein Distance.” *arXiv preprint arXiv:2512.00448*, 2025. doi:10.48550/arxiv.2512.00448. (**TR702**, [Rough-Bergomi Simulation and Wasserstein Calibration with Modified Exponential Ram Panels]).
- [261] Théo Fromentin. “Demystification of the Joint SPX/VIX Calibration Problem with the Quadratic Rough Heston Model.” *SSRN working paper*, 2025. doi:10.2139/ssrn.5781162. (**TR704**, [Joint SPX/VIX Calibration in Quadratic Rough Heston Conditioned Multifactor Ram Operators and Stable VIX Moments]).
- [262] Antoine Jacquier, Adriano Oliveri Orioles, and Zan Zuric. “ROUGH BERGOMI TURNS GREY.” *SSRN working paper*, 2025. doi:10.2139/ssrn.5252858. (**TR705**, [Grey Rough-Bergomi Pricing and Joint SPX/VIX Analysis M-Wright Mixture Ram Panels with Conditional Gaussian Cores]).
- [263] Jules Delemotte. “Smile dynamics, rough volatility, volatility with memory.” *Dissertation, Agence Bibliographique de l’Enseignement Supérieur*, 2026. doi:10.70675/6004c604z3067z42bez9d1dz176937bflf6d. (**TR706**, [Smile Dynamics, Rough Volatility, and Volatility with Memory Multiscale Ram Estimation and Conditioned Response Operators]).
- [264] Léo Parent. “Rough Path-Dependent Volatility Models.” *HAL (Le Centre pour la Communication Scientifique Directe)*, 2024. online record. (**TR1011**, [A Ram Transform Forward/Inverse Operator for Rough Path-Dependent Volatility Models]).
- [265] Mesias Alfeus, Christina S. Nikitopoulos, and Ludger Overbeck. “Implied roughness in the term structure of oil market volatility.” *Quantitative Finance*, vol. 24, no. 3-4, pp. 347-363, 2024. doi:10.1080/14697688.2023.2291081. (**TR1012**, [Local-Jet (Ram Transform) Inversion of the Rough Fractional Volterra Kernel for the Term Structure of Oil-Market Implied Volatility Semi-Blind Calibration of the Roughness Index H and the Forward-Variance Curve]).
- [266] Arezou Karimi, Farshid Mehrdoust, and Maziar Salahi. “Two-factor Rough Bergomi Model: American Call Option Pricing and Calibration by Interior Point Optimization Algorithm.” *Computational Economics*, vol. 66, no. 1, pp. 681-714, 2024. doi:10.1007/s10614-024-10725-y. (**TR1013**, [Ram Transform Local Operators for the Two-Factor Rough Bergomi Calibration Map: Fractional Volterra Forward/Inverse Derivation with an American Early-Exercise Residual]).

- [267] Changqing Teng and Guanglian Li. “Unsupervised Learning-based Calibration Scheme for Rough Volatility Models.” *arXiv preprint arXiv:2412.02135*, 2024. [doi:10.48550/arxiv.2412.02135](https://doi.org/10.48550/arxiv.2412.02135). (TR1015, [A Fractional Ram Transform for Analytic-Core Calibration of Rough Volatility Models Local Moment-Jet Inversion of the Rough-Bergomi / Rough-Heston Pricing Map with an Inverse-Consistency Learned Residual]).
- [268] Dilip B. Madan and King Wang. “Unmasking stochastic volatility in discontinuous continuity approximations and extracting VIX optionality directly from SPX implied volatilities.” *Frontiers of Mathematical Finance*, vol. 4, no. 0, pp. 1-24, 2025. [doi:10.3934/fmf.2024010](https://doi.org/10.3934/fmf.2024010). (TR1025, [Localized Ram-Transform Inversion of the Log-Strip / Variance-Swap Kernel: Extracting VIX Optionality Directly from SPX Implied Volatilities A Composite Forward/Inverse Operator for Joint SPX/VIX Moment-Consistency in Rough Stochastic-Volatility Surfaces]).

5.2 Arbitrage-Free Surfaces and Risk-Neutral Density Extraction

- [269] Hans Buehler, Blanka Horvath, Anastasis Kratsios, Yannick Limmer, and Raeid Saqr. “SANOS Smooth strictly Arbitrage-free Non-parametric Option Surfaces.” *arXiv preprint arXiv:2601.11209*, 2026. [arXiv:2601.11209](https://arxiv.org/abs/2601.11209). (TR362, [Panel-Jet Ram Transforms for Smooth, Certified Arbitrage-Free Non-Parametric Option Surfaces A Dupire-Jet Analytic Core with Shape-Constrained Learned Residual]).
- [270] Hao Qin, Ruozhong Yang, Charlie Che, and Liming Feng. “Arbitrage-Free Multi-Maturity Risk-Neutral Marginals.” *arXiv preprint arXiv:2607.06204*, 2026. [arXiv:2607.06204](https://arxiv.org/abs/2607.06204). (TR363, [Arbitrage-Free Multi-Maturity Risk-Neutral Marginals via a Panel-Coupled Local Ram Transform]).
- [271] Aaron Wizman, Gabriel Turinici, and Gregory Merran. “From Arbitrage Removal to Density Extraction: A Model-Free Framework for Short-Dated Options.” *arXiv preprint arXiv:2605.22792*, 2026. [arXiv:2605.22792](https://arxiv.org/abs/2605.22792). (TR364, [Arbitrage-Constrained Local-Jet Ram Transform for Model-Free Risk-Neutral Density Extraction from Short-Dated Options]).
- [272] Pablo Rodriguez Manzi. “Volatility Surface Reconstruction using Deep Learning under No-Arbitrage Constraints.” *arXiv preprint arXiv:2605.24031*, 2026. [arXiv:2605.24031](https://arxiv.org/abs/2605.24031). (TR365, [Panel-Local Dupire Operator Inversion with a Certified No-Arbitrage-Preserving Learned Residual A Ram-Transform Approach to Volatility-Surface Reconstruction]).
- [273] Arjun Shah and Erik Schlögl. “Implementing Neural SDEs for Data-Driven Dynamics of the Bitcoin Option Surface.” *Risks*, vol. 14, no. 7, art. 151, 2026. [doi:10.3390/risks14070151](https://doi.org/10.3390/risks14070151). (TR366, [A Fokker-Planck-Ram Analytic-Core-Plus-Learned-Residual Treatment of Neural-SDE Bitcoin Option-Surface Dynamics]).

5.3 Interest Rates, Term Structures, and Energy Markets

- [274] Nunik Srikanthi Putri, Ajay Kumar Verma, and Neo Paul Lesupi. “Stochastic Volatility, Jumps, and Rates: A Unified Framework for Option Pricing and Term-Structure Simulation.” *arXiv preprint arXiv:2605.27945*, 2026. [arXiv:2605.27945](https://arxiv.org/abs/2605.27945). (TR350, [A Coupled Analytic-Core Ram Transform for Joint Stochastic-Volatility, Jump, and Short-Rate Option Pricing and Term-Structure Calibration]).
- [275] Anna Knezevic. “Towards Generative Interest-Rate Modeling: Neural Perturbations Within the LIBOR Market Model.” *Journal of Risk and Financial Management*, vol. 19, no. 1, art. 82, 2026. [doi:10.3390/jrfm19010082](https://doi.org/10.3390/jrfm19010082). (TR367, [Analytic-Core-Plus-Learned-Residual Ram Transform for Generative Interest-Rate Modeling: A Ram-Jet Reformulation of Neural Perturbations Within the LIBOR Market Model]).
- [276] Peilun He, Gareth W. Peters, Nino Kordzakhia, and Pavel V. Shevchenko. “State-space dynamic functional regression for multicurve fixed income spread analysis and stress testing.” *Annals of Actuarial Science*, vol. 20, no. 2, pp. 439-472, 2026. [doi:10.1017/s174849952610027x](https://doi.org/10.1017/s174849952610027x). (TR369, [Local-Jet Ram Inversion of a Time-Varying Functional Loading Operator for Multicurve Fixed-Income Spread Analysis and Stress Testing A State-Space Dynamic Functional-Regression Formulation via the Analytic-Core-plus-Learned-Residual Umbrella]).

- [277] Viktor Pitkänen Funghrant. “OIS Cap Pricing Using a CIR++ Model with Time-Dependent Volatility.” *Master’s thesis, Lund University, 2026*. [online record](#). (TR370, [Time-Dependent-Volatility CIR++ OIS Cap Pricing via a Variable-Coefficient Ram Transform Inversion A Ram Transform Pipeline]).
- [278] V. S. Yanishevskiy. “Path Integral Solutions for Extended Heston Models.” *Mathematical Modeling and Computing*, vol. 12, no. 4, pp. 1341-1356, 2025. [doi:10.23939/mmc2025.04.1341](#). (TR710, [Extended Heston Models with Stochastic Interest Rates Source-accurate path-integral scope and a rank-aware local operator construction]).
- [279] Malefane Molibeli and Gary van Vuuren. “USV-Affine Models Without Derivatives: A Bayesian Time-Series Approach.” *Journal of Risk and Financial Management*, vol. 18, no. 7, art. 395, 2025. [doi:10.3390/jrfm18070395](#). (TR714, [Affine Term-Structure Models with Unspanned Stochastic Volatility Bayesian yield-only estimation, observability, and local state-space surrogates]).
- [280] Dalma Tóth-Lakits, Miklós Arató, and András Ványolos. “An Analysis of Implied Volatility, Sensitivity and Calibration of the Kennedy Model.” *MDPI AG, 2025*. [doi:10.20944/preprints202508.0832.v1](#). (TR715, [Sensitivity and Calibration of the Kennedy Gaussian Term-Structure Model A rank-aware trust-region jet for prices and implied volatilities]).

5.4 Stochastic Dynamics, Filtering, and Simulation

- [281] Òscar Burés and Rafael De Santiago. “Signature-based identification of volatility models from path geometry.” *arXiv preprint arXiv:2607.06340*, 2026. [doi:10.48550/arxiv.2607.06340](#). (TR343, [Local Analytic Identification of Volatility-Model Coefficients via the Kramers-Moyal-as-Ram-Moment Operator: A Design-Around to Signature-Based SDE Identification]).
- [282] Jim Dai and Zhanhao Zhang. “Deep Learning Method for Stationary Distribution of Reflected Brownian Motion.” *arXiv preprint arXiv:2607.08091*, 2026. [doi:10.48550/arxiv.2607.08091](#). (TR352, [An Analytic Boundary-Flux Ram Operator for the Stationary Distribution of Oblique-Reflected Brownian Motion A Panelized Fokker-Planck-Ram Core with Learned Residual as a Design-Around to Deep-Learning RBM Solvers]).
- [283] Mehran Pazireh, Karim Ivaz, and Mariyan Milev. “Computational Linearization of Nonlinear Kolmogorov Equations via the Generalized Newton Method in LSV Models.” *Mathematics*, vol. 14, no. 3, art. 555, 2026. [doi:10.3390/math14030555](#). (TR357, [Computational Linearization of Nonlinear Kolmogorov Equations in Local-Stochastic-Volatility Calibration via Division-Free Variable-Coefficient Ram Panel Inversion]).
- [284] Kaito Iwasaki, Anthony Bloch, Taeyoung Lee, and Maani Ghaffari. “The Score Kalman Filter.” *arXiv preprint arXiv:2605.16644*, 2026. [arXiv:2605.16644](#). (TR359, [A Fokker-Planck-Ram Core for the Score Kalman Filter: Analytic Predict/Correct Jets with a Learned Score Residual]).
- [285] Peter Koepernik, Thomas Coxon, and James Foster. “ARCANE: Scalable high-degree cubature formulae for simulating SDEs without Monte Carlo error.” *arXiv preprint arXiv:2602.17151*, 2026. [arXiv:2602.17151](#). (TR360, [A Ram-Transform Cubature Core for Monte-Carlo-Free Weak SDE Simulation Analytic moment-matched cubature weights with a certified super-geometric truncation bound]).
- [286] Sumei Zhang, Tianci Wu, Haiyang Xiao, Yi Gong, and Weihong Xu. “Efficient Calibration for Option Pricing via a Physics-Informed Chebyshev Kolmogorov-Arnold Network.” *Mathematics*, vol. 14, no. 9, art. 1529, 2026. [doi:10.3390/math14091529](#). (TR374, [Analytic Feynman-Kac / Fokker-Planck Ram Core with a Bounded Learned Residual for Option-Pricing Calibration: A Design-Around for Physics-Informed Chebyshev-Kolmogorov-Arnold Networks]).
- [287] Zoltán Köntös and Ruslan Megdetovics Rahimkulov. “ORAKULUM: An Information-Impact Asset Pricing Model Introducing a Jump-Diffusion Framework for Information-Driven Markets.” *Risks*, vol. 14, no. 5, art. 108, 2026. [doi:10.3390/risks14050108](#). (TR376, [A Ram-Transform Treatment of the ORAKULUM Information-Impact Jump-Diffusion Asset-Pricing Model: Fokker-Planck-Ram Identification and Semi-Blind Information-Impact Kernel Calibration]).

- [288] Jan Bartsch, Robert Denk, and Stefan Volkwein. “Adjoint-Based Calibration of Nonlinear Stochastic Differential Equations.” *Applied Mathematics & Optimization*, vol. 90, no. 3, art. 50, 2024. doi:10.1007/s00245-024-10181-y. (TR1018, [Analytic Local Identification of Nonlinear SDE Generators via the Ram Transform: A One-Shot Alternative to Adjoint-Descent Calibration]).
- [289] Haozhe Su, M. V. Tretyakov, and David P. Newton. “Deep Learning of Transition Probability Densities for Stochastic Asset Models with Applications in Option Pricing.” *Management Science*, vol. 71, no. 4, pp. 2922-2952, 2025. doi:10.1287/mnsc.2022.01448. (TR1019, [A Jet-Exact Fokker-Planck-Ram Core with Learned Residual for Transition-Probability-Density Surrogates in Stochastic Asset Models]).
- [290] S. Stoykov. “Calibration of Heston Stochastic Local Volatility Model by Numerical Solution of Nonlinear Fokker-Planck Equation.” In *9th European Congress on Computational Methods in Applied Sciences and Engineering*, 2024. doi:10.23967/eccomas.2024.030. (TR1020, [A Ram Transform Derivation for Heston Stochastic-Local-Volatility Calibration via Nonlinear Fokker-Planck Operator Identification]).

5.5 Option Pricing, Calibration, Hedging, and Market Models

- [291] Prabakaran Raghavendran and Yamini Parthiban. “A Hybrid Neural Network Approach to Controllability in Caputo Fractional Neutral Integro-Differential Systems for Cryptocurrency Forecasting.” *Fractal and Fractional*, vol. 10, no. 4, p. 268, 2026. doi:10.3390/fractalfract10040268. (TR288, [Analytic Controllability Operators for Caputo Fractional Neutral Integro-Differential Systems via Fractional Ramlets and Variable-Coefficient Jet Inversion A Ram-Transform Reformulation of Hybrid Neural Controllability]).
- [292] Sanjay Kumar Mohanty. “Explainable Artificial Intelligence for Financial Integral Equations: A Fixed-Point Neural Operator Approach.” *arXiv preprint arXiv:2604.27127*, 2026. arXiv:2604.27127. (TR292, [Explainable Ram Analytic-Core Solvers for Financial Integral Equations: An Analytic-Core-plus-Learned-Residual Fixed-Point Neural Operator]).
- [293] Sanjay Kumar Mohanty. “Explainable Artificial Intelligence for Financial Integral Equations: A Fixed-Point Neural Operator Approach.” *arXiv preprint arXiv:2604.27127*, 2026. doi:10.48550/arxiv.2604.27127. (TR294, [An Explainable Analytic-Core Ram Transform for Financial Fixed-Point Integral Equations A Polynomial-Exact Interpretable Core with Learned Residual and Verifier-as-Certificate]).
- [294] Pere Diaz-Lozano and Thomas K. Kloster. “A Wiener Chaos Approach to Martingale Modelling and Implied Volatility Calibration.” *arXiv preprint arXiv:2602.16232*, 2026. doi:10.48550/arxiv.2602.16232. (TR341, [A Ram-Transform Chaos-Core for Martingale Modelling and Implied-Volatility Calibration Graded Hermite/Wiener-Chaos Moment Operator, Exact Local-Jet Inversion and an Analytic-Core-plus-Learned-Residual Calibration Engine]).
- [295] Pere Diaz-Lozano and Thomas K. Kloster. “A Wiener Chaos Approach to Martingale Modelling and Implied Volatility Calibration.” *arXiv preprint arXiv:2602.16232*, 2026. arXiv:2602.16232. (TR342, [A Ram-Transform Perspective on Wiener-Chaos Martingale Modelling and Implied-Volatility Calibration]).
- [296] Takayuki Sakuma. “Differential Machine Learning for 0DTE Options with Stochastic Volatility and Jumps.” *arXiv preprint arXiv:2603.07600*, 2026. doi:10.48550/arxiv.2603.07600. (TR344, [A Panelized Ram Transform with Analytic-Core-plus-Learned-Residual Inversion for 0DTE Option Pricing, Greeks, and Semi-Blind Calibration under Stochastic Volatility with Jumps]).
- [297] Takayuki Sakuma. “Differential Machine Learning for 0DTE Options with Stochastic Volatility and Jumps.” *arXiv preprint arXiv:2603.07600*, 2026. arXiv:2603.07600. (TR345, [Near-Expiry Local-Jet Inversion of the Stochastic-Volatility Jump PIDE for 0DTE Options: An Analytic Ram Core with Learned Residual]).
- [298] Ramiro Fontes. “The Boundary of Hedgeability: Pricing and Hedging in Volterra-Lévy Markets.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.19211992. (TR347, [The Boundary of Hedgeability: A Ram-Transform Treatment of Pricing and Hedging in Volterra-Lévy Markets]).

- [299] Ramiro Fontes. “The Boundary of Hedgeability: Pricing and Hedging in Volterra-Lévy Markets.” *Zenodo repository record*, 2026. [doi:10.5281/zenodo.19211991](https://doi.org/10.5281/zenodo.19211991). (**TR348**, [Panel-Volterra Ram Transform for the Volterra-Lévy Pricing and Calibration Layer A Derivation]).
- [300] Arman Zadgar, Somayeh Fallah, Farshid Mehrdoust, and Juan E. Trinidad Segovia. “Deep Learning-Enhanced Calibration of the Heston Model: A Unified Framework.” *Mathematics*, vol. 14, no. 13, art. 2322, 2026. [doi:10.3390/math14132322](https://doi.org/10.3390/math14132322). (**TR349**, [Analytic-Core-plus-Learned-Residual Calibration of the Heston Model via Local Ram Moment Inversion of the Characteristic Function]).
- [301] Peng Yang, Wenyu Lei, and Liwei Xu. “High-order complete flux schemes for convection-diffusion equations on arbitrary subdivisions.” *arXiv preprint arXiv:2607.08422*, 2026. [doi:10.48550/arxiv.2607.08422](https://doi.org/10.48550/arxiv.2607.08422). (**TR361**, [High-Order Complete-Flux Convection-Diffusion Schemes as Variable-Coefficient Ram Jets on Coordinate-Normalized Panels A Ram Transform Reformulation on Arbitrary Subdivisions]).
- [302] Miquel Noguer I Alonso. “Derivative-Informed Operator Learning for Finance: On-the-Fly Greeks, Surfaces, Hedging, and Control.” *arXiv preprint arXiv:2606.05900*, 2026. [arXiv:2606.05900](https://arxiv.org/abs/2606.05900). (**TR368**, [Derivative-Informed Operator Learning for Finance: On-the-Fly Greeks, Surfaces, Hedging, and Control via an Analytic Ram-Jet Core plus a Learned Residual]).
- [303] Juanjuan Li. “European Option Pricing and Deep Learning-Aided Calibration Under Heston-Hull-White with a Stochastic Long-Run Variance Mean.” *Mathematics*, vol. 14, no. 10, art. 1618, 2026. [doi:10.3390/math14101618](https://doi.org/10.3390/math14101618). (**TR372**, [A Coordinate-Mapped, Panelized Local-Jet Ram Transform for the Four-Factor Heston-Hull-White Generator with a Stochastic Long-Run Variance Mean: Analytic Pricing Core plus Learned-Residual Calibration]).
- [304] Julia Sun, Zheyu Jin, Jiawei Zhang, and Jeffrey D. Varner. “Synthetic American Option Pricing via Jump-HMM-Driven Heston Implied Volatility.” *arXiv preprint arXiv:2605.13998*, 2026. [arXiv:2605.13998](https://arxiv.org/abs/2605.13998). (**TR373**, [Synthetic American Option Pricing via a Jump-HMM-Driven Regime-Switching Heston Operator: A Multimodal Panel Ram Transform with Block-Newton Free-Boundary Coupling]).
- [305] Tristan Guillaume. “Extrema, Barrier Options, and Semi-Analytic Leverage Corrections in Stochastic-Clock Volatility Models.” *arXiv preprint arXiv:2605.06677*, 2026. [arXiv:2605.06677](https://arxiv.org/abs/2605.06677). (**TR375**, [Extrema, Barrier Options, and Semi-Analytic Leverage Corrections in Stochastic-Clock Volatility Models A Panel-Jet Ram Transform for First-Passage Functionals on Stopped Domains]).
- [306] Boyi Li and Weixuan Xia. “Crypto inverse-power options and fractional stochastic volatility.” *Quantitative Finance*, vol. 25, no. 7, pp. 1073-1099, 2025. [doi:10.1080/14697688.2025.2518252](https://doi.org/10.1080/14697688.2025.2518252). (**TR694**, [Certified Ram-Panel Pricing and Calibration of Crypto Inverse-Power Options Fractional Lévy-Driven Activity, Negative-Moment Admissibility, Transform Error Bounds, and Identifiability]).
- [307] Yanqing Ma, Carmine Ventre, Renzo Tiranti, and Aiming Chen. “Deep Generative Calibration on Stochastic Volatility Models with Applications in FX Barrier Options.” In *Proceedings of the 40th ACM/SIGAPP Symposium on Applied Computing*, pp. 122-130, 2025. [doi:10.1145/3672608.3707874](https://doi.org/10.1145/3672608.3707874). (**TR695**, [Certified Ram-Core Warm Starts for Deep Generative Calibration of FX Stochastic-Volatility Models and Barrier Options Admissible Data Generation, Local Residual Panels, Identifiability, Reference Repricing, and Uncertainty Gates]).
- [308] Eduardo Abi Jaber and Louis-Amand Gérard. “Signature Volatility Models: Pricing and Hedging with Fourier.” *SIAM Journal on Financial Mathematics*, vol. 16, no. 2, pp. 606-642, 2025. [doi:10.1137/24m1636952](https://doi.org/10.1137/24m1636952). (**TR697**, [Certified Ram-Panel Acceleration and Error Control for Fourier Pricing and Quadratic Hedging in Signature-Volatility Models]).
- [309] Ofelia Bonesini, Antoine Jacquier, and Chloé Lacombe. “A Theoretical Analysis of Guyon’s Toy Volatility Model.” *SIAM Journal on Financial Mathematics*, vol. 16, no. 2, pp. 271-309, 2025. [doi:10.1137/22m1536339](https://doi.org/10.1137/22m1536339). (**TR698**, [Boundary-Aware Ram Jet Operators for Guyon’s Toy Path-Dependent Volatility Model Correct Markov State, Conditioned Pricing and Calibration, Panel Error Budgets, and Reproducible Checks]).

- [310] HERVÉ ANDRÈS and BENJAMIN JOURDAIN. “EXISTENCE, UNIQUENESS AND POSITIVITY OF SOLUTIONS TO THE GUYON-LEKEUFACK PATH-DEPENDENT VOLATILITY MODEL WITH GENERAL KERNELS.” *International Journal of Theoretical and Applied Finance*, vol. 28, no. 07n08, art. 2550019, 2025. doi:10.1142/s0219024925500190. (TR699, [Conditioned Kernel-Jet Ram Surrogates for the Guyon-Lekeufack Path-Dependent Volatility Model Non-convolutional stochastic Volterra kernels, mean-square error control, and positivity-aware computation]).
- [311] Florian Aichinger and Sascha Desmettre. “Pricing of geometric Asian options in the Volterra-Heston model.” *Review of Derivatives Research*, vol. 28, no. 1, art. 5, 2025. doi:10.1007/s11147-025-09211-w. (TR703, [Geometric Asian Options in Volterra-Heston Models A Joint-Transform Ram Formulation with Certified Panels]).
- [312] Thomas K. Kloster. “An Ambit Field Framework for the Full Panel of Day-ahead Electricity Prices.” *arXiv preprint arXiv:2509.17236*, 2025. doi:10.48550/arxiv.2509.17236. (TR707, [Ambit Fields for the Full Day-Ahead Electricity Panel Cylindrical Ram Operators, Kernel Estimation, and Derivative Pricing]).
- [313] Makumbe, Zororo Stanelake. “Approximate option pricing for jump-diffusion stochastic volatility models.” *Dissertation, Dipòsit Digital de la Universitat de Barcelona (Universitat de Barcelona)*, 2025. online record. (TR708, [Approximate Option Pricing for Jump-Diffusion Stochastic Volatility Ram Decomposition, Malliavin Sensitivities, and Small-Jump Control]).
- [314] Tian’ai Song. “End-to-End Neural Calibration of Stochastic Volatility Models via Option Panels.” *Transactions on Computer Science and Intelligent Systems Research*, vol. 11, pp. 480-487, 2025. doi:10.62051/w5dgt92. (TR709, [End-to-End Neural Calibration from Option Panels Structure-Preserving Ram Maps, Identifiability, and Core Certification]).
- [315] T. van der Zwaard, L. A. Grzelak, and C. W. Oosterlee. “On the Hull-White model with volatility smile for Valuation Adjustments.” *Quantitative Finance*, vol. 25, no. 10, pp. 1535-1555, 2025. doi:10.1080/14697688.2025.2565270. (TR711, [Randomized Hull-White Smile Models for Valuation Adjustments Marginal mixtures, local diffusion dynamics, and condition-aware deterministic acceleration]).
- [316] Meira Iske, Hannes Albers, Tobias Knopp, and Tobias Kluth. “Learned Discrepancy Reconstruction and Benchmark Dataset for Magnetic Particle Imaging.” *arXiv preprint arXiv:2501.05583*, 2025. doi:10.48550/arxiv.2501.05583. (TR712, [Learned-Discrepancy Reconstruction for Magnetic Particle Imaging Likelihood-correct inversion, operator rank, and a local normal-operator preconditioner]).
- [317] Mohamed Hamdouche. “Machine learning and generative modeling for stochastic control problems.” *Dissertation, Agence Bibliographique de l’Enseignement Supérieur*, 2026. doi:10.70675/98bda863z1ee1z49f2z8d0cze1105a226603. (TR713, [Machine Learning and Generative Modeling for Stochastic Control Exit-time policy gradients, Schrödinger bridges, and limited local operator assistance]).
- [318] Paula Morales-Bañuelos, Sebastian Elias Rodríguez Bojalil, Luis Alberto Quezada-Téllez, and Guillermo Fernández-Anaya. “A General Conformable Black-Scholes Equation for Option Pricing.” *Mathematics*, vol. 13, no. 10, art. 1576, 2025. doi:10.3390/math13101576. (TR716, [The General Conformable Black-Scholes Equation Coordinate equivalence, correct adjoints, and conditional local discretization]).
- [319] Mengmeng Feng and Hui Lv. “Hybrid Neural Operator Framework for Stochastic Partial Differential Equation Based Option Pricing.” *Informatica*, vol. 49, no. 31, 2025. doi:10.31449/inf.v49i31.10321. (TR717, [Hybrid Neural Operators for Stochastic-Model Option Pricing Target semantics, linearized adjoints, and a condition-aware analytic residual core]).
- [320] Guido Gazzani and Julien Guyon. “Pricing and calibration in the 4-factor path-dependent volatility model.” *arXiv preprint arXiv:2406.02319*, 2024. doi:10.48550/arxiv.2406.02319. (TR1014, [Local Ram-Transform Derivation for Pricing and Calibration in the 4-Factor Path-Dependent Volatility Model A Separable-Exponential Volterra Composite Operator with Explicit Local Inverse]).

- [321] Martin Bergerhausen, David J. Prömel, and David Scheffels. “Neural stochastic Volterra equations: learning path-dependent dynamics.” *arXiv preprint arXiv:2407.19557*, 2024. doi:10.48550/arxiv.2407.19557. (TR1016, [A Ram Transform Derivation for Neural Stochastic Volterra Equations: Analytic Moment-Jet Core plus Learned Residual]).
- [322] Andrey Itkin and Yerkin Kitapbayev. “Semi-analytical pricing of options written on SOFR futures.” *Frontiers of Mathematical Finance*, vol. 3, no. 4, pp. 520-559, 2024. doi:10.3934/fmf.2024017. (TR1017, [A Ram Windowed-Exponential Operator Formulation for Semi-Analytical Pricing of Options on SOFR Futures]).
- [323] Mark Stedman and Luca Capriotti. “A Path Integral Approach for Time-Dependent Hamiltonians with Applications to Derivatives Pricing.” *arXiv preprint arXiv:2408.02064*, 2024. doi:10.48550/arxiv.2408.02064. (TR1022, [A Local Ram-Transform Derivation for Time-Dependent-Hamiltonian Path-Integral Propagators in Derivatives Pricing]).
- [324] Hao Qin, Charlie Che, Ruozhong Yang, and Liming Feng. “Robust and Fast Bass Local Volatility.” *arXiv preprint arXiv:2411.04321*, 2024. doi:10.48550/arxiv.2411.04321. (TR1023, [Robust and Fast Bass Local Volatility via a Mollified Gaussian-Atom Ram Deconvolution Jet]).
- [325] Hideharu Funahashi. “Deep learning for derivatives pricing: a comparative study of asymptotic and quasi-process corrections.” *Annals of Operations Research*, vol. 357, no. 1, pp. 113-157, 2024. doi:10.1007/s10479-024-06114-1. (TR1024, [A Ram Transform Derivation for Asymptotic-plus-Quasi-Process Corrections in Deep-Learning Derivatives Pricing Analytic Moment-Jet Core with a Learned Neural Residual (Feynman-Kac / Parabolic Pricing Operators)]).

6 Radar and Chirp-Based Sensing

64 bibliography items.

6.1 FMCW and PMCW Interference Mitigation

- [326] Christian Oswald and Franz Pernkopf. “FMCW Radar Interference Mitigation Based on the Fractional Fourier Transform.” *IEEE Transactions on Radar Systems*, vol. 4, pp. 549-563, 2026. doi:10.1109/trs.2026.3666094. (TR380, [A Fractional-Ram Beat Jet for FMCW Radar Interference Mitigation An Analytic Forward/Inverse Chirp Operator as a Design-Around of Plain FrFT Projection]).
- [327] Rajat Awadhiya, Felipe Torres, and Markus Clemens. “MU-Net: Mask-Guided Reconstruction for FMCW Radar Interference Mitigation.” In *2026 27th International Radar Symposium (IRS)*, pp. 247-252, 2026. doi:10.23919/irs70539.2026.11549121. (TR381, [A Ram-Transform Formulation of Mask-Guided FMCW Radar Interference Mitigation: Analytic Chirp Core plus Learned Residual]).
- [328] Majid Joshani, Bruna G. Palm, Mattias Dahl, and Mats I. Pettersson. “Adaptive Interference Mitigation in FMCW Radars Using 2DAR.” *IEEE Access*, vol. 14, pp. 39995-40008, 2026. doi:10.1109/access.2026.3673034. (TR382, [Analytic Beat-Domain Core with Learned Residual for Adaptive FMCW Radar Interference Mitigation A Ram-Transform Reformulation and Comparison against 2D-AR Reconstruction]).
- [329] Zhijie Sun, Niraj Tamrakar, Yuxuan Gong, Subash T D, Shilong Pan, and Bikash Nakarmi. “Time-Frequency Attention Network for Interference Mitigation in FMCW Radar.” In *2026 International Conference on ICT and Photonics (ICTP)*, pp. 1-5, 2026. doi:10.1109/ictp67998.2026.11485060. (TR383, [Analytic Chirp-Atom Ram Core with Learned Time-Frequency Residual for Interference Mitigation in FMCW Radar]).

- [330] Alessandro Bazzi, Francesco Miccoli, Fabrizio Cuccoli, Luca Facheris, and Vincent Martinez. “Analysis of Proactive Uncoordinated Techniques to Mitigate Interference in FMCW Automotive Radars.” *IEEE Transactions on Radar Systems*, vol. 4, pp. 597-612, 2026. doi:10.1109/trs.2026.3670939. (TR384, [A Multimodal Ram Transform for Proactive Uncoordinated Interference Mitigation in FMCW Automotive Radar Per-Lobe Chirp Ramlet Inversion with a Shift-Variant Ram Sampling Guarantee]).
- [331] Alessandro Bazzi, Francesco Miccoli, Fabrizio Cuccoli, Luca Facheris, and Vincent Martinez. “Analysis of Proactive Uncoordinated Techniques to Mitigate Interference in FMCW Automotive Radars.” *IEEE Transactions on Radar Systems*, vol. 4, pp. 597-612, 2026. doi:10.1109/trs.2026.3670939. (TR385, [Ram Transform Analysis of Proactive Uncoordinated Techniques to Mitigate Interference in FMCW Automotive Radars A Methods-Survey Report (Duplicative of TR142/TR173)]).
- [332] Alessandro Bazzi, Francesco Miccoli, Fabrizio Cuccoli, Luca Facheris, and Vincent Martinez. “Analysis of Proactive Uncoordinated Techniques to Mitigate Interference in FMCW Automotive Radars.” *IEEE Transactions on Radar Systems*, vol. 4, pp. 597-612, 2026. doi:10.1109/trs.2026.3670939. (TR386, [A Ram Transform Perspective on Proactive Uncoordinated Interference Mitigation in FMCW Automotive Radar A Design-Around Reference under the TR173 Receive-Side Umbrella]).
- [333] Peiyu Zhang, Ashish Pandharipande, and Alexander Yarovoy. “Interference Mitigation for FMCW Radar Systems With Modulo Sampling Framework.” *IEEE Transactions on Radar Systems*, vol. 4, pp. 1113-1124, 2026. doi:10.1109/trs.2026.3702532. (TR387, [Modulo-Folded FMCW Beat Inversion via Nilpotent-Jet Unfolding and Local Ram Transforms A Composition of Piecewise-Linear Modulo Unwrapping with Analytic Chirp/Beat Ram Inversion Under a Shift-Variant Sampling Theorem]).
- [334] Yu Chen, Minglei Yang, Baixiao Chen, Jiadong Yi, Meng Liu, Maria Sabrina Greco, and Fulvio Gini. “Cognitive FMCW Automotive Radar for Interference Suppression.” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 62, pp. 5006-5020, 2026. doi:10.1109/taes.2026.3654913. (TR388, [A Multimodal Ramlet / AFDM Operator Framework for Cognitive FMCW Automotive Radar Interference Suppression A First-Draft Derivation Report]).
- [335] Yeong Choi, Chanul Park, and Seongwook Lee. “Deep Learning-Based Interference Mitigation of SF-Modulated Signals for FMCW Systems.” In *2026 International Conference on Artificial Intelligence in Information and Communication (ICAIIIC)*, pp. 633-638, 2026. doi:10.1109/icaaic68212.2026.11454291. (TR389, [Ram Transform Interference Mitigation for SF-Modulated FMCW Systems: An Analytic Chirp-Core Plus Learned-Residual Formulation Design-around study against TR142 / TR173 / TR165]).
- [336] Tai-Hsing Lee and Nur Azis Salim. “A lightweight interference suppression technique for FMCW automotive radar.” *Measurement Science and Technology*, vol. 37, no. 6, art. 066113, 2026. doi:10.1088/1361-6501/ae4257. (TR390, [A Chirp-Beat Ramlet Operator for Lightweight Mutual-Interference Suppression in FMCW Automotive Radar]).
- [337] Heekwon Yoon, Seonmin Cho, and Seongwook Lee. “Memory-Efficient 1D Neural Network for PMCW Interference Mitigation in FMCW-Based Sensing Systems.” In *2026 International Conference on Artificial Intelligence in Information and Communication (ICAIIIC)*, pp. 346-350, 2026. doi:10.1109/icaaic68212.2026.11454398. (TR394, [Analytic De-Chirp Core plus Learned Residual for PMCW-on-FMCW Interference Mitigation: A Ram-Transform Screening Derivation]).
- [338] Han-Sol Kim, Muhammad Tayyab Azim, Tommi Hariyadi, Ju-Hye Kim, Hong-Jip Jung, Dong-Sik Ko, Seong-Ho Seo, and Seong-Ook Park. “Interference Mitigation of 24-GHz FMCW Sensor Using IQ-Channel Projection Method.” *IEEE Sensors Journal*, vol. 26, no. 5, pp. 7165-7177, 2026. doi:10.1109/jsen.2026.3650931. (TR396, [Multimodal Chirp-Atom Ram Transform for FMCW Mutual-Interference Mitigation: An Analytic Analog of IQ-Channel Projection]).
- [339] Feng Zhao, Yuanzhe Li, Tao Yuan, Zhenhua Liang, Weidong Hu, and Hongqi Fan. “Relative Range-Doppler Map for Multipath Ghost Suppression in FMCW Harmonic Radar.” *IEEE Transactions on Radar Systems*, vol. 4, pp. 969-982, 2026. doi:10.1109/trs.2026.3691225. (TR397, [A Multimodal Ram Transform for the Relative Range-Doppler Map: Analytic Ghost-Lobe Suppression in FMCW Harmonic Radar]).

- [340] Jiajia Shi, Haojie Zhou, Liu Chu, Fengling Tan, Guocheng Sun, and Yu Tao. “RIME-Net: A Physics-Guided Unpaired Learning Framework for Automotive Radar Interference Mitigation and Weak Target Enhancement.” *Sensors*, vol. 26, no. 4, art. 1277, 2026. doi:10.3390/s26041277. (TR399, [A Ram-Transform Re-Derivation of RIME-Net – Analytic Ramlet Chirp/Beat Core plus Unpaired Learned Residual for Automotive FMCW Radar Interference Mitigation and Weak-Target Enhancement]).
- [341] Shuyun Cheng, Hao Zhang, Yinghao Cheng, Shunjun Wei, Mou Wang, Jun Shi, and Xiaoling Zhang. “SparseTVNet: Deep Learning for FMCW Radar Interference Mitigation.” In *2025 IEEE MTT-S International Microwave Workshop Series On Advanced Materials and Processes for RF and THz Applications (IMWS-AMP)*, pp. 1-3, 2025. doi:10.1109/imws-amp66175.2025.11136393. (TR718, [Sparse and Learned Mitigation of FMCW Radar Interference Source-bounded coverage, identifiable operators, and a chirp-aligned local residual design]).
- [342] Deniz Kumlu, Muhammad Arsalan, Fabian Harrer, and Ernesto Horne. “V2V-Aided Adaptive FMCW Radar Interference Mitigation.” In *2025 IEEE Vehicular Networking Conference (VNC)*, pp. 104-107, 2025. doi:10.1109/vnc64509.2025.11054136. (TR720, [Metadata-Aided Decomposition of FMCW Radar Interference A Conditioned Ram-Operator Reformulation of V2V-Adaptive RPCA TR720]).
- [343] Christian Oswald and Franz Pernkopf. “FMCW Radar Interference Mitigation based on the Fractional Fourier Transform.” *arXiv preprint arXiv:2504.03963*, 2025. doi:10.48550/arxiv.2504.03963. (TR721, [Masked Fractional-Fourier Frames for FMCW Radar Interference Mitigation A Ram-Operator Reconstruction Analysis of Multi-Angle DFrFT Excision TR721]).
- [344] Elif Ozturk and Isin Erer. “An Encoder-Decoder Retnet Model for Fmcw Radar Interference Mitigation.” In *2025 33rd Telecommunications Forum (TELFOR)*, pp. 1-4, 2025. doi:10.1109/telfor67910.2025.11314236. (TR722, [A Physics-Conditioned Residual RetNet for FMCW Interference Mitigation Finite Ram Dictionaries, Identifiability, and Leakage-Safe Evaluation TR722]).
- [345] Yubo Wu, Alexander Li, Wenjing Lou, and Y. Thomas Hou. “Real-Time Interference Mitigation for Automotive Radar Sensor.” *IEEE Journal of Selected Areas in Sensors*, vol. 2, pp. 290-302, 2025. doi:10.1109/jsas.2025.3609274. (TR725, [Sparse Wavelet-Chirp Recovery for Real-Time Automotive Radar A Conditioned Ram-Operator Analysis of Soteria TR725]).
- [346] Joshani, Majid. “Interference Mitigation in FMCW Radars : Adaptive Methods for Automotive Applications.” *Dissertation, KTH Publication Database DiVA (KTH Royal Institute of Technology)*, 2025. online record. (TR730, [Adaptive Two-Dimensional Autoregressive Reconstruction for FMCW Radar Interference Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [347] Albert Garcia Abenia. “Interference mitigation techniques for automotive FMCW radar systems.” *Dissertation, UPCommons institutional repository (Universitat Politècnica de Catalunya)*, 2025. online record. (TR731, [Audited Min/Median Spectral Substitution and Time-Domain Interpolation for Automotive FMCW Radar Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [348] Marí Muñoz, Luis. “Phase-codification of FMCW radars for interference mitigation in autonomous automotive or aerial vehicles.” *Dissertation, UPCommons institutional repository (Universitat Politècnica de Catalunya)*, 2025. online record. (TR732, [Phase-Coded FMCW Interference Mitigation with Gold and Kasami Sequences Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [349] Lukas Rienessl, Michael Gerstmair, Christian M. Schmid, Andreas Stelzer, and Reinhard Feger. “Passive spectral sensing and localization using interfering automotive FMCW radar signals.” *International Journal of Microwave and Wireless Technologies*, vol. 17, no. 9, pp. 1542-1555, 2025. doi:10.1017/s1759078725102730. (TR742, [Passive Spectral Sensing with Automotive FMCW Interference: Exact Source Model and Ram Local Parameter Refinement]).
- [350] Ziang Zhang, Guangzhi Chen, Youlong Weng, Shunchuan Yang, Zhiyu Jia, and Jingxuan Chen. “RIM-former: An End-to-End Transformer for FMCW Radar Interference Mitigation.” *IEEE Transactions on Geoscience and Remote Sensing*, vol. 62, pp. 1-13, 2024. doi:10.1109/tgrs.2024.3487855. (TR1026, [A Ram-Transform Analytic-Core Reformulation of End-to-End FMCW Radar Interference Mitigation]).

- [351] Yifan Wang, Yibing Li, Gang Yu, Yingsong Li, Zitao Zhou, and Xiaoyu Geng. “Interference mitigation for FMCW radar via chirp rate estimation and signal separation.” *Signal Processing*, vol. 222, p. 109537, 2024. doi:10.1016/j.sigpro.2024.109537. (TR1027, [Ram Transform Interference Mitigation for FMCW Radar: Chirp-Rate Estimation and Per-Component Local Operator Separation A Multimodal Ramlet Forward/Inverse Formulation]).
- [352] Yu Zhou, Ronggang Cao, Anqi Zhang, and Ping Li. “An Interference Mitigation Method for FMCW Radar Based on Time-Frequency Distribution and Dual-Domain Fusion Filtering.” *Sensors*, vol. 24, no. 11, art. 3288, 2024. doi:10.3390/s24113288. (TR1028, [Analytic Localized Inversion for FMCW Radar Interference Mitigation: A Ram Transform Reformulation of Time-Frequency Dual-Domain Fusion Filtering]).
- [353] Sian Jin, Pu Wang, Petros T. Boufounos, Philip V. Orlik, Ryuhei Takahashi, and Sumit Roy. “Spatial-Domain Mutual Interference Mitigation for MIMO-FMCW Automotive Radar.” *IEEE Transactions on Vehicular Technology*, vol. 74, no. 2, pp. 2753-2769, 2025. doi:10.1109/tvt.2024.3467917. (TR1029, [Spatial-Domain Mutual-Interference Mitigation for MIMO-FMCW Automotive Radar via a Local-Jet / Panel Inverse of the Array-Manifold Operator (Ram Transform)]).
- [354] Youlong Weng, Ziang Zhang, Guangzhi Chen, Yaru Zhang, Jiabao Chen, and Hongzhan Song. “Real-Time Interference Mitigation for Reliable Target Detection with FMCW Radar in Interference Environments.” *Remote Sensing*, vol. 17, no. 1, art. 26, 2024. doi:10.3390/rs17010026. (TR1030, [A Ram Transform Formulation for Real-Time Mutual-Interference Mitigation in FMCW Radar Beat-Signal Reconstruction]).
- [355] Qile Chen, Shengkai Ren, Haoyang Sun, Zhenxing Li, Wei Liang, Caixia Qiao, and Ruiheng Zhang. “Interference Mitigation for FMCW Radar Based on Filtering in Fractional Fourier Domain.” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 61, no. 3, pp. 5799-5813, 2025. doi:10.1109/taes.2024.3523255. (TR1031, [A Multimodal Fractional-Ramlet Operator for FMCW Radar Mutual-Interference Mitigation in the Fractional Fourier Domain]).
- [356] Xinyi Wei, Jeroen Overdevest, Jun Li, Jihwan Youn, Satish Ravindran, and Ruud J.G. Van Sloun. “Score-based Generative Modeling for Interference Mitigation in Automotive FMCW Radar.” In *2024 21st European Radar Conference (EuRAD)*, pp. 27-30, 2024. doi:10.23919/eurad61604.2024.10734954. (TR1032, [Ram Transform De-Interference for Automotive FMCW Radar: An Analytic Chirp/Beat Core with a Learned Score Residual]).
- [357] Hojung Lee, Song-Yi Kwon, and Seongwook Lee. “Restoration of Automotive Radar Signals Under Mutual Interference by Digital In-Painting.” *IEEE Transactions on Instrumentation and Measurement*, vol. 73, pp. 1-17, 2024. doi:10.1109/tim.2024.3427748. (TR1034, [Local Ram-Transform Restoration of Automotive FMCW Radar Beat Signals under Mutual Interference: An Analytic-Core-plus-Learned-Residual Formulation]).
- [358] Ziang Zhang, Guangzhi Chen, Youlong Weng, Shunchuan Yang, Zhiyu Jia, and Jingxuan Chen. “RIMformer: An End-to-End Transformer for FMCW Radar Interference Mitigation.” *IEEE Transactions on Geoscience and Remote Sensing*, vol. 62, pp. 1-13, 2024. doi:10.1109/tgrs.2024.3487855. (TR1035, [Ram Transform Analytic-Core-Plus-Learned-Residual Interference Mitigation for FMCW Radar A Derivation Report Benchmarked Against RIMformer]).
- [359] Mate Toth, Erik Leitinger, and Klaus Witrisal. “Variational Signal Separation for Automotive Radar Interference Mitigation.” *IEEE Transactions on Radar Systems*, vol. 2, pp. 1007-1026, 2024. doi:10.1109/trs.2024.3477353. (TR1036, [A Ram-Transform Variational Signal-Separation Method for Automotive Radar Interference Mitigation]).
- [360] Sungpil Cheon, Hyungwoo Kim, and Byungkwan Kim. “FMCW Interference Waveform Estimation Based on Intentional Local Interference for Automotive Radars.” *Journal of Electromagnetic Engineering and Science*, vol. 24, no. 4, pp. 350-357, 2024. doi:10.26866/jees.2024.4.r.222. (TR1037, [A Ram Transform Estimator for FMCW Mutual-Interference Waveform Parameters via Intentional Local Interference]).
- [361] J. Overdevest, X. Wei, H. van Gorp, and R. J. G. van Sloun. “Model-Based Diffusion for Mitigating Automotive Radar Interference.” In *2024 IEEE International Conference on Acoustics, Speech, and Signal Processing Workshops (ICASSPW)*, pp. 284-288, 2024. doi:10.1109/icasspw62465.2024.10626218. (TR1038,

[Analytic Chirp/Beat Ram Core with a Learned Diffusion Residual for Automotive FMCW Radar Mutual-Interference Mitigation A Ram Transform Re-Framing of Model-Based Diffusion Denoising]).

- [362] Jeroen Overdeest, Arie G. C. Koppelaar, Jihwan Youn, Xinyi Wei, and Ruud J. G. van Sloun. “Neurally Augmented Deep Unfolding for Automotive Radar Interference Mitigation.” *IEEE Transactions on Radar Systems*, vol. 2, pp. 712-724, 2024. doi:10.1109/trs.2024.3442692. (TR1039, [A Ram-Transform Analytic Core for Automotive FMCW Radar Mutual-Interference Mitigation]).
- [363] Ryoto KOIZUMI, Xiaoyan WANG, Masahiro UMEHIRA, Ran SUN, and Shigeki TAKEDA. “Experimental Evaluations on Learning-Based Inter-Radar Wideband Interference Mitigation Method.” *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, vol. E107.A, no. 8, pp. 1255-1264, 2024. doi:10.1587/transfun.2023eap1122. (TR1041, [A Ram Transform Formulation for Inter-Radar Wideband Nonlinear-Chirp Interference Mitigation]).

6.2 Detection, Localization, Imaging, and Artifact Suppression

- [364] Jeroen Overdeest. “Model-based Deep Learning for Radar Artifact Mitigation.” *Dissertation, Eindhoven University of Technology*, 2026. online record. (TR391, [Analytic-Core-plus-Learned-Residual Ram Transform for Model-Based Deep Learning Radar Artifact Mitigation]).
- [365] Yingquan Zou, Haihan Ding, Jingfu Li, Chong Huang, Pei Xiao, and Guan Gui. “Enhanced Two-Stage Sparse Bayesian Learning Algorithm for Multivehicle Precise Detection and Localization With MIMO-FMCW Radar.” *IEEE Sensors Journal*, vol. 26, no. 7, pp. 11107-11119, 2026. doi:10.1109/jsen.2026.3666310. (TR392, [A Multimodal-Panel Ram Forward/Inverse Operator as an Analytic-Core-plus-Learned-Residual Replacement for Two-Stage Sparse Bayesian Learning in Multivehicle MIMO-FMCW Radar]).
- [366] Hayato Mitsuhashi, Hiroyuki Kamata, and Taku Itami. “Simultaneous Rain Detection and Inter-vehicle Distance Estimation Using a Single FMCW Automotive Radar.” *Sensing and Imaging*, vol. 27, no. 1, art. 66, 2026. doi:10.1007/s11220-026-00769-9. (TR402, [A Ram-Transform Framework for Simultaneous Rain Detection and Inter-vehicle Distance Estimation from a Single FMCW Automotive Radar Waveform Analytic Delay-Chirp Jet Core plus Semi-Blind Rain-Channel Identification under the TR165 Analytic-Core-plus-Learned-Residual Umbrella]).
- [367] Hongyan Chen, Tonghui Huang, Yuexia Wang, Jiajia Shi, and Zhihuo Xu. “Structural-Prior Deep Learning Network for Millimeter-Wave Radar Image Enhancement in Autonomous Driving Road Sensing.” *Sensors*, vol. 26, no. 10, art. 2976, 2026. doi:10.3390/s26102976. (TR403, [Certified Shift-Variant Panel-Jet Deblur Core with Bounded Learned Residual for Millimeter-Wave Radar Image Enhancement A Ram-Transform Analytic Core plus Learned-Residual Formulation for Automotive Radar Road Sensing]).
- [368] Yanxi Lu, Shize Yu, Yao Wang, Fang Li, Longlong Tan, Bo Huang, Ge Jiang, Gaozheng Liu, and Lei Yang. “Spatial-Variant Delay-Doppler Imagery of Airborne Wide-Beam Radar Altimeter for Contour Extraction of Undulating Terrain.” *Remote Sensing*, vol. 18, no. 7, art. 1039, 2026. doi:10.3390/rs18071039. (TR412, [A Coordinate-Mapped Panel Ram Transform for Spatial-Variant Delay-Doppler Imaging and Terrain-Contour Extraction in Airborne Wide-Beam Radar Altimetry]).
- [369] Huijea Park, Seungsu Chung, Jaehyun Park, and Yang Huang. “High-Resolution Localization Using Distributed MIMO FMCW Radars.” *Sensors*, vol. 25, no. 12, art. 3579, 2025. doi:10.3390/s25123579. (TR728, [Resolution-Weighted Localization with Distributed MIMO FMCW Radars A Geometric Ram Fusion Operator for Local MUSIC Position Estimates TR728]).
- [370] Tong Pei, Tao Liao, Xiangkui Wan, Binhui Wang, and Danni Hao. “Spatial Blind Source Estimation of Respiratory Rate and Heart Rate Detection Based on Frequency-Modulated Continuous Wave Radar.” *Sensors*, vol. 25, no. 4, art. 1198, 2025. doi:10.3390/s25041198. (TR753, [Spatial Blind Source Estimation of Respiratory Rate and Heart Rate Detection Based on FMCW Radar]).

- [371] Adnan Albaba, Marc Bauduin, Adham Sakhnini, Hichem Sahli, and André Bourdoux. “Sidelobes and Ghost Targets Mitigation Technique for High-Resolution Forward-Looking MIMO-SAR.” *IEEE Transactions on Radar Systems*, vol. 2, pp. 237-250, 2024. doi:10.1109/trs.2024.3366779. (TR1042, [A Closed-Form Ram-Transform Operator for Sidelobe and Virtual-Array Ghost Mitigation in High-Resolution Forward-Looking MIMO-SAR Imaging]).
- [372] Mingqian Liu, Jie Pan, Jinbiao Zhu, Zhengchao Chen, Bingchen Zhang, and Yirong Wu. “A Sparse SAR Imaging Method for Low-Oversampled Staggered Mode via Compound Regularization.” *Remote Sensing*, vol. 16, no. 8, art. 1459, 2024. doi:10.3390/rs16081459. (TR1048, [A Ram Transform Reconstruction Method for Low-Oversampled Staggered-Mode Spaceborne SAR: Known-Channel Azimuth Recovery with a Certified Super-Geometric Error Bound]).

6.3 LiDAR, Chirp, and Delay-Doppler Processing

- [373] Chanul Park, Jeong-Hoon Park, and Seongwook Lee. “Nonlinear Stepped-Frequency MIMO PMCW Radar Systems with High Range Resolution Under Low Sampling Rates.” *Remote Sensing*, vol. 18, no. 10, art. 1576, 2026. doi:10.3390/rs18101576. (TR406, [Sub-Nyquist Range Reconstruction for Nonlinear Stepped-Frequency MIMO PMCW Radar via the Ram Sampling Theorem for Known Shift-Variant Channels A Ram Transform Derivation]).
- [374] Alfred Krister Ulvog, Joshua Rapp, and Vivek K Goyal. “FMCW Lidar Beyond Nyquist by Instantaneous Frequency Fitting.” *arXiv preprint arXiv:2605.14039*, 2026. arXiv:2605.14039. (TR407, [FMCW Lidar Beyond Nyquist by Instantaneous-Frequency Fitting – A Certified Sub-Nyquist Ram Sampling Formulation]).
- [375] Bowen Yang, Chunsheng Sun, and Jingbo Sun. “Research on Frequency Modulated Continuous Wave (FMCW) Lidar Equation Based on Optical Mixing.” *Applied Sciences*, vol. 16, no. 4, art. 1728, 2026. doi:10.3390/app16041728. (TR411, [A Ram-Transform Analysis of the FMCW LiDAR Optical-Mixing Beat Equation: Local Analytic Beat-Frequency Inversion and a Super-Geometric Underspread Error Bound]).
- [376] Luís C. P. Pinto and Maria C. R. Medeiros. “Enhanced High-Resolution and Long-Range FMCW LiDAR with Directly Modulated Semiconductor Lasers.” *Sensors*, vol. 25, no. 13, art. 4131, 2025. doi:10.3390/s25134131. (TR727, [Offline Iterative Linearization of Directly Modulated FMCW LiDAR A Jacobian Ram-Operator Analysis of Frequency-Sweep Predistortion TR727]).
- [377] Tao Xue, Jingyang Liu, Cheng Lu, and Guodong Liu. “High Precision Range Extracting Method for FMCW LiDAR Using Semiconductor Laser Based on EO-PLL and NUDFT.” *Photonics*, vol. 12, no. 5, art. 466, 2025. doi:10.3390/photonics12050466. (TR737, [EO-PLL Linearization and Nonuniform-DFT Range Extraction for Semiconductor-Laser FMCW LiDAR Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [378] Shichang Xu, Guohui Yuan, Hongwei Zhang, Chunyu Hou, Zhirong Li, Pansong Zhang, Wenhao Xu, and Zhuoran Wang. “A Novel Two-Stage Approach for Nonlinearity Correction of Frequency-Modulated Continuous-Wave Laser Ranging Combining Data-Driven and Principle-Based Strategies.” *Photonics*, vol. 12, no. 4, art. 356, 2025. doi:10.3390/photonics12040356. (TR738, [Data-Driven Feedforward plus EO-PLL Correction of FMCW-LiDAR Sweep Nonlinearity Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [379] Brian Redman. “Bitstream Photon Counting Chirped AM Lidar with a Digital Logic Local Oscillator.” *Open Engineering Inc*, 2025. doi:10.31224/4625. (TR739, [Bitstream Photon-Counting Chirped-AM LiDAR with a Digital-Logic Local Oscillator Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [380] Zhiwei Li, Ning Wang, Yao Li, Jiaji He, and Yiqiang Zhao. “FMCW LiDAR Nonlinearity Compensation Based on Deep Reinforcement Learning with Hybrid Prioritized Experience Replay.” *Photonics*, vol. 12, no. 10, art. 1020, 2025. doi:10.3390/photonics12101020. (TR740, [FMCW LiDAR Nonlinearity Compensation with HPER-SAC: A Corrected Delay Operator and Ram Local-Control Reformulation]).

6.4 Radar Architectures and Environmental Sensing

- [381] Robin Amar, Mohammad Alae-Kerahroodi, and M. R. Bhavani Shankar. “Polynomial Phase Constrained Waveforms for mmWave MIMO Radars.” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 61, no. 4, pp. 8225-8243, 2025. doi:10.1109/taes.2025.3544186. (TR726, [Polynomial-Phase-Constrained Waveform Design for mmWave MIMO Radar A Nonlinear Ram Coordinate Map with MM, BCD, and Conditioned Coefficient Updates TR726]).
- [382] Ionela-Cristina Voicu and Filip Rosu. “Enabling Super-Resolution for Automotive Imaging Radars in the Presence of Antenna Calibration Errors.” *IEEE Open Journal of Vehicular Technology*, vol. 6, pp. 385-395, 2025. doi:10.1109/ojvt.2025.3526133. (TR733, [Calibrated AR Aperture Extrapolation and Spatial Smoothing for Automotive Imaging Radar Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [383] Danyang Yu, Lei Du, Jie Bai, and Yulin Chen. “High-Precision 2D-DOA Estimation Method for Millimeter-Wave Radar Based on Double-Parallel Linear Array and Joint IAA-RIT.” *Sensors*, vol. 25, no. 8, art. 2609, 2025. doi:10.3390/s25082609. (TR734, [Joint IAA-Rotational-Invariance 2D Direction Finding on a Double-Parallel Array Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [384] Shuxiao Wu, Jianyong Hu, Yaole Cao, Yuxing Jiang, Yanshan Fan, Zhixing Qiao, Guosheng Feng, Changgang Yang, Jianqiang Liu, Ruiyun Chen, Chengbing Qin, Guofeng Zhang, Liantuan Xiao, and Suotang Jia. “Photon-level single-pixel imaging of dynamic features in frequency domain.” *Chinese Optics Letters*, vol. 23, no. 8, art. 081101, 2025. doi:10.3788/col202523.081101. (TR735, [Frequency-Domain Photon-Level Single-Pixel Imaging of Dynamic Features Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [385] Siyuan Ding, Deshan Feng, Xun Wang, Tianxiao Yu, Shuo Liu, and Mengchen Yang. “Three-Dimensional Imaging of High-Contrast Subsurface Anomalies: Composite Model-Constrained Dual-Parameter Full-Waveform Inversion for GPR.” *Applied Sciences*, vol. 15, no. 15, art. 8401, 2025. doi:10.3390/app15158401. (TR736, [Composite-Regularized Dual-Parameter Full-Waveform Inversion for Three-Dimensional GPR Paper-Specific Technical Audit and Conditional Ram Formulation]).
- [386] Thierry Chaneleire. “Arbitrary laser frequency modulation algorithm based on iterative on-the-fly deconvolution.” *Applied Optics*, vol. 65, no. 1, p. 341, 2025. doi:10.1364/ao.577439. (TR743, [Iterative On-the-Fly Laser Deconvolution: Transfer-Function Limits and Ram Local Predistortion]).
- [387] Jonas Brandstetter, Eva-Maria Knoch, and Frank Gauterin. “Heart Rate Estimation Using FMCW Radar: A Two-Stage Method Evaluated for In-Vehicle Applications.” *Biomimetics*, vol. 10, no. 9, art. 630, 2025. doi:10.3390/biomimetics10090630. (TR754, [Heart-Rate Estimation Using FMCW Radar: A Two-Stage Method Evaluated for In-Vehicle Applications]).
- [388] Bong-seok Kim, Jonghun Lee, Sangdong Kim, and Ram M. Narayanan. “MIMO Imaging Method with Extrapolation-Iterative Adaptive Approach-Based Super-Resolution Technique for Automotive Radar.” In *2024 IEEE Radar Conference (RadarConf24)*, pp. 1-6, 2024. doi:10.1109/radarconf2458775.2024.10549243. (TR1043, [A Conditioned Analytic Aperture/Bandwidth Extrapolation and Per-Lobe Manifold-Jet Inverse (EIAA-Ram) for MIMO Automotive Radar Angular Super-Resolution]).
- [389] Yadong Li, Dongheng Zhang, Ruixu Geng, Zhi Lu, Zhi Wu, Yang Hu, Qibin Sun, and Yan Chen. “A high-resolution handheld millimeter-wave imaging system with phase error estimation and compensation.” *Communications Engineering*, vol. 3, no. 1, art. 4, 2024. doi:10.1038/s44172-023-00156-2. (TR1045, [Handheld Coherent-Aperture Millimeter-Wave Autofocus as Joint Kernel-Moment and Phase Identification with a Conditioned Local Ram Inverse A Ram-Transform Derivation, Algorithm, and Verification Plan]).

7 Physiological and Biomedical Sensing

58 bibliography items.

7.1 Cuffless Blood Pressure and Hemodynamic Monitoring

- [390] Henry Crandall, Tyler Schuessler, Filip Bělík, Albert Fabregas, Barry M. Stults, Alexandra Boyadzhiev, Huanan Zhang, Jim S. Wu, Aylin R. Rodan, Stephen P. Juraschek, Ramakrishna Mukkamala, Alfred K. Cheung, Stavros G. Drakos, Christel Hohenegger, Braxton Osting, and Benjamin Sanchez. “Cuffless hemodynamic monitoring with physics-informed machine learning models.” *Nature Communications*, 2026. doi:10.1038/s41467-026-72693-1. (TR416, [Analytic-Core-plus-Learned-Residual Ram Transform for Cuffless Hemodynamic Monitoring: Windkessel/Wave-Propagation Inverse Operators with Semi-Blind Calibration]).
- [391] Dongyuan Xiao, Xiaolu Zeng, Xiaopeng Yang, Zixin Wang, Shichao Zhong, and Honggang Zhang. “Blood pressure estimation based on millimeter wave radar.” *IET Conference Proceedings*, vol. 2025, no. 52, pp. 4951-4957, 2026. doi:10.1049/icp.2026.1746. (TR417, [Analytic Radar-Chirp/Beat Forward Operator and Local Ram Inverse for Contactless Cuffless Blood-Pressure Estimation via mmWave Radar]).
- [392] Tristan Wen Jie Choo, Alicia Ann May Yap, Ariffin Kawaja, Victor T. T. Chao, Chirk Jenn Ng, Malini Olivo, and Renzhe Bi. “Clinical-grade Cuffless Blood Pressure Monitoring via Deep-tissue Diffuse Speckle Pulsatile Flowmetry.” *openRxiv*, 2026. doi:10.64898/2026.06.19.26356074. (TR418, [A Ram Transform for Clinical-Grade Cuffless Blood-Pressure Monitoring via Deep-Tissue Diffuse Speckle Pulsatile Flowmetry Analytic-Core-Plus-Learned-Residual Inversion of the Correlation-Diffusion / Speckle-Statistics Forward Operator]).
- [393] Tzu-Hsuan Lu, Yu-Hsuan Fan Chiang, and Chuen-Chau Chang. “A wearable cuffless blood pressure monitoring system: real-time measurement using force sensing and waveform analysis.” *Journal of Clinical Monitoring and Computing*, 2026. doi:10.1007/s10877-026-01454-8. (TR419, [A Local Ram-Transform Formulation of Force-Sensing Cuffless Blood Pressure Estimation An Application Instance of the Analytic-Core-plus-Learned-Residual (TR165) Umbrella]).
- [394] Hamed Abdollahzadeh, Elisa Montaldi, Riccardo Olivieri, Paolo Esposito, Gianluca Barile, Giuseppe Ferri, and Vincenzo Stornelli. “Peak-Independent Cuffless Blood Pressure Monitoring Using a Smart Sock: The Role of Temporal Lag Modeling in Foot-Based PPG.” *Sensors*, vol. 26, no. 4, art. 1269, 2026. doi:10.3390/s26041269. (TR420, [A Peak-Independent Analytic Operator for Foot-PPG Cuffless Blood Pressure via a Known Underspread Shift-Variant Delay Channel: The Ram Sampling Theorem with a Learned Peripheral Residual]).
- [395] Timothy Oladunni and Farouk Ganiyu Adewumi. “Attractor-Vascular Coupling Theory: Formal Grounding and Empirical Validation for AAMI-Standard Cuffless Blood Pressure Estimation from Smartphone Photoplethysmography.” *arXiv preprint arXiv:2605.10871*, 2026. arXiv:2605.10871. (TR421, [Certified Analytic-Core Inversion of the Attractor-Vascular Coupling Operator for AAMI-Standard Cuffless Blood-Pressure Estimation from Smartphone Photoplethysmography A Coordinate-Mapped Local-Jet Ram Transform with Difference-Jet Sampling Bound and Learned Residual]).
- [396] Deen Osman, Kaan Sel, Erica Spatz, and Roozbeh Jafari. “Cardiovascular digital twins using a Windkessel physics informed neural network.” *npj Digital Medicine*, vol. 9, no. 1, art. 443, 2026. doi:10.1038/s41746-026-02610-9. (TR422, [An Analytic-Core-plus-Learned-Residual Ram Transform for Windkessel Cardiovascular Digital Twins Exact Variable-Coefficient RCR ODE Inversion and Sampled Waveform Reconstruction as an Alternative to the Windkessel PINN]).
- [397] Yu-Jen Cheng, Edward Kim, Jin-Oh Hahn, Jae-Hyun Chung, and Younghoon Kwon. “Continuous blood pressure monitoring via hemodynamic parameter and pulse transit time derived from capacitive sensing pads.” *Physiological Measurement*, vol. 47, no. 4, art. 045006, 2026. doi:10.1088/1361-6579/ae575a.

(**TR423**, [A Ram-Transform Analysis of Continuous Cuffless Blood-Pressure Estimation from Capacitive-Pad Pulse-Transit-Time Sensing Analytic-Core-plus-Learned-Residual Framing under the TR165 Umbrella]).

- [398] Luyao Liu, Jie Zhang, Ziyang Feng, Sen Zhang, Zhiqiang Zhang, and Wendong Xiao. “Contactless and Continuous Blood Pressure Detection With FMCW Millimeter-Wave Radar.” *IEEE Sensors Journal*, vol. 25, no. 9, pp. 15489-15501, 2025. doi:10.1109/jsen.2025.3548259. (**TR723**, [Contactless Blood-Pressure Estimation from mmWave Arterial Motion A Calibrated Ram-Operator Reading of Range-Beamforming, Pulse Translation, and Transfer Learning TR723]).
- [399] Shengze Wang, Mondher Bouazizi, Siyuan Yang, and Tomoaki Ohtsuki. “Accurate Cardiac Duration Detection for Remote Blood Pressure Estimation Using mm-Wave Doppler Radar.” *Sensors*, vol. 25, no. 3, art. 619, 2025. doi:10.3390/s25030619. (**TR746**, [Radar Cardiac-Duration Detection for Remote BP Estimation: Nonlinear Feature Operators and Ram Local Timing]).
- [400] Junghwan Lee, YuSang Nam, Jihwan Won, Suhwan Baek, Donggyu Sim, Ryanghee Sohn, and Cheolsoo Park. “Multi-task learning for estimation of remote PPG and respiration signals with complex valued convolutional neural network.” *Scientific Reports*, vol. 15, no. 1, art. 39272, 2025. doi:10.1038/s41598-025-23103-x. (**TR762**, [Ram Analytic Feature Core for Complex-Valued Multi-Task Remote PPG and Respiration Networks]).
- [401] Heng Zhao, Zicheng Wang, Chuanwei Ding, Biao Xue, Dongbo Xu, Zehan Wang, Hong Hong, and Xiaohua Zhu. “Noncontact Blood Pressure Estimation From the Carotid Pulse Wave Signal Using a Modified ResNet-18 Network With LFM CW Radar.” *IEEE Sensors Journal*, vol. 24, no. 23, pp. 39383-39393, 2024. doi:10.1109/jsen.2024.3476130. (**TR1050**, [A Ram Transform Derivation for Noncontact Blood-Pressure Estimation from the Carotid Pulse Wave with LFM CW Radar]).

7.2 Contactless Radar Cardiorespiratory and Vital-Sign Sensing

- [402] Dongsheng Lai, Zhiming Cai, Ganhong Tian, Jiangchao Zhang, and Long Chen. “Robust multi-person vital-sign sensing in indoor environments using FMCW MIMO radar.” *Electronic Research Archive*, vol. 34, no. 3, pp. 1477-1505, 2026. doi:10.3934/era.2026067. (**TR393**, [Multimodal Ram Transform for Robust Multi-Person Vital-Sign Sensing with FMCW MIMO Radar Per-Person Expansion Centers, Block-Bidiagonal Coupling and an Analytic Local Inverse for Superimposed Periodic Phase Modulations]).
- [403] Silvia Mura, Davide Scazzoli, Lorenzo Fineschi, and Maurizio Magarini. “Trade-Offs in FMCW Radar-Based Respiration and Heart Rate Variability.” *arXiv preprint arXiv:2603.09791*, 2026. arXiv:2603.09791. (**TR395**, [A Ram-Transform View of Trade-Offs in FMCW Radar-Based Respiration and Heart Rate Variability Estimation Reproduction and Fold-In under the TR142 (Chirp/Beat) and TR174 (Contactless Physiological Inverse) Claim Families]).
- [404] Laura Miro, Ruochen Wu, Albert Aguiasca, Antoni Broquetas, Cosme Garcia, Oriol Estrada, and Montse Najar. “Contactless Acquisition and Decoupling of Respiratory and Cardiac Signals using a 122 GHz FMCW Radar.” *IEEE Journal of Biomedical and Health Informatics*, pp. 1-14, 2026. doi:10.1109/jbhi.2026.3673391. (**TR398**, [Multimodal Per-Lobe Ram Transform Decoupling of Respiratory and Cardiac Signals from a 122 GHz FMCW Radar A Local Analytic Beat/Phase Inverse-Operator]).
- [405] Chaoyan Zhang, Hui Liu, Yi Zhu, Guangjie Fu, Xianzhen Chen, and Daixin Yang. “A radar vital signs detection method in complex environments.” *Scientific Reports*, vol. 16, no. 1, art. 2333, 2026. doi:10.1038/s41598-025-32042-6. (**TR400**, [A Multimodal Ram Transform with Analytic Core and Learned Residual for Contactless Radar Vital-Signs Detection in Complex Environments]).
- [406] Guang Yu, Chenxi Yang, Haobo Li, Chaochao Wang, Xianchao Zhang, Jianqing Li, and Chengyu Liu. “Non-contact seismocardiogram measurement and HRV analysis using cardiac beamforming with FMCW radar.” *Frontiers in Physiology*, vol. 16, art. 1733573, 2026. doi:10.3389/fphys.2025.1733573. (**TR401**, [A Ram-Transform Formulation of Non-Contact Seismocardiogram Measurement and HRV Analysis via Cardiac Beamforming with FMCW Radar Forward Chirp/Beat Operator, Beamforming Selection Stage and Local Analytic Phase-Jet Inversion]).

- [407] Zhi Lu, Jinbo Chen, Dongheng Zhang, Haoyu Wang, Pengcheng Huang, Fang Zhou, Yang Hu, Qibin Sun, Min Gao, and Yan Chen. “Contactless 12-lead electrocardiogram via deep computational radar.” *npj Biomedical Innovations*, vol. 3, no. 1, art. 6, 2026. doi:10.1038/s44385-025-00060-8. (TR424, [An Analytic Ram Core for Contactless 12-Lead ECG via Computational Radar: Near-Field Shift-Variant Beat Operator, Exact Local Motion Recovery, and a Core-Plus-Learned-Residual Decomposition]).
- [408] Anastasios G. Koutinos, Constantinos L. Zekios, and Stavros V. Georgakopoulos. “COTS mmW radar systems for remote sensing of vital signs.” In *2026 United States National Committee of URSI National Radio Science Meeting (USNC-URSI NRSM)*, pp. 301-301, 2026. doi:10.23919/nrsm68586.2026.11550845. (TR425, [Mapping Note on COTS mmW Radar Vital-Sign Sensing to the Ram Transform Corpus A Screening / Design-Around Assessment under the TR165 Analytic-Core-plus-Learned-Residual Umbrella]).
- [409] Tao Li, Tong Wu, Liukang Qin, and Wenyi Li. “Interference resistant contactless heart rate variability monitoring via millimeter wave radar.” *Scientific Reports*, 2026. doi:10.1038/s41598-026-59339-4. (TR426, [Interference-Resistant Contactless Heart-Rate-Variability Monitoring via mmWave Radar – A Multimodal Ram-Transform Formulation]).
- [410] Samagra Singh, Kavita Pandya, and Keerti Jituri. “Real-Time in-Cabin Vital Sensing and Response System Using Ultra-Wideband Radar in Automotive.” In *SAE Technical Paper Series*, vol. 1, art. 2026-26-0012, 2026. doi:10.4271/2026-26-0012. (TR427, [Coordinate-Mapped Ram Transform Inversion for Real-Time In-Cabin Vital Sensing with UWB Radar A Shift-Variant Occupant-Clutter Panel Formulation]).
- [411] Waldemar Susek and Zenon Szczepaniak. “A noise radar implemented in UAV for remote human vital-signs detection.” *Journal of Automation, Electronics and Electrical Engineering*, vol. 8, no. 1, pp. 19-30, 2026. doi:10.24136/jaece.2026.002. (TR428, [A Platform-Motion-Compensated Ram Transform for UAV-Borne Noise-Radar Remote Vital-Signs Sensing]).
- [412] Pouya Mehrjouseresh. “Radar-gebaseerde intelligente detectie voor de volgende generatie binnenhuissystemen: van veiligheid tot gezondheid.” *Dissertation, Lirias*, 2026. online record. (TR429, [Radar-Based Intelligent Indoor Sensing as a Shift-Variant Ram-Transform Inverse Problem: A Mapping Exhibit for Contactless Security and Vital-Sign Monitoring]).
- [413] Jiangyifei Zhu, Yuzhe Wang, Tao Qiang, Vu Phan, Zhixiong Li, Evy Meinders, Eni Halilaj, Justin Chan, and Swarun Kumar. “GigaFlex: Contactless Monitoring of Muscle Vibrations During Exercise with a Chaos-Inspired Radar.” In *Proceedings of the 2026 ACM/IEEE International Conference on Embedded Artificial Intelligence and Sensing Systems*, pp. 274-290, 2026. doi:10.1145/3774906.3802776. (TR430, [Coordinate-Mapped Ram Transform and Ramlet Inversion for Contactless Muscle-Vibration Sensing with Chaos-Inspired Nonlinear-Chirp Radar]).
- [414] Ziyang Liu, Siyuan He, Feng Liang, Chang Huang, Shuxin Zhong, and Kaishun Wu. “mmJEPA-ECG: Cross-Posture Robust Contactless Electrocardiogram Monitoring via Millimeter Wave Radar Sensing.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, no. 45, pp. 38962-38970, 2026. doi:10.1609/aaai.v40i45.41242. (TR431, [A Posture-Parametrized Shift-Variant Ram Transform for Cross-Posture Contactless ECG Recovery from mmWave Radar An Analytic-Core-plus-Learned-Residual Formulation for mmJEPA-ECG]).
- [415] Lang Qin, Mandong Zhang, Wenting Song, Zhiqiang Huang, and Xiaoguang Liu. “Respiration Monitoring of Multiple People using Multi-site FMCW SISO Radar Systems.” *arXiv preprint arXiv:2604.12556*, 2026. arXiv:2604.12556. (TR432, [Multimodal Multi-Panel Ram Transform for Respiration Monitoring of Multiple People using Multi-Site FMCW SISO Radar Systems]).
- [416] Mohammad Hossein Shirazi, Sira Yongchareon, Anuradha Singh, and Jing Ma. “AVAESA: Adaptive VAE with self-attention and learnable signal processing for robust radar-based heart rate estimation.” *Internet of Things*, vol. 37, p. 101931, 2026. doi:10.1016/j.iot.2026.101931. (TR433, [An Analytic Ram Oscillatory-Beat Core with Lightweight Learned Residual for Robust Radar-Based Heart-Rate Estimation A Design-Around of the AVAESA Learnable Signal-Processing Front-End]).

- [417] Giulio Montanari, Marco Mura, Pasquale Di Viesti, Elia Vignoli, Giorgio Guerzoni, and Giorgio Matteo Vitetta. “A Radar-Based Contactless System for Joint Phonocardiogram Reconstruction and Cardiac State Segmentation Using a Self-Attention 1D U-Net.” *Sensors*, vol. 26, no. 10, art. 3151, 2026. doi:10.3390/s26103151. (TR434, [Radar-Based Joint Phonocardiogram Reconstruction and Cardiac-State Segmentation via a Ram Analytic-Core-plus-Learned-Residual Operator A Coordinate-Warped Phase-Jet Inverse with a Bounded Learned Residual Displacing the Self-Attention 1D U-Net]).
- [418] Diyah Widiyasari, Istiqomah Istiqomah, Fiky Yosef Suratman, and Suto Setiyadi. “Non-Contact Heart Rate Detection Using FMCW Radar Based on 1-D Convolutional Neural Networks.” *Journal of Electronics, Electromedical Engineering, and Medical Informatics*, vol. 8, no. 2, pp. 638-656, 2026. doi:10.35882/jeeemi.v8i2.1547. (TR435, [Analytic Chirp/Beat Core with Learned Residual for Non-Contact FMCW Heart-Rate Estimation – A Screening Derivation A Ram Transform Pipeline Technical Report]).
- [419] Udhayami M B and Joseph Rodrigues. “UWB Monostatic RADAR-Based Heartbeat Monitoring in an Autonomous Vehicle.” *International Journal of Electrical and Electronics Engineering*, vol. 13, no. 3, pp. 200-209, 2026. doi:10.14445/23488379/ijeee-v13i3p115. (TR436, [A Ram Transform Treatment of UWB Monostatic Radar-Based Heartbeat and Respiration Monitoring in Autonomous Vehicles Local Jet Inversion of the Shift-Variant Micro-Doppler Operator with a TR167 Super-Geometric Error Bound]).
- [420] Matteo Pardi, Amir Hosein Oveis, Saba Kharabadze, and Ajeet Kumar. “Transformer-Based Heartbeat Monitoring with FMCW Radar Under Random Body Motion.” *arXiv preprint arXiv:2605.28432*, 2026. arXiv:2605.28432. (TR438, [A Ram-Core-Plus-Learned-Residual Operator for Contactless Heartbeat Monitoring with FMCW Radar Under Random Body Motion]).
- [421] Jiasheng Cao, Xiao Li, Xiangwei Dang, Nanyi Jiang, and Yanlei Li. “Millimeter-Wave Radar-Based Weak Neonatal Heart Rate Detection Using an Adaptive Subband Variable Step-Size LMS Filtering Algorithm.” *Electronics*, vol. 15, no. 4, art. 731, 2026. doi:10.3390/electronics15040731. (TR439, [A Multimodal Ramlet Analytic-Core Approach to mmWave Radar-Based Weak Neonatal Heart-Rate Extraction A Ram-Transform Reformulation of Adaptive Subband VSS-LMS Cardiac Micro-Motion Recovery]).
- [422] Yukun Huang, Denghao Li, Jingran Cheng, Haoming Feng, Min Duan, Junlin Yu, Jinqu Zhou, Shengwei Liu, Zheng Wang, Yonghui Wu, and Huaqing Li. “Harmonic-Suppressed BR/HR Detection in FMCW Radar via Phase Correction with APSVD and VMD-Denoising.” *Journal of Machine Learning and Information Security*, vol. 2, no. 3, 2026. doi:10.53941/jmlis.2026.100014. (TR440, [Multimodal Ram-Transform Harmonic Suppression for FMCW Radar Breathing- and Heart-Rate Estimation A Local-Analytic Alternative to APSVD + VMD-Denoising Phase Correction]).
- [423] Chi Zhang, Jinyuan Duan, Shuai Lu, DuoJun Zhang, Murat Temiz, Yongwei Zhang, and Zhaozong Meng. “Design and Experimental Demonstration of an Integrated Sensing and Communication System for Vital Sign Detection.” *Sensors*, vol. 25, no. 12, art. 3766, 2025. doi:10.3390/s25123766. (TR632, [A Small-Displacement Local Operator for OFDM-ISAC Vital-Sign Sensing]).
- [424] Zhanjun Hao, Yifei Gao, Yangyang Tang, Yue Wang, Kai Fan, and Fenfang Li. “FMCW-based contactless heart rate monitoring.” *Scientific Reports*, vol. 15, no. 1, art. 2616, 2025. doi:10.1038/s41598-025-86438-5. (TR719, [Contactless Heart-Rate Monitoring with FMCW Radar Phase identifiability, adaptive VMD, and a condition-aware local demodulation core]).
- [425] Zhanjun Hao, Yue Wang, Fenfang Li, Guozhen Ding, Kai Fan, and Yifei Gao. “Detection of vital signs based on millimeter wave radar.” *Scientific Reports*, vol. 15, no. 1, art. 28112, 2025. doi:10.1038/s41598-025-09112-w. (TR724, [Multiscale State Estimation for mmWave Respiration and Heart Rate A Ram-Operator Formulation of Coherent Enhancement, Wavelets, and Adaptive Kalman Filtering TR724]).
- [426] Ashwini Kanakapura Sriranga, Qian Lu, and Stewart Birrell. “Enhancing Heart Rate Detection in Vehicular Settings Using FMCW Radar and SCR-Guided Signal Processing.” *Sensors*, vol. 25, no. 18, art. 5885, 2025. doi:10.3390/s25185885. (TR729, [SCR-Guided Vehicular Heart-Rate Sensing with Multichannel Radar A Selection-Aware Ram Phase Operator and Evidence Audit TR729]).

- [427] Rahul Manoj, Kiran V. Raj, P. M. Nabeel, Mohanasankar Sivaprakasam, and Jayaraj Joseph. “Measurement of pressure dependent variations in local pulse wave velocity within a cardiac cycle from forward travelling pulse waves.” *Scientific Reports*, vol. 15, no. 1, art. 3066, 2025. doi:10.1038/s41598-025-87143-z. (TR745, [Pressure-Dependent Local Pulse-Wave Velocity after Wave Separation: Delay-Operator Analysis and Ram Local Timing Estimation]).
- [428] Nima Bahmani, Dariush Salami, Huseyin Yigitler, Juhapekka Hietala, Tuukka Panula, and Stephan Sigg. “Wearable Non-Invasive Arterial Pulse Detection with a Millimeter-wave Radar.” In *Proceedings of the 2025 ACM International Symposium on Wearable Computers*, pp. 184-190, 2025. doi:10.1145/3715071.3750411. (TR747, [Wearable mmWave Arterial-Pulse Detection: Phase Identifiability and a Ram Multimodal Local Model]).
- [429] Yuan Liu, Xuemei Fu, Ritesh Chandra Tewari, Xingze Wang, and Andy W. H. Khong. “Contactless Vital Sign Monitoring for Multiple People Using a Millimeter-wave MIMO Radar.” In *ICASSP 2025 - 2025 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 1-5, 2025. doi:10.1109/icassp49660.2025.10890100. (TR748, [Multi-Person Vital Signs with mmWave MIMO Radar and RBSS: Sparse-Operator Audit and Ram Local Separation]).
- [430] Elia Vignoli, Pasquale Di Viesti, and Giorgio Matteo Vitetta. “A Deterministic Method for Contactless Monitoring of Vital Signs Using Multiple FMCW Radars in the 24 GHz Band.” *IEEE Access*, vol. 13, pp. 27868-27892, 2025. doi:10.1109/access.2025.3540316. (TR749, [Deterministic Vital-Sign Monitoring with Multiple 24-GHz FMCW Radars: VSEADA Audit and Ram Local Phase-Gradient Model]).
- [431] Ashwini Kanakapura Sriranga, Qian Lu, and Stewart A. Birrell. “A Deep Learning-Based Contactless Driver State Monitoring Radar System for In-Vehicle Physiological Applications.” *IEEE Transactions on Intelligent Transportation Systems*, vol. 26, no. 7, pp. 9491-9499, 2025. doi:10.1109/tits.2025.3566896. (TR750, [A Deep Learning-Based Contactless Driver State Monitoring Radar System for In-Vehicle Physiological Applications]).
- [432] Nanyi Jiang, Xuerui Liang, Xiangwei Dang, Yanlei Li, Shiguang Yang, Xingdong Liang, and Tongyan Han. “Separation of thoracic and abdominal measurements in neonatal vital sign monitoring using radar vision fusion system.” *Scientific Reports*, vol. 15, no. 1, art. 11800, 2025. doi:10.1038/s41598-025-95542-5. (TR751, [Separation of Thoracic and Abdominal Measurements in Neonatal Vital-Sign Monitoring Using a Radar-Vision Fusion System]).
- [433] Changming Li, Cong Shi, Athina Petropulu, and Yingying Chen. “Fine-grained Vital Sign Reconstruction through Machine Learning on Multi-channel Radar Signals.” In *ICASSP 2025 - 2025 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 1-5, 2025. doi:10.1109/icassp49660.2025.10890245. (TR752, [Fine-Grained Vital-Sign Reconstruction through Machine Learning on Multi-Channel Radar Signals]).
- [434] Zihan Yang, Yinzhe Liu, Hao Yang, Jing Shi, Anyong Hu, Jun Xu, Xiaodong Zhuge, and Jungang Miao. “Noncontact Breathing Pattern Monitoring Using a 120 GHz Dual Radar System with Motion Interference Suppression.” *Biosensors*, vol. 15, no. 8, art. 486, 2025. doi:10.3390/bios15080486. (TR756, [Noncontact Breathing-Pattern Monitoring Using a 120 GHz Dual-Radar System with Motion-Interference Suppression]).
- [435] Ouafaa Ikhzmane, Sara Sandabad, Wajih Rhalem, and Achraf Benba. “DR-MUSIC: Deep Learning-Based Reconstruction of ECG from Millimeter-Wave Radar for Contactless Cardiac Monitoring.” *Research Square preprint*, 2025. doi:10.21203/rs.3.rs-6688774/v1. (TR757, [DR-MUSIC: Deep Learning-Based Reconstruction of ECG from Millimeter-Wave Radar for Contactless Cardiac Monitoring]).
- [436] Kun-Ta Lee, Wen-Te Liu, Yi-Chih Lin, Zhihe Chen, Yu-Hsuan Ho, Yu-Wen Huang, Zong-Lin Tsai, Chih-Wei Hsu, Shang-Min Yeh, Hsiao Yi Lin, Arnab Majumdar, Yen-Ling Chen, Yi-Chun Kuan, Kang-Yun Lee, Po-Hao Feng, Kuan-Yuan Chen, Jiunn-Horng Kang, Hsin-Chien Lee, Shu-Chuan Ho, and Cheng-Yu Tsai. “Utilizing a Wireless Radar Framework in Combination With Deep Learning Approaches to Evaluate Obstructive Sleep Apnea Severity in Home-Setting Environments.” *Journal of Multidisciplinary Healthcare*, vol. Volume 18, pp. 381-393, 2025. doi:10.2147/jmdh.s486261. (TR759, [Utilizing a Wireless Radar Framework with Deep Learning to Evaluate Obstructive Sleep-Apnea Severity in Home Settings]).

- [437] Zehan Guo, Binbin Zhang, Jinbo Chen, Yang Hu, and Yan Chen. “Contactless Fine-grained Cardiac Events Detection and Segmentation with Radio Frequency Signals.” *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, vol. 9, no. 3, pp. 1-28, 2025. doi:10.1145/3749457. (TR760, [“Certified Ram-Panel Front End for Contactless Fine-Grained Cardiac-Event Segmentation”]).
- [438] Inoh Choi, Jieun Lee, Sewon Yoon, Jayol Lee, Bontae Koo, Youngseok Baek, Youngmin Kim, and Sanghong Park. “Estimation of Oxygen Saturation for an Individual Using Noncontact Radar Sensor.” *The Journal of Korean Institute of Electromagnetic Engineering and Science*, vol. 36, no. 1, pp. 64-75, 2025. doi:10.5515/kjkiees.2025.36.1.64. (TR761, [Uncertainty-Aware Ram Local-Jet Enhancement of Radar-Based Oxygen-Saturation Estimation]).
- [439] Chieh-Hsun Hsieh and Po-Hsuan Tseng. “Multiperson Localization and Vital Signs Estimation Using mmWave MIMO Radar.” *IEEE Transactions on Microwave Theory and Techniques*, vol. 73, no. 2, pp. 1222-1234, 2025. doi:10.1109/tmtt.2024.3434958. (TR1033, [A Multimodal Ram Transform for Multiperson Localization and Vital-Sign Estimation with mmWave MIMO Radar]).

7.3 Biomedical Imaging, Biosensing, and Physiological Inversion

- [440] Yang Tian, Ziyu Liu, Chaitanya Pallerla, Siavash Mahmoudi, Ramesh Bahadur Bist, Yiting Xiao, Terry Howell, Jeyamkondan Subbiah, and Dongyi Wang. “Portable electrochemical impedance biosensing with DRT-enabled machine learning for detecting E. coli O157:H7 in poultry meat.” *Frontiers in Artificial Intelligence*, vol. 9, art. 1741144, 2026. doi:10.3389/frai.2026.1741144. (TR316, [An Analytic Distribution-of-Relaxation-Times (DRT) Ram Core with Learned-Residual Classifier for Portable EIS Biosensing of O157:H7 in Poultry Meat A Narrow Design-Around under the TR165 Analytic-Core-plus-Learned-Residual Umbrella]).
- [441] Constantino Álvarez Casado, Mohammad Rahman, Sasan Sharifipour, Nhi Nguyen, Manuel Lage Cañellas, Xiaoting Wu, and Miguel Bordallo López. “Thermal Imaging for Contactless Cardiorespiratory and Sudomotor Response Monitoring.” *arXiv preprint arXiv:2602.12361*, 2026. arXiv:2602.12361. (TR437, [A Sudomotor/Cardiorespiratory Thermal-Diffusion Inverse-Source Operator for Contactless Physiological Monitoring Panel/Coordinate-Mapped Local Ram Deconvolution with Variable-Coefficient Back-Substitution and Analytic-Core-plus-Learned-Residual Recovery]).
- [442] Merel Stiekema, Frans C. S. Ramaekers, Jos L. V. Broers, and Marc A. M. J. van Zandvoort. “From convolution to clarity: effect of different point spread functions for deconvolution in CLSM and STED microscopy images of the nuclear lamina.” *Methods in Microscopy*, vol. 2, no. 4, pp. 453-465, 2025. doi:10.1515/mim-2025-0025. (TR744, [PSF Choice for CLSM and STED Deconvolution: A Ram Local-Imaging Reformulation with Honest Identifiability]).
- [443] Tom Michaelis, João Jorge, Nivedita Bijlani, and Mauricio Villarroel. “VitalCSI: Contactless Respiratory Rate Estimation Using Consumer-Grade Wi-Fi Channel State Information.” *Sensors*, vol. 26, no. 1, art. 225, 2025. doi:10.3390/s26010225. (TR755, [VitalCSI: Contactless Respiratory-Rate Estimation Using Consumer-Grade Wi-Fi Channel State Information]).
- [444] Duo Zhang, Xusheng Zhang, Zhehui Yin, Pengfei Zhou, Hongliu Yang, Pei Wang, Zhiyun Yao, Junzhe Wang, Fusang Zhang, and Daqing Zhang. “Breaking the Resolution Barriers of mmWave Arrays via Null Steering for Sleep Monitoring in Multi-Person Scenarios.” *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, vol. 9, no. 3, pp. 1-29, 2025. doi:10.1145/3749466. (TR758, [Breaking the Resolution Barriers of mmWave Arrays via Null Steering for Sleep Monitoring in Multi-Person Scenarios]).
- [445] Gunjan Kayal, Benjamin Van, George Andl, Cheng Tu, Todd Wareing, Scott Wilderman, Justin Mikell, and Yuni K. Dewaraja. “Linear Boltzmann equation solver for voxel-level dosimetry in radiopharmaceutical therapy: Comparison with Monte Carlo and kernel convolution.” *Medical Physics*, vol. 51, no. 8, pp. 5604-5617, 2024. doi:10.1002/mp.16996. (TR1021, [A Local Ram-Transform Solver for the Linear Boltzmann Equation in Voxel-Level Radiopharmaceutical Dosimetry]).

- [446] Mohammad Omid Bagheri, Ali Gharamohammadi, Serene Abu-Sardanah, Omar M. Ramahi, and George Shaker. “Radar near-field sensing using metasurface for biomedical applications.” *Communications Engineering*, vol. 3, no. 1, art. 51, 2024. doi:10.1038/s44172-024-00194-4. (TR1040, [A Calibrated Panel Ram Transform for 60-GHz Near-Field Metasurface Biomedical Dielectric Sensing]).
- [447] Sungcheol Hong and Gerard Coté. “Arterial Pulse Wave Velocity Signal Reconstruction Using Low Sampling Rates.” *Biosensors*, vol. 14, no. 2, art. 92, 2024. doi:10.3390/bios14020092. (TR1051, [Certified Sub-Nyquist Reconstruction of Arterial Pulse-Wave Signals via the Ram Sampling Theorem for Known Time-Variant Channels A Local-Jet Inverse Operator with a Super-Geometric Error Bound, and a Two-Site Delay Operator for Pulse-Wave Velocity]).

8 Quantum Systems, Learning, and Control

50 bibliography items.

8.1 Hamiltonian and Lindbladian Learning

- [448] Taiqi Zhou and Weiyuan Gong. “Optimal Ansatz-free Hamiltonian Learning In Situ.” *arXiv preprint arXiv:2606.19486*, 2026. arXiv:2606.19486. (TR441, [A Superoperator Nilpotent-Jet Ram Transform for Ansatz-Free In-Situ Hamiltonian Learning Local Liouville-Space Generator Identification via Short-Time Ram Moments]).
- [449] Taiqi Zhou and Weiyuan Gong. “Optimal Ansatz-free Hamiltonian Learning In Situ.” *arXiv preprint arXiv:2606.19486*, 2026. doi:10.48550/arxiv.2606.19486. (TR442, [Ansatz-free In-Situ Hamiltonian and Lindblad-Generator Identification via the Ram Transform: A Superoperator Nilpotent-Jet Approach]).
- [450] L. Lewis, Ewin Tang, and John Wright. “Learning the structure of open quantum systems.” *arXiv preprint arXiv:2606.30358*, 2026. arXiv:2606.30358. (TR443, [Structure Identification of Open Quantum Systems via a Liouville-Space Ram Transform A Nilpotent-Jet Ram-Moment / Kramers-Moyal Approach to Generator Topology Learning]).
- [451] Greta Lupi, Saketh Ravuri, Chenxiao Zhao, Weidan Zhang, Cesare Roncaglia, Liu R, Xinliang Feng, Daniele Passerone, Pascal Ruffieux, Román Fasel, Jose L. Lado, and Gonçalo Catarina. “Learning Inhomogeneous Heisenberg Hamiltonians in Nanographene Spin Chains.” *arXiv preprint arXiv:2606.29281*, 2026. arXiv:2606.29281. (TR444, [A Ram-Transform Framework for Learning Inhomogeneous Heisenberg Hamiltonians in Nanographene Spin Chains Local Superoperator-Jet Inversion for In-Situ Site-Dependent Coupling Identification]).
- [452] Mohammad Aamir Sohail, Ranga R. Sudharshan, S. Sandeep Pradhan, and Arvind Rao. “Quantum Hamiltonian Learning using Time-Resolved Measurement Data and its Application to Gene Regulatory Network Inference.” *openRxiv*, 2026. doi:10.64898/2026.03.05.709897. (TR445, [Cross-Domain Generator Identification via the Ram Transform: From Time-Resolved Quantum Hamiltonian Learning to Fokker-Planck Gene Regulatory Network Inference A Ram-Moment = Kramers-Moyal Coefficient Identification Bridge]).
- [453] Mohammad Aamir Sohail, Ranga R. Sudharshan, S. Sandeep Pradhan, and Arvind Rao. “Quantum Hamiltonian Learning using Time-Resolved Measurement Data and its Application to Gene Regulatory Network Inference.” *arXiv preprint arXiv:2602.19496*, 2026. arXiv:2602.19496. (TR446, [Local Ram-Moment Identification of Open-System Generators from Time-Resolved Data, with Cross-Domain Transfer to Gene-Regulatory-Network Inference A Kramers-Moyal / Fokker-Planck-Ram Approach to Quantum Hamiltonian Learning and Graph Drift-Diffusion Identification]).
- [454] Myeongjin Shin, Junseo Lee, and Changhun Oh. “Heisenberg-limited Hamiltonian learning without short-time control.” *arXiv preprint arXiv:2604.27838*, 2026. arXiv:2604.27838. (TR447, [A Complementary Long-Time / Heisenberg-Limited Hamiltonian Learning Estimator via Liouville-Space Nilpotent-Jet Inversion and Inverse-Consistency Calibration]).

- [455] Petr Ivashkov, Nikita Romanov, Weiyuan Gong, Andi Gu, Hong-Ye Hu, and Susanne F. Yelin. “Ansatz-Free Learning of Lindbladian Dynamics In Situ.” *arXiv preprint arXiv:2603.05492*, 2026. [arXiv:2603.05492](#). (TR448, [Ansatz-Free Identification of Lindbladian Dynamics In Situ via a Liouville-Space Ram Transform A Terminating-Neumann Nilpotent-Jet Inverse with Analytic Core and Learned Dissipator Residual]).
- [456] Nikita Romanov, Petr Ivashkov, Weiyuan Gong, Ishaan Kannan, Andi Gu, Hong-Ye Hu, and Susanne F. Yelin. “Learning Arbitrary Lindbladians with Quantum Error Correction.” *arXiv preprint arXiv:2606.18188*, 2026. [arXiv:2606.18188](#). (TR449, [A Ram-Transform Formulation of Arbitrary Lindbladian Learning under Quantum Error Correction Nilpotent Superoperator-Jet Inversion with a GKSL Constraint Layer and an Analytic-Core-plus-Learned-Residual Umbrella]).
- [457] Petr Ivashkov, Nikita Romanov, Weiyuan Gong, Andi Gu, Hong-Ye Hu, and Susanne F. Yelin. “Ansatz-Free Learning of Lindbladian Dynamics In Situ.” *arXiv preprint arXiv:2603.05492*, 2026. [doi:10.48550/arxiv.2603.05492](#). (TR450, [Ansatz-Free Identification of Lindbladian Dynamics via the Ram Transform: A Nilpotent-Jet Superoperator Core with a Learned Dissipator Residual]).
- [458] Suying Liu, Xiaodi Wu, and Murphy Yuezhen Niu. “Optimal and Robust In-situ Quantum Hamiltonian Learning through Parallelization.” *arXiv preprint arXiv:2510.07818*, 2025. [doi:10.48550/arxiv.2510.07818](#). (TR763, [Ram Local-Derivative Estimation and Fisher-Gated Parallel In-Situ Hamiltonian Learning]).

8.2 Quantum Optimal Control, Gates, and Pulse Design

- [459] Santiago Ferreyra, Valentín Reparaz, María José Sánchez, Leandro Tosi, and Daniel Domínguez. “Optimizing LZSM protocol for high-fidelity gates in open-system fluxonium.” *arXiv preprint arXiv:2607.07999*, 2026. [doi:10.48550/arxiv.2607.07999](#). (TR379, [Panel-Decomposed Nilpotent-Jet Inversion of the LZSM Liouvillian for High-Fidelity Open-System Fluxonium Gates A Ram Transform Derivation]).
- [460] Isabella L Giovannelli, Steven M Anlage, and Thomas M Antonsen. “Chirped pulse analysis and control in non-Hermitian scattering systems using complex time delay.” *Journal of Physics: Photonics*, vol. 8, no. 3, art. 035006, 2026. [doi:10.1088/2515-7647/ae7b9b](#). (TR409, [Complex-Atom Ram Transform for Chirped-Pulse Analysis and Control in Non-Hermitian Scattering Systems A Local Complex-Spectral Ramlet Inversion of the Complex-Time-Delay Scattering Integral]).
- [461] Isabella L Giovannelli, Steven M Anlage, and Thomas M Antonsen. “Chirped pulse analysis and control in non-Hermitian scattering systems using complex time delay.” *Journal of Physics: Photonics*, vol. 8, no. 3, art. 035006, 2026. [doi:10.1088/2515-7647/ae7b9b](#). (TR410, [A Complex-Time-Delay Ram Transform for Chirped-Pulse Analysis and Control in Non-Hermitian Scattering Systems]).
- [462] Aishwarya Majumdar, John M. Martyn, Yuan Liu, and Nathan Wiebe. “Analytic Approach to Quantum Control Using Quantum Signal Processing.” *arXiv preprint arXiv:2606.26085*, 2026. [arXiv:2606.26085](#). (TR452, [A Local-Jet Inverse for Quantum Signal Processing Phase-Factor Synthesis, with a Liouville-Space Extension for Open-System Control]).
- [463] David Layden, Bradley Mitchell, and Karthik Siva. “Theory of quantum error mitigation for non-Clifford gates.” *Quantum*, vol. 10, p. 2003, 2026. [doi:10.22331/q-2026-02-10-2003](#). (TR453, [A Terminating Neumann-Ram Superoperator Inversion for Error Mitigation of Non-Clifford Quantum Gates Analytic Core-plus-Learned-Residual Mitigation in Liouville Space]).
- [464] Leanghok Hour, Myeongseong Go, and Youngsun Han. “Improving Zero-Noise Extrapolation for Quantum-Gate Error Mitigation Using a Noise-Aware Folding Method.” *IEEE Access*, vol. 14, pp. 37362-37372, 2026. [doi:10.1109/access.2026.3672056](#). (TR454, [A Superoperator-Inversion (Nilpotent-Jet) Reformulation of Noise-Aware Folding Zero-Noise Extrapolation for Quantum-Gate Error Mitigation]).
- [465] Shebha Anandhi Jegadeesan, Yujie Zhao, Robert Hunter, Hassane El Mkami, Maximilian Keitel, Callum Musselwhite, Graham Smith, Guinevere Mathies, and Ilya Kuprov. “Quantum optimal control of steady orbits.” *arXiv preprint arXiv:2606.15383*, 2026. [arXiv:2606.15383](#). (TR455, [A Ram-Transform Approach to Quantum Optimal Control of Steady and Periodic Orbits in Open Quantum Systems]).

- [466] Andrew Kamen, Samuel Fine, Bikrant Bhattacharyya, Frederic T. Chong, and Andy J. Goldschmidt. “Comparing and correcting robustness metrics for quantum optimal control.” *arXiv preprint arXiv:2602.10349*, 2026. [arXiv:2602.10349](#). (TR456, [Certified High-Order Ram-Jet Robustness Metrics for Quantum Optimal Control: Comparing and Correcting Filter-Function and Sampled Estimates]).
- [467] Jun-Dong Zhong and Zhao-Ming Wang. “Optimal control of open-quantum-system dynamics predicted by long short-term memory.” *Physical Review A*, vol. 113, no. 6, art. 062442, 2026. [doi:10.1103/shn6-53wk](#). (TR458, [A Certified Liouville-Space Nilpotent-Jet Inverse with Bounded Learned-Residual Correction for Open-Quantum-System Optimal Control]).
- [468] Aarón Villanueva and Hilbert Kappen. “Path integral control of open quantum systems.” *Physical Review A*, vol. 114, no. 1, art. 012426, 2026. [doi:10.1103/kwxb-3jy1](#). (TR459, [A Nilpotent-Jet Liouville-Space Ram Transform for Path-Integral Optimal Control of Open Quantum Systems]).
- [469] Rylan Malarchick. “End-to-End Fidelity Analysis of Quantum Circuit Optimization: From Gate-Level Transformations to Pulse-Level Control.” *arXiv preprint arXiv:2601.20871*, 2026. [arXiv:2601.20871](#). (TR460, [End-to-End Fidelity Analysis of Quantum Circuit Optimization via Liouville-Space Ram Jets: Certified-Sensitivity Pulse Synthesis and Terminating Neumann-Series Channel Inversion]).
- [470] Daniele Gabriele and Lorenzo Ricciardi Celsi. “Reinforcement Learning Based Warm Initialization for Constrained Open-System Quantum Optimal Control: A Controlled Budget-Matched RL-GRAPE Benchmark.” *Electronics*, vol. 15, no. 6, art. 1251, 2026. [doi:10.3390/electronics15061251](#). (TR461, [An Analytic Ram-Core Warm-Start for Constrained Open-System Quantum Optimal Control A TR165 Analytic-Core-Plus-Learned-Residual Instance that Budget-Matches and Dominates RL/GRAPE Initializers]).
- [471] Tathagata Karmakar and Andrew N. Jordan. “CDJ-Pontryagin Optimal Control for General Continuously Monitored Quantum Systems.” *Quantum*, vol. 10, p. 2043, 2026. [doi:10.22331/q-2026-03-24-2043](#). (TR462, [Ram-Jet Superoperator Inversion for CDJ-Pontryagin Optimal Control of Continuously Monitored Quantum Systems A Panelized Block-Tridiagonal Forward/Costate Solver with Terminating Nilpotent Neumann Inverse and Certified Sensitivities]).
- [472] Liang-Xu Xie, Lui Zuccherelli de Paula, Weizhou Cai, Qing-Xuan Jie, Luyan Sun, Chang-Ling Zou, Guang-Can Guo, Zi-Jie Chen, and Xu-Bo Zou. “Optimal control with flag qubits.” *arXiv preprint arXiv:2603.12162*, 2026. [arXiv:2603.12162](#). (TR463, [A Ram-Transform Formulation of Flag-Qubit Optimal Control via Nilpotent Liouville-Space Channel Inversion and Certified Jet Sensitivities]).
- [473] Yuki Kurokawa and Yoshihiko Hasegawa. “Optimal Control to Minimize Dissipation and Fluctuations in Open Quantum Systems Beyond Slow and Rapid Regimes.” *arXiv preprint arXiv:2602.01688*, 2026. [arXiv:2602.01688](#). (TR464, [Panel-Jet Liouville-Space Optimal Control for Joint Dissipation and Fluctuation Minimization in Open Quantum Systems Beyond the Slow and Rapid Regimes A Ram-Transform]).
- [474] Y.-C. Chen, Xinxin Yang, and Simon Gröblacher. “High-Fidelity Quantum State Transfer in Multimode Resonators via Tunable Pulses.” *arXiv preprint arXiv:2603.25264*, 2026. [arXiv:2603.25264](#). (TR465, [Multimodal Nilpotent-Jet Ram Inversion for High-Fidelity Quantum State Transfer in Multimode Resonators A Multi-Lobe Liouville-Space Pulse-Synthesis Operator]).
- [475] Muhammad Saleem Samejo, Sibghatullah Khoso, Ihsan Ahmed, and Muhammad Rizwan Mahar. “Decoherence Control in Open Quantum Systems for Scalable Quantum Technologies.” *Social Science Review Archives*, vol. 4, no. 1, pp. 255-260, 2026. [doi:10.70670/sra.v4i1.1529](#). (TR466, [Ram-Transform Analysis of Decoherence Control in Open Quantum Systems for Scalable Quantum Technologies: A Liouville-Space Nilpotent-Jet Treatment (Prior-Corpus Coverage Assessment)]).
- [476] R. Weiss, Sandro Wimberger, and David Guéry-Odelin. “Cooperative control and geometric amplification in dissipative quantum systems.” *arXiv preprint arXiv:2606.30073*, 2026. [arXiv:2606.30073](#). (TR467, [Analytic-Core Nilpotent-Jet Inversion of Collective-Decay Lindbladians for Dissipative Quantum Control and Geometric Amplification A Ram-Transform Approach to Cooperative Open-System Gate and State Synthesis]).

- [477] Paul Surrey, Julian D. Teske, Tobias Hangleiter, Hendrik Bluhm, and Pascal Cerfontaine. “Data-Driven Qubit Characterization and Optimal Control using Deep Learning.” *arXiv preprint arXiv:2601.18704*, 2026. [arXiv:2601.18704](#). (**TR468**, [A Certified Analytic-Core Design-Around for Data-Driven Qubit Characterization and Optimal Control A Terminating-Neumann-Series (Liouville-Jet) Alternative to Black-Box Deep Learning Quantum Control]).
- [478] Anonymous. “Deterministic equations for feedback control of open quantum systems.” *Physical Review Letters*, 2026. [doi:10.1103/pg2p-h529](#). (**TR469**, [Ram Transform Synthesis of Deterministic Feedback Control Laws for Open Quantum Systems A Nilpotent-Jet Liouville Inversion with Certified Trajectory Sensitivities]).
- [479] R. J. P. T. de Keijzer, L. Y. Visser, O. Tse, and S. J. J. M. F. Kokkelmans. “Fidelity-enhanced variational quantum optimal control.” *Physical Review A*, vol. 111, no. 5, art. 052625, 2025. [doi:10.1103/physreva.111.052625](#). (**TR764**, [Ram-Panel Surrogates and Variance-Controlled Gradients for Fidelity-Enhanced Stochastic Quantum Optimal Control]).
- [480] Zi-Jie Chen, Hongwei Huang, Lida Sun, Qing-Xuan Jie, Jie Zhou, Ziyue Hua, Yifang Xu, Weiting Wang, Guang-Can Guo, Chang-Ling Zou, Luyan Sun, and Xu-Bo Zou. “Robust and optimal control of open quantum systems.” *Science Advances*, vol. 11, no. 9, art. eadr0875, 2025. [doi:10.1126/sciadv.adr0875](#). (**TR765**, [Ram-Panel Frechet Sensitivities for Efficient Robust Control of Open Quantum Systems]).
- [481] Jiaji Zhang, Carlos L. Benavides-Riveros, and Lipeng Chen. “Neural quantum propagators for driven-dissipative quantum dynamics.” *Physical Review Research*, vol. 7, no. 1, art. L012013, 2025. [doi:10.1103/physrevresearch.7.1012013](#). (**TR766**, [CPTP-Gated Ram-Panel Analytic Cores for Neural Quantum Propagators]).
- [482] Chris Ventura-Meinersen, Stefano Bosco, and Maximilian Rimbach-Russ. “Quantum geometric protocols for fast high-fidelity adiabatic state transfer.” *EPJ Quantum Technology*, vol. 12, no. 1, art. 125, 2025. [doi:10.1140/epjqt/s40507-025-00426-2](#). (**TR767**, [Adaptive Ram Metric Panels for Quantum-Geometric Fast Adiabatic State Transfer]).
- [483] Modesto Orozco-Ruiz, Wasim Rehman, and Florian Mintert. “Generally noise-resilient quantum gates for trapped ions.” *Physical Review A*, vol. 111, no. 4, art. 042404, 2025. [doi:10.1103/physreva.111.042404](#). (**TR769**, [SVD-Gated Ram Moment Panels for Multimode Noise-Resilient Trapped-Ion Gates]).
- [484] Muhammad AbuGhanem. “Full Quantum Process Tomography of a Universal Entangling Gate on an IBM’s Quantum Computer.” *Arabian Journal for Science and Engineering*, vol. 50, no. 23, pp. 19923-19937, 2025. [doi:10.1007/s13369-025-10391-8](#). (**TR772**, [Full Quantum Process Tomography of a Two-Qubit Entangling Gate Correct Choi geometry and a conditioned Ram Calculus residual-core reformulation]).
- [485] Dirk Heimann, Felix Wiebe, Tahereh Abad, Elie Mounzer, Tangyou Huang, Frank Kirchner, and Shivesh Kumar. “Iterative Linear Quadratic Regulator for Quantum Optimal Control.” *arXiv preprint arXiv:2504.10938*, 2025. [doi:10.48550/arxiv.2504.10938](#). (**TR836**, [Exact Ram-Jet Sensitivities for Iterative-LQR Quantum Optimal Control: An Analytic-Core-plus-Learned-Residual Formulation]).

8.3 Error Mitigation and Open-System Numerical Dynamics

- [486] Jiuhua Hu, Daniel Appelö, and Yingda Cheng. “Gregory Nested Picard Iteration Schemes for Open Quantum Systems Governed by the Lindblad Equation.” *arXiv preprint arXiv:2606.29002*, 2026. [arXiv:2606.29002](#). (**TR457**, [Panel-Jet Ram Transforms for Time-Ordered Lindblad Propagation: A Terminating Neumann-Series Companion to Gregory Nested Picard Iteration]).
- [487] P Delmastro, Daniel Appelö, and Yingda Cheng. “Completely Positive and Trace Preserving Schemes with Tensor Train Compression for the Lindblad Equation.” *arXiv preprint arXiv:2605.01494*, 2026. [arXiv:2605.01494](#). (**TR470**, [A CPTP-Certified Analytic-Core-plus-Tensor-Train-Residual Integrator for the Lindblad Equation Nilpotent Liouville-Jet Forward/Inverse Operators with Certified Jet- and Rank-Truncation Bounds]).

8.4 Quantum Sensing and Parameter Estimation

- [488] Changyu Yao, Haochen Shen, Zhongyuan Liu, Ruotian Gong, Md Shakil Bin Kashem, Stella Varnum, Liangyu Li, Hangyue Li, Yue Yu, Yizhou Wang, Xiaoshui Lin, Jonathan R. Brestoff, Chenyang Lu, Shankar Mukherji, Chuanwei Zhang, and Chong Zu. “A Deep-Learning-Boosted Framework for Quantum Sensing with Nitrogen-Vacancy Centers in Diamond.” *arXiv preprint arXiv:2603.14728*, 2026. [arXiv:2603.14728](https://arxiv.org/abs/2603.14728). (TR451, [An Analytic-Core-Plus-Learned-Residual Ram Transform for Nitrogen-Vacancy Quantum Sensing: Liouville-Space Nilpotent-Jet Inversion with Certified Bounds]).
- [489] Marco Radaelli, Joseph A. Smiga, Gabriel T. Landi, and Felix C. Binder. “Parameter estimation for quantum jump unraveling.” *Quantum*, vol. 10, p. 1993, 2026. [doi:10.22331/q-2026-02-02-1993](https://doi.org/10.22331/q-2026-02-02-1993). (TR471, [A Superoperator Ram Transform for Parameter Estimation in Quantum-Jump Unravelings Point-Process Ram-Moment Identification of Lindblad Generators and Jump Rates]).
- [490] Anthony J. Brady, Yu-Xin Wang, Victor V. Albert, Alexey V. Gorshkov, and Quntao Zhuang. “Correlated Noise Estimation with Quantum Sensor Networks.” *Physical Review Letters*, vol. 136, no. 8, art. 080803, 2026. [doi:10.1103/slj32-jn82](https://doi.org/10.1103/slj32-jn82). (TR472, [Correlated-Noise Graph-Covariance Kernel Recovery for Quantum Sensor Networks via a Banded Graph Local Ram Transform with Kramers-Moyal Moment Identification A Panel-Decomposed, Nilpotent-Neumann, Analytic-Core-plus-Learned-Residual Design]).

8.5 Quantum Algorithms, Signal Processing, and Non-Hermitian Systems

- [491] Paolo Marcandelli, Stefano Mariani, Martina Siena, and Stefano Markidis. “Continuous-Variable Quantum Fourier Layer: Applications to Filtering and PDE Solving.” *Algorithms*, vol. 19, no. 5, p. 370, 2026. [doi:10.3390/a19050370](https://doi.org/10.3390/a19050370). (TR266, [Continuous-Variable Quantum Fourier Layers as Exact GGRT Restriction Instances: A Ram-Transform Analysis of Spectral Neural-Operator Layers for Filtering and PDE Solving]).
- [492] Kevin J. Joven, Elin Ranjan Das, Joel Bierman, Aishwarya Majumdar, Masoud Hakimi Heris, and Yuan Liu. “Scalable quantum computational science: A perspective from block-encodings and polynomial transformations.” *APL Computational Physics*, vol. 2, no. 1, art. 010901, 2026. [doi:10.1063/5.0312254](https://doi.org/10.1063/5.0312254). (TR473, [A Ram Functional-Calculus Perspective on Block-Encodings and Polynomial Transformations: Master-Atom Expansions and Nilpotent-Jet Superoperator Inversion]).
- [493] Zikang Jia, Suying Liu, and Yulong Dong. “Programmable Signal Design for Quantum Phase Estimation via Quantum Signal Processing.” *arXiv preprint arXiv:2604.01205*, 2026. [arXiv:2604.01205](https://arxiv.org/abs/2604.01205). (TR474, [A Ram-Jet / Terminating-Neumann Phase-Factor Synthesizer for Quantum Signal Processing and Phase Estimation Analytic-Core Nilpotent Superoperator Inversion with a Learned Residual]).
- [494] Zikang Jia, Suying Liu, and Yulong Dong. “Programmable Signal Design for Quantum Phase Estimation via Quantum Signal Processing.” *arXiv preprint arXiv:2604.01205*, 2026. [doi:10.48550/arxiv.2604.01205](https://doi.org/10.48550/arxiv.2604.01205). (TR475, [Analytic Angle Synthesis for Quantum Signal Processing via a Layer-Stripping Ram Transform A Ram-Transform inverse-of-polynomial-map derivation for programmable signal design in quantum phase estimation]).
- [495] Sebastián Roca-Jerat, Emilio Macaluso, Alessandro Chiesa, Paolo Santini, and Stefano Carretta. “Simulating open quantum systems with molecular spin qudits.” *Materials Horizons*, vol. 12, no. 11, pp. 3918-3928, 2025. [doi:10.1039/d4mh01512f](https://doi.org/10.1039/d4mh01512f). (TR768, [Ram-Panel Resource and Error Co-Design for Open-System Simulation with Molecular Spin Qudits]).
- [496] Stewart Wallace, Yoann Altmann, Brian D. Gerardot, Erik M. Gauger, and Cristian Bonato. “Learning the dynamics of Markovian open quantum systems from experimental data.” *Physical Review Research*, vol. 7, no. 3, art. 033217, 2025. [doi:10.1103/m66m-lnjh](https://doi.org/10.1103/m66m-lnjh). (TR770, [Learning Markovian Open-Quantum Dynamics from Incomplete Correlation Data Source-faithful analysis and a conditioned Ram Calculus moment-jet reformulation]).

- [497] Ahmet M. Elbir, Özlem Tuğfe Demir, Kumar Vijay Mishra, Symeon Chatzinotas, and Martin Haardt. “Near-Field Signal Processing: Unleashing the power of proximity.” *IEEE Signal Processing Magazine*, vol. 42, no. 1, pp. 20-32, 2025. doi:10.1109/msp.2025.3527199. (TR771, [Near-Field Signal Processing with Spherical-Wave Models Source-faithful tutorial synthesis and a conditioned Ram Calculus range-angle moment-jet]).

9 Weather, Climate, Data Assimilation, and Turbulence

27 bibliography items.

9.1 Atmospheric and Ocean Data Assimilation and Downscaling

- [498] Hang Fan, Lei Bai, Ben Fei, Yi Xiao, Kun Chen, Yubao Liu, Yongquan Qu, Fenghua Ling, and Pierre Gentine. “Physically consistent global atmospheric data assimilation with machine learning in latent space.” *Science Advances*, vol. 12, no. 1, art. eaea4248, 2026. doi:10.1126/sciadv.aea4248. (TR270, [A Panelized Latent-Space Ram Transform for Physically Consistent Atmospheric Data Assimilation: Analytic-Core-plus-Learned-Residual Inversion of the Latent Observation Operator]).
- [499] Guangyu Xu, Feng Bao, Siyu Lu, Chunlai Wu, Yuxin Liu, and Wenfeng Zheng. “Enhancing Observation Point Analysis for Atmospheric State Estimation Using Self-Supervised Graph Neural Networks.” *Atmosphere*, vol. 17, no. 2, art. 163, 2026. doi:10.3390/atmos17020163. (TR477, [Graph-Global Ram Transform for Self-Supervised Atmospheric State Estimation from Sparse Observation Points A GGRT/GLRT Analytic Core with Learned Residual for Graph-Structured Observability]).
- [500] Hyebin Park, Seonyoung Park, Daehyun Kang, and Jeong-Hwan Kim. “A super-resolution framework for downscaling machine learning weather prediction toward 1-km air temperature.” *npj Climate and Atmospheric Science*, vol. 9, no. 1, art. 56, 2026. doi:10.1038/s41612-026-01328-5. (TR478, [A Panel-Jet Ram-Transform Analytic Core with Learned Residual for Shift-Variant Downscaling of Machine-Learning Weather Prediction toward 1-km Air Temperature]).
- [501] Devon Dunmire, Michel Bechtold, Lucas Boeykens, and Gabriëlle J. M. De Lannoy. “Advancing snow data assimilation with a dynamic observation uncertainty.” *The Cryosphere*, vol. 20, no. 1, pp. 609-628, 2026. doi:10.5194/tc-20-609-2026. (TR479, [Dynamic Observation Uncertainty in Snow Data Assimilation as a Calibrated Composite Ram Inverse A Time-Varying Observation-Noise-Moment Calibration Framework]).
- [502] Elizabeth Carlson, Aseel Farhat, Vincent R. Martinez, and Collin Victor. “On the Nudging Approach to Continuous Data Assimilation in the Limit of Infinite Error Feedback Gain.” *SIAM Journal on Control and Optimization*, vol. 64, no. 3, pp. 2026-2057, 2026. doi:10.1137/24m1689983. (TR480, [A Localized Ram Nudging-Observer Inverse Operator with a Certified Infinite-Gain Limit for Continuous Data Assimilation Design-around of (2026) https://doi.org/10.1137/24m1689983]).
- [503] Nils Lehmann, Ando Shah, Jonathan Bamber, and Xiaoxiang Zhu. “OceanBottle: Sea Surface State Data Assimilation and Downscaling.” *Copernicus GmbH*, 2026. doi:10.5194/egusphere-egu26-11308. (TR481, [OceanBottle: Coordinate-Mapped, Panel-Decomposed Ram-Transform Inversion of the Shift-Variant Sea-Surface Observation Operator for Data Assimilation and Downscaling]).
- [504] Alexander Kovalenko. “CASCADE: Cross-scale Advective Super-resolution with Climate Assimilation and Downscaling Evolution.” *arXiv preprint arXiv:2603.00109*, 2026. arXiv:2603.00109. (TR482, [Advective Coordinate-Mapped Panel Ram Transforms for Cross-Scale Climate Super-Resolution, Downscaling, and Assimilation A TR165 Analytic-Core-Plus-Learned-Residual Design-Around of CASCADE]).
- [505] Huan HE, Bi-yun ZHAO, Yue ZHOU, Hong-bin FANG, and Hai-xia QI. “Temperature Bias Correction and Downscaling Forecasting Based on Numerical Weather Prediction and Deep Learning.” *Journal of Tropical*

Meteorology, vol. 32, no. 2, pp. 199-210, 2026. doi:10.3724/j.1006-8775.2026.004. (TR483, [A Coordinate-Mapped Panel-Jet Analytic Core with Learned Residual for Temperature Bias Correction and Statistical Downscaling of Numerical Weather Prediction Fields]).

- [506] Kunle Adefarati Ibrahim, Ologun Sodi Babatunde, Chiagoziem C. Ukwuoma, Richard Joshua Akeredolu, Victoria Chioma Ayozie-Samuel, and Maryam Saleem. “Securing the Silent Reserve: Physics-Informed Deep Learning for Global Groundwater Storage Downscaling.” *Iconic Research and Engineering Journals*, vol. 9, no. 9, pp. 109-125, 2026. doi:10.64388/irev9i9-1714801. (TR484, [Securing the Silent Reserve via Panel-Jet Ram Transforms: A Coordinate-Warped Analytic-Core-plus-Learned-Residual Method for Shift-Variant Groundwater Storage Downscaling]).
- [507] Edoardo Calvello, Elizabeth Carlson, Nikola Kovachki, Michael N. Manta, and Andrew M. Stuart. “Operator Learning for Smoothing and Forecasting.” *arXiv preprint arXiv:2603.20359*, 2026. arXiv:2603.20359. (TR490, [An Exact Local Forward/Inverse Ram Jet Core for the Fixed-Interval (RTS-Style) Backward Smoother with Analytic-Core-Plus-Learned-Residual Correction for Data Assimilation and Forecasting]).
- [508] Saumya Sinha, Brandon Benton, and Patrick Emami. “On the effectiveness of neural operators at zero-shot weather downscaling.” *Environmental Data Science*, vol. 4, art. e21, 2025. doi:10.1017/eds.2025.11. (TR773, [Neural Operators for Zero-Shot Weather Downscaling Source-faithful benchmark analysis and a consistency-aware Ram Calculus reformulation]).
- [509] Seyed Mojtaba Mousavimehr and Mohammad Reza Kavianpour. “A non-stationary downscaling and gap-filling approach for GRACE/GRACE-FO data under climatic and anthropogenic influences.” *Applied Water Science*, vol. 15, no. 5, art. 91, 2025. doi:10.1007/s13201-025-02427-z. (TR775, [Nonstationary Downscaling and Gap Filling for GRACE/GRACE-FO Water Storage Source-faithful reconstruction and a conditioned Ram Calculus covariate-jet extension]).
- [510] Leonard Lupin-Jimenez, Moein Darman, Subhashis Hazarika, Tianning Wu, Michael Gray, Ruyong He, Anthony Wong, and Ashesh Chattopadhyay. “Simultaneous Emulation and Downscaling With Physically Consistent Deep Learning-Based Regional Ocean Emulators.” *Journal of Geophysical Research: Machine Learning and Computation*, vol. 2, no. 3, art. e2025JH000851, 2025. doi:10.1029/2025jh000851. (TR776, [Conditioned Local-Jet Cores for Simultaneous Regional-Ocean Emulation and Downscaling A Source-Verified Ram Calculus Reformulation]).
- [511] Linus Wrba, Antonia Englberger, Andreas Dörnbrack, Gerard Kilroy, and Norman Wildmann. “Data assimilation of generic boundary layer flows for wind turbine applications - an LES study.” *Wind Energy Science*, vol. 10, no. 10, pp. 2217-2236, 2025. doi:10.5194/wes-10-2217-2025. (TR777, [Local-Jet Gain Calibration for Vibration-Equation Assimilation in Wind-Energy LES A Source-Verified Ram Calculus Reformulation]).
- [512] Suyash Bire, Björn Lütjens, Kamyar Azizzadenesheli, Animashree Anandkumar, and Chris Hill. “Ocean Emulation With Fourier Neural Operators: Double Gyre.” *Journal of Advances in Modeling Earth Systems*, vol. 17, no. 7, art. e2023MS004137, 2025. doi:10.1029/2023ms004137. (TR780, [Paneewise Analytic Cores for Fourier-Neural-Operator Emulation of a Double-Gyre Ocean A Source-Verified Ram Calculus Reformulation]).

9.2 Turbulence, Closure, and Reduced-Order Modeling

- [513] Abed Hammoud, Edriss S. Titi, Mitchell Bushuk, Marc Calaf, Khaled Ghannam, and Elie Bou-Zeid. “Data-Driven Flux Parameterization for the Atmospheric Boundary Layer.” *arXiv preprint arXiv:2606.24593*, 2026. doi:10.48550/arxiv.2606.24593. (TR485, [A Variable-Coefficient Ram Transform Formulation for Data-Driven Turbulent-Flux Parameterization in the Atmospheric Boundary Layer (Analytic-Core-Plus-Learned-Residual Framing)]).
- [514] Xander M. de Wit, Alessandro Gabbana, Michael Woodward, Yen Ting Lin, Federico Toschi, and Daniel Livescu. “Data-driven Mori-Zwanzig modeling of Lagrangian particle dynamics in turbulent flows.” *Proceedings of the National Academy of Sciences*, vol. 123, no. 13, art. e2525390123, 2026. doi:10.1073/pnas.2525390123. (TR486, [A Ram-Transform Identification of Shift-Variant Volterra Memory Kernels for Data-Driven Mori-Zwanzig Modeling of Lagrangian Particle Dynamics in Turbulent Flows]).

- [515] Laure Zanna and Pavel Perezhogin. “Towards bridging the gap between data-driven and theoretical turbulence closures in stratified flows.” *arXiv preprint arXiv:2606.20901*, 2026. [arXiv:2606.20901](#). (**TR487**, [A Ram-Transform Analytic-Core-plus-Learned-Residual Framework for Buoyancy-Modified Subgrid Turbulence Closure in Stratified Flows]).
- [516] Gabriele Codega, Anna Ivagnes, Nicola Demo, and Gianluigi Rozza. “Machine Learning-Based Quadratic Closures for Non-Intrusive Reduced Order Models.” *SIAM Journal on Scientific Computing*, vol. 48, no. 3, pp. C505-C525, 2026. [doi:10.1137/25m1766759](#). (**TR489**, [A Ram-Transform View of Machine-Learning Quadratic Closures for Non-Intrusive Reduced-Order Models]).
- [517] Daniel Dehtyriov, Jonathan F. MacArt, and Justin Sirignano. “Deep Learning-based Algebraic Reynolds Stress Closures for RANS Simulations of Turbulent Flows.” *arXiv preprint arXiv:2605.26358*, 2026. [arXiv:2605.26358](#). (**TR491**, [Analytic-Core-plus-Learned-Residual Ram Closures for Algebraic Reynolds-Stress RANS Turbulence Models An Integrity-Basis Local-Jet Core with Ram-Moment Coefficient Identification (TR165 / TR154 Instantiation)]).
- [518] Gianluca Galletti, Fabian Paischer, Paul Setinek, William Hornsby, Lorenzo Zanisi, Naomi Carey, Stanislas Pamela, and Johannes Brandstetter. “5D Neural Surrogates for Nonlinear Gyrokinetic Simulations of Plasma Turbulence.” *arXiv preprint arXiv:2502.07469*, 2025. [doi:10.48550/arxiv.2502.07469](#). (**TR649**, [Verification-Conditioned Hybrid Surrogates for Five-Dimensional Gyrokinetic Turbulence]).
- [519] Aviral Prakash and Yongjie Jessica Zhang. “Nonintrusive projection-based reduced order modeling using stable learned differential operators.” *Computer Methods in Applied Mechanics and Engineering*, vol. 442, p. 117946, 2025. [doi:10.1016/j.cma.2025.117946](#). (**TR779**, [Moment-Factorized Stable Learned Differential Operators for Nonintrusive Projection ROMs A Source-Verified Ram Calculus Reformulation]).

9.3 Environmental Sensing, Air Quality, and Emissions

- [520] Vongani Chabalala, Craig Rudolph, Karabo Mosala, Edward Khomotso Nkadimeng, Chuene Mosomane, Thuso Mathaha, Pallab Basu, Muhammad Ahsan Mahboob, Jude Kong, Nicola Bragazzi, Iqra Atif, Mukesh Kumar, and Bruce Mellado. “Spatiotemporal Graph Neural Networks for PM2.5 Concentration Forecasting.” *Air*, vol. 4, no. 1, art. 2, 2026. [doi:10.3390/air4010002](#). (**TR476**, [Integral Research – Technical Report Series A Graph-Global Ram Transform Instance for Spatiotemporal PM2.5 Concentration Forecasting Analytic Diffusion/Advection Core plus Learned Emission Residual]).
- [521] Kenneth Scheel, Elias Vänskä, Damien Weidmann, and Aku Ursin. “Dynamic quantification of methane emissions at facility scale using laser tomography: demonstration of a farm deployment.” *Atmospheric Measurement Techniques*, vol. 19, no. 7, pp. 2343-2367, 2026. [doi:10.5194/amt-19-2343-2026](#). (**TR488**, [Panelized Analytic Ram Tomography for Dynamic Facility-Scale Methane Quantification A localized forward/inverse line-integral operator with mollified regularization, block-tridiagonal coupling, and certified error bounds]).

9.4 Forecasting, Smoothing, and Optimal Fingerprinting

- [522] Valerio Lucarini. “Linear Response and Optimal Fingerprinting for Nonautonomous Systems.” *arXiv preprint arXiv:2602.08022*, 2026. [arXiv:2602.08022](#). (**TR358**, [A Ram Transform Framework for Linear Response and Optimal Fingerprinting in Nonautonomous Systems: Panel-Jet Inversion of the Time-Variant Susceptibility Kernel with Sigma-Inverse-Weighted Attribution]).
- [523] Seth Minor, Daniel A. Messenger, Vanja Dukic, and David M. Bortz. “Learning Physically Interpretable Atmospheric Models From Data With WSINDy.” *Journal of Geophysical Research: Machine Learning and Computation*, vol. 2, no. 3, art. e2025JH000602, 2025. [doi:10.1029/2025jh000602](#). (**TR778**, [Conditioned Local-Jet Preconditioning for Weak-Form Atmospheric Equation Discovery A Source-Verified Ram Calculus Reformulation]).

- [524] John Bartzis, Spyros Andronopoulos, and Ioannis Sakellaris. “Source Term Estimation for Puff Releases Using Machine Learning: A Case Study.” *Atmosphere*, vol. 16, no. 6, art. 697, 2025. doi:10.3390/atmos16060697. (TR781, [Conditioned Green-Function Jets and Learned Residuals for Urban Puff Source-Term Estimation A Source-Verified Ram Calculus Reformulation]).

10 World Models and Digital Twins

5 bibliography items.

10.1 Physics-Guided Digital Twins and Reality-Gap Modeling

- [525] Sizhe Ma, Katherine A. Flanigan, and Mario Bergés. “Bridging the Reality Gap in Digital Twins with Context-Aware, Physics-Guided Deep Learning.” *Journal of Computing in Civil Engineering*, vol. 40, no. 3, art. 04026009, 2026. doi:10.1061/jccee5.cpeng-7024. (TR493, [A Ram-Transform Formulation of Context-Aware, Physics-Guided Reality-Gap Correction for Civil-Infrastructure Digital Twins Analytic-Core-plus-Learned-Residual (TR165) with Variable-Coefficient Core Inversion (TR182) and Semi-Blind Calibration (TR155/TR158-159/TR183)]).
- [526] Muhammad Saad Zia, Corentin Houpert, Ashiq Anjum, Lu Liu, Anthony Conway, and Anasol Peña-Rios. “Physics encoded blocks in residual neural network architectures for digital twin models.” *Machine Learning*, vol. 114, no. 8, art. 180, 2025. doi:10.1007/s10994-025-06808-y. (TR653, [Verification-Conditioned Physics-Encoded Residual Networks for Digital Twins Correct operator interfaces, local differential audits, adjoints, conditioning, and uncertainty]).
- [527] Ning Liu, Xuxiao Li, Manoj R. Rajanna, Edward W. Reutzel, Brady Sawyer, Prahalada Rao, Jim Lua, Nam Phan, and Yue Yu. “Deep Neural Operator Enabled Digital Twin Modeling for Additive Manufacturing.” *arXiv preprint arXiv:2405.09572*, 2024. doi:10.48550/arxiv.2405.09572. (TR977, [An Analytically Invertible Moving-Source Ram Core plus Learned Residual for Additive-Manufacturing Thermal Digital Twins]).
- [528] Luisa Peterson, Ali Forootani, Edgar Ivan Sanchez Medina, Ion Victor Gosea, Kai Sundmacher, and Peter Benner. “Towards Digital Twins for Power-to-X: Comparing Surrogate Models for a Catalytic CO₂ Methanation Reactor.” *TechRxiv preprint*, 2024. doi:10.36227/techrxiv.172263007.76668955/v1. (TR984, [Panel-Jet Ram Transform Inversion of the 1D Reaction-Advection-Diffusion Operator for Catalytic CO₂ Methanation Digital Twins A Variable-Coefficient Analytic-Core-plus-Learned-Residual Surrogate]).

10.2 Learned Manufacturing and Robotic Prediction

- [529] Chaoyue Niu, Bin Chen, Simon Fletcher, Peace Onawumi, Erdem Ozturk, Mahdi Mahfouf, and Visakan Kadirkamanathan. “Learning-based robotic machining error prediction for high precision manufacturing.” *Robotics and Computer-Integrated Manufacturing*, vol. 100, p. 103217, 2026. doi:10.1016/j.rcim.2025.103217. (TR494, [An Analytic-Core-plus-Learned-Residual Ram Transform for Shift-Variant Robotic Machining Error Prediction and Tool-Path Compensation]).

11 Power Systems

51 bibliography items.

11.1 State Estimation, Observability, Bad Data, and Security

- [530] Kfourir Ronald, A. Jabr Rabih, and Dzafic Izudin. “Bad Data Detection and Identification Based on Graph Neural Network for Power System State Estimation.” *Journal of Modern Power Systems and Clean Energy*, vol. 14, no. 2, pp. 760-772, 2026. doi:10.35833/mpce.2025.000178. (TR495, [An Analytic-Core-Plus-Learned-Residual Formulation of Bad-Data Detection and Identification for Power-System State Estimation via Graph Local Ram Transforms]).
- [531] Ping Li, Zhen Dai, Zhenyu Wang, and Yuyuan Yu. “Spatio-temporal dynamic graph neural network-based missing measurement recovery method for power system state estimation.” *Applied Energy*, vol. 411, p. 127604, 2026. doi:10.1016/j.apenergy.2026.127604. (TR496, [A Graph-Global Ram Transform Missing-Measurement Recovery Operator for Power-System State Estimation: Analytic Core plus Learned Spatio-Temporal Residual]).
- [532] Muhammad Furqan Azam, Marta Vanin, Chris Hermans, Reinhilde D’hulst, and Geert Deconinck. “Physics-Informed Factor Graph Neural Networks for Constrained State Estimation in Low Observable Distribution Networks.” *SSRN working paper*, 2026. doi:10.2139/ssrn.6096275. (TR497, [Physics-Informed Factor-Graph Ram Transforms for Constrained State Estimation in Low-Observability Distribution Networks A GLRT/GGRT Analytic Core with Learned Residual Correction]).
- [533] Arbel Yaniv, Kilian Golinski, and Christoph Goebel. “Robust and interpretable graph neural networks for power systems state estimation.” *Electric Power Systems Research*, vol. 262, p. 113595, 2027. doi:10.1016/j.epsr.2026.113595. (TR499, [Analytic-Core Analysis of Robust and Interpretable Graph Neural Networks for Power-System State Estimation A Ram-Transform Screening and Defensive Prior-Art Report]).
- [534] Arbel Yaniv, Kilian Golinski, and Christoph Goebel. “Robust and interpretable graph neural networks for power systems state estimation.” *Electric Power Systems Research*, vol. 262, p. 113595, 2027. doi:10.1016/j.epsr.2026.113595. (TR500, [Analytic-Core-Plus-Learned-Residual Ram Transforms for Robust and Interpretable Graph Neural Network Power-System State Estimation: A GLRT Local-Jet/GGRT Global-Restriction Derivation of a Certified Interpretable State-Estimation Core with a Learned Residual]).
- [535] Arbel Yaniv, Kilian Golinski, and Christoph Goebel. “Robust and interpretable graph neural networks for power systems state estimation.” *Electric Power Systems Research*, vol. 262, p. 113595, 2027. doi:10.1016/j.epsr.2026.113595. (TR501, [Certified-Interpretable, Robust Power-System State Estimation as an Analytic Graph-Ram Core Plus Bounded Learned Residual A Ram Transform Derivation Targeting EPSR 2026:113595]).
- [536] Betül Mamudi, Jochen Stiasny, and Jochen Cremer. “Sensitivity Quantification for Distribution System State Estimation.” *arXiv preprint arXiv:2605.13390*, 2026. arXiv:2605.13390. (TR504, [Closed-Form Analytic Sensitivity Quantification for Distribution System State Estimation via Graph-Local Ram Transforms A Ram-Jet Sensitivity and Covariance-Propagation Operator with Certified Truncation Bounds]).
- [537] Jorge Lara, Mauricio Samper, and Delia Graciela Colomé. “An Integrated and Modular Deep Learning Framework for Distribution System State Estimation.” *Processes*, vol. 14, no. 14, art. 2261, 2026. doi:10.3390/pr14142261. (TR506, [Graph Local Ram Transform with Learned Residual for Distribution System State Estimation A GLRT Analytic-Core-plus-Learned-Residual Formulation of Modular Deep Learning DSSE]).
- [538] Milos Saric. “Advanced state estimation in distribution networks using graph and physics-informed neural networks.” *Dissertation, UPCommons institutional repository (Universitat Politècnica de Catalunya)*, 2026. online record. (TR507, [Distribution-Network State Estimation via Graph and Physics-Informed Neural Networks as an Instance of the GLRT/GGRT Analytic-Core-plus-Learned-Residual Framework]).

- [539] Yingjie Liang. “Real-Time State Estimation and Security Early Warning of Distribution Networks under IoT Edge Computing Architecture.” *Ingegneria Sismica*, vol. 42, no. 4, pp. 1-29, 2026. doi:10.65102/is2026486. (TR508, [Edge-Distributed Local/Global Ram Transforms for Real-Time Distribution-Network State Estimation and Security Early Warning under an IoT Edge-Computing Architecture A Panel-Coupled GLRT/GGRT Formulation with Certified Per-Cycle Latency-Accuracy Bounds]).
- [540] Jiannan Qu, Xianglong Meng, Bo Zhang, and Zhenhao Wang. “A Flexible Voltage-Regulation Method for Distribution Networks Based on Pseudo-Measurement-Assisted State Estimation.” *Energies*, vol. 19, no. 6, art. 1405, 2026. doi:10.3390/en19061405. (TR509, [A Graph-Local Ram-Transform View of Pseudo-Measurement-Assisted Distribution State Estimation and Flexible Voltage Regulation]).
- [541] Om Rishi and Ravi Yadav. “A Tiered FDI Detection Method in AC State Estimation Coupled with Distributed Partitioning Approach.” *Research Square preprint*, 2026. doi:10.21203/rs.3.rs-8916567/v1. (TR511, [Tiered False-Data-Injection Detection via Panel-Decomposed Graph-Local Ram Transforms and Inverse-Consistency Residuals A Ram-Transform Design-Around of Distributed AC State Estimation with an Analytic-Core-plus-Learned-Residual Detection Layer]).
- [542] Andrea Bragantini, Andreas Sumper, Yamen Alsyoudi, and Samuel Galceran-Arellano. “Impact of bad and partial input data on neural network-based low voltage state estimation.” *Sustainable Energy, Grids and Networks*, vol. 46, p. 102327, 2026. doi:10.1016/j.segan.2026.102327. (TR512, [A Certified Analytic-Core-plus-Learned-Residual Ram Transform for Robust Low-Voltage Distribution State Estimation under Bad and Partial Data Graph Local Ram Transform (GLRT) on Radial LV Feeders with Panel Decomposition, Mollified Bad-Data Rejection and Certified Bounded-Error Voltage Recovery]).
- [543] J. G. De la Varga, S. Pineda, A. Stratigakos, and J. M. Morales. “End-to-End Pseudo-Measurement Learning for State Estimation under Limited Observability.” *arXiv preprint arXiv:2605.23525*, 2026. arXiv:2605.23525. (TR514, [Certified Analytic-Core Pseudo-Measurement Synthesis for Distribution State Estimation under Limited Observability A Graph Local Ram Transform Core with Bounded Learned Residual and Persistent-Excitation Calibration]).
- [544] Shariq Shaikh and M M Aman. “Deep learning-based power system state estimation under dynamic loading and photovoltaic penetration.” *Engineering Research Express*, vol. 8, no. 2, art. 025305, 2026. doi:10.1088/2631-8695/ae335a. (TR515, [Analytic-Core-plus-Learned-Residual Graph Local Ram Transform for Power System State Estimation under Dynamic Loading and Photovoltaic Penetration]).
- [545] Malek Alduhaymi, Ravindra Singh, Firdous Ul Nazir, Bikash C. Pal, and Ali Ahmadi. “Forecasting-Aided State Estimation With Deep Learning-Generated Pseudo Measurements.” *IEEE Transactions on Instrumentation and Measurement*, vol. 74, pp. 1-12, 2025. doi:10.1109/tim.2025.3550591. (TR774, [Condition-Aware Ram Graph Jets for Forecasting-Aided Distribution-System State Estimation Physics-based measurement updates, learned pseudo-measurements, adaptive Holt smoothing, and uncertainty propagation]).
- [546] Shiva Moshtaghi, Behrouz Azimian, Mohammad Golgol, and Anamitra Pal. “Topology-Aware Graph Neural Network-Based State Estimation for PMU-Unobservable Power Systems.” *IEEE Transactions on Power Systems*, vol. 40, no. 6, pp. 4547-4560, 2025. doi:10.1109/tpwrs.2025.3572848. (TR785, [Observable-Subspace Graph-Polynomial Cores for State Estimation with Missing PMU Features A Source-Verified Ram Calculus Reformulation]).
- [547] Ping Li, Zhen Dai, Mengzhen Wang, and Zhenyu Wang. “Power system state estimation based on graph contrastive learning.” *Expert Systems with Applications*, vol. 270, p. 126571, 2025. doi:10.1016/j.eswa.2025.126571. (TR786, [Graph-Contrastive State Estimation with a Rank-Qualified Graph-Local Ram Core and Learned Residual]).
- [548] Seyed Hamed Haghsheenas and Mia Naeini. “Resilient Temporal Graph Convolutional Network for Smart Grid State Estimation Under Topology Inaccuracies.” *IEEE Open Access Journal of Power and Energy*, vol. 12, pp. 529-540, 2025. doi:10.1109/oajpe.2025.3594276. (TR788, [Topology-Resilient Temporal Graph State Estimation with a Conditioned Graph-Local Ram Core]).

- [549] Yitong Liu, Alireza Rouhani, Junbo Zhao, Jinxian Zhang, Gerald J. Warchol, and Keith Scott. “Data Enhanced Robust Distribution System State Estimation for Realistic System With Parameter Corrections.” *IEEE Transactions on Power Systems*, vol. 40, no. 5, pp. 4170-4181, 2025. doi:10.1109/tpwrs.2025.3533592. (TR789, [Graph-Local Ram State Estimation with Semi-Blind Distribution-Line Parameter Correction]).
- [550] Ronald Kfoury and Harag Margossian. “A Resilient Deep Learning Approach for State Estimation in Distribution Grids With Distributed Generation.” *International Transactions on Electrical Energy Systems*, vol. 2025, no. 1, art. 2734170, 2025. doi:10.1155/etep/2734170. (TR790, [A Graph-Local Ram Analytic Core for Resilient Deep Distribution-Grid State Estimation]).
- [551] Ali Aljazeera, Petr Toman, and Obed Muhayimana. “A Comparative Study Between Synchrophasor-Measurement-Based Linear and Nonlinear State Estimation in Power Systems.” *Energies*, vol. 18, no. 4, art. 983, 2025. doi:10.3390/en18040983. (TR792, [A Conditioned Graph-Local Ram Comparison of Linear PMU and Nonlinear SCADA State Estimation]).
- [552] Guorun He, Dong Liang, Yuezi Zhao, and Xiaoxue Wang. “Enhanced Fault Localization for Active Distribution Networks via Robust Three-Phase State Estimation.” *Energies*, vol. 18, no. 10, art. 2551, 2025. doi:10.3390/en18102551. (TR793, [Robust Three-Phase Graph-Local Ram State Estimation for Distribution Fault Localization]).
- [553] Haoli Gu, Shichao Liu, Bo Chen, Rusheng Wang, Li Yu, and Okyay Kaynak. “Deep Reinforcement Learning-Assisted Robust Cubature Kalman Filter for Power System Dynamic State Estimation With Multi-Rate Measurements.” *IEEE Transactions on Automation Science and Engineering*, vol. 22, pp. 14346-14357, 2025. doi:10.1109/tase.2025.3560081. (TR796, [Conditional Graph-Local Ram Operators for Robust Multi-Rate Power-System Dynamic State Estimation Corrected, Extended, and Reproducibly Verified Formulation]).
- [554] Shuxin Tian, Feng Zhu, Jinhua Shen, Xijun Yang, Yang Fu, Yang Mi, and Ping Ling. “Distributed state estimation of active distribution network considering mixed-frequency measurement data hierarchical encryption.” *Applied Energy*, vol. 388, p. 125661, 2025. doi:10.1016/j.apenergy.2025.125661. (TR797, [Panelized Ram Operator Methods for Mixed-Frequency Distributed State Estimation in Active Distribution Networks Corrected, Extended, and Reproducibly Verified Formulation]).
- [555] Nima HajiHeydari Varnoosfaderani and Amir Khorsandi. “State estimation in an islanded hybrid solar-wind DC microgrid using Unscented Kalman Filter.” *Heliyon*, vol. 11, no. 3, p. e42073, 2025. doi:10.1016/j.heliyon.2025.e42073. (TR799, [Moment-Exact Ram Jet Filtering for Decoupled State Estimation in an Islanded Solar-Wind DC Microgrid Corrected, Extended, and Reproducibly Verified Formulation]).
- [556] Abdulelah Alharbi. “State estimation of voltage and frequency stability in solar wind integrated grids using multiple filtering techniques.” *Scientific Reports*, vol. 15, no. 1, art. 28085, 2025. doi:10.1038/s41598-025-10171-2. (TR801, [Rank-Qualified Graph-Local Ram Updates for Voltage and Frequency State Estimation in Solar-Wind Integrated Grids Corrected, Extended, and Reproducibly Verified Formulation]).
- [557] Nida Khanam, Mohd. Rihan, and Salman Hameed. “Robust Framework for PMU Placement and Voltage Estimation of Power Distribution Network.” *IEEE Access*, vol. 13, pp. 55841-55857, 2025. doi:10.1109/access.2025.3554522. (TR802, [Ram Observability Operators for Joint PMU Placement and Voltage Estimation in Distribution Networks Corrected, Extended, and Reproducibly Verified Formulation]).
- [558] Subin Koshy, V. Sreehari Venugopal, R. Sunitha, Elizabeth P. Cheriyan, and K. Ananthakrishnan. “Dynamic State Estimation of Power Systems Using a Modified Unscented Kalman Filter and Wavelet Transform Considering Missing and Noisy PMU Data.” *IEEE Access*, vol. 13, pp. 144183-144194, 2025. doi:10.1109/access.2025.3598922. (TR804, [Mask-Aware Ram Local Operators for Dynamic State Estimation with Missing and Noisy PMU Data Corrected, Extended, and Reproducibly Verified Formulation]).
- [559] Shahin Riahinia, Amir Ameli, Mohsen Ghafouri, and Abdulsalam Yassine. “Adaptive Dynamic State Estimation in Power Systems With Real-Time Y-Bus Matrix Estimation: A Step Toward Greater Practicality.” *IEEE Transactions on Power Systems*, vol. 40, no. 6, pp. 5103-5115, 2025. doi:10.1109/tpwrs.2025.3555858.

(**TR806**, [Condition-Gated Local Operators for Joint Real-Time Y-Bus Identification and Dynamic State Estimation Corrected, Extended, and Reproducibly Testable Formulation]).

- [560] Mingyang Liu, Yanxin Liu, Yi Wang, Venkata Dinavahi, and Ze Gao. “Robust Dynamic State Estimation of Power System With Measurement Outliers Based on Parameterized Analytical Cubature Kalman Filter.” *IET Renewable Power Generation*, vol. 19, no. 1, art. e70047, 2025. doi:10.1049/rpg2.70047. (**TR807**, [Polynomial-Moment Local Operators for Robust Parameterized Analytical Cubature State Estimation Corrected, Extended, and Reproducibly Testable Formulation]).

11.2 Grid Topology, Admittance, Impedance, and Phasor Measurements

- [561] Norak Rin, Iman Shames, Ian Petersen, and Elizabeth Ratnam. “Electric Grid Topology and Admittance Estimation using Phasor Measurements.” *arXiv preprint arXiv:2605.00404*, 2026. arXiv:2605.00404. (**TR503**, [Electric Grid Topology and Admittance Estimation using Phasor Measurements A Graph Local / Graph-Global Ram Transform Approach to Joint Edge-Support and Complex-Admittance Identification]).
- [562] Chengyi Wu, Xiao-Ping Zhang, Xiaoyao Zhou, Jay Ramachandran, and Shuailong Dai. “Immittance Model Estimation of Grid-connected VSCs: A Dual-linear Dependence.” *TechRxiv preprint*, 2026. doi:10.36227/techrxiv.175877878.86417969/v2. (**TR505**, [A Ram Transform Formulation of VSC Immittance Identification: Dual-Linear Persistent-Excitation Calibration with a Local-Analytic Recovery Guarantee]).
- [563] Henrique Caetano, Carlos Dias Maciel, and Rahul K. Gupta. “Admittance Sensitivity-Informed Modular GP for Scalable Topology-Adaptive Power-Flow Learning.” *arXiv preprint arXiv:2606.03717*, 2026. arXiv:2606.03717. (**TR513**, [Admittance-Jet Analytic Core plus Modular Gaussian-Process Residual: A Topology-Adaptive Ram Transform for Scalable Power-Flow Surrogates]).
- [564] Mirhamed Pourmirasghariyan, David Campos-Gaona, Panagiotis N. Papadopoulos, Olimpo Anaya-Lara, Georgios Rogdakis, and Helena Perez-Martinez. “A Novel Noninvasive Nonrecursive Impedance Estimation Strategy for Converter-Dominated Systems: An Approach for Wind Farms.” *IEEE Transactions on Instrumentation and Measurement*, vol. 75, pp. 9004215-9004215, 2026. doi:10.1109/tim.2026.3687337. (**TR516**, [A Ram-Transform Approach to Noninvasive, Nonrecursive Frequency-Dependent Impedance Identification in Converter-Dominated Wind Farms Frequency-Warped Local-Jet Panels, Division-Free Batch Inversion and an Analytic-Core-Plus-Learned-Residual Umbrella]).
- [565] John Steven Fierro-Rincón, Carlos Arturo Lozano-Moncada, Eduardo Gómez-Luna, Luis Fernando Grisales-Noreña, and Daniel Sanin-Villa. “Applications of Distribution Phasor Measurement Units for the Integration of Distributed Energy Resources in Modern Distribution Networks.” *Applied System Innovation*, vol. 9, no. 5, art. 92, 2026. doi:10.3390/asi9050092. (**TR517**, [Mapping D-PMU-Based Distributed-Energy-Resource Integration onto Existing Graph Local / Graph-Global Ram Transform Operators]).
- [566] Felipe Proença de Albuquerque, Francisco Rodrigues Lemes, Rafael Nascimento, Eduardo C. Marques Costa, and Pablo Torrez Caballero. “Comprehensive analysis of admittance matrix estimation considering different noise models.” *IET Generation, Transmission & Distribution*, vol. 19, no. 1, art. e70011, 2025. doi:10.1049/gtd2.70011. (**TR791**, [Noise-Model-Aware Admittance Identification by Graph-Local Ram Covariance Operators]).
- [567] Youhang Yang, Shaorong Wang, Mingming Shi, and Xian Zheng. “A Piecewise Linearization Based Method for Crossed Frequency Admittance Matrix Model Calculation of Harmonic Sources.” *Sensors*, vol. 25, no. 2, art. 582, 2025. doi:10.3390/s25020582. (**TR794**, [Multimodal Panel Ram Operators for Crossed-Frequency Admittance Models of Harmonic Sources]).

11.3 Stability, Frequency Response, and Dynamic Parameter Estimation

- [568] Ruiqi Jiao, Shuqing Zhang, Hao Zhang, Beila Deng, Tongtong Zhang, Shaopu Tang, Xianfa Hu, and Weijie Zhang. “Physics-Data-Integrated Hybrid Simulation for Transient Stability in New Power Systems: Status, Challenges, and Prospects.” *Energies*, vol. 19, no. 7, art. 1687, 2026. doi:10.3390/en19071687. (TR257, [Panel-GLRT Hybrid Ram Transform for Transient-Stability Simulation in New (High-IBR) Power Systems: An Analytic Swing-DAE Core with Learned Residual]).
- [569] Sirwan Shazdeh, Sharara Rehim, and Hassan Bevrani. “Updated Frequency Response Model in Modern Power Grids: An Analytical Approach and Parameters Estimation.” *IET Generation, Transmission & Distribution*, vol. 20, no. 1, art. e70265, 2026. doi:10.1049/gtd2.70265. (TR510, [A Variable-Coefficient Ram-Transform Approach to Frequency-Response Model Inversion and Inertia / Damping / Governor Parameter Estimation in Low-Inertia Grids]).
- [570] Feiqin Zhu, Dmitrii Torbunov, Zhongjing Jiang, Tianqiao Zhao, Amirthagunaraj Yogarathnam, Yihui Ren, and Meng Yue. “Diffusion model-based parameter estimation in dynamic power systems.” *Communications Engineering*, vol. 5, no. 1, art. 123, 2026. doi:10.1038/s44172-026-00670-z. (TR518, [A Ram-Core Analytic Surrogate for Diffusion-Model Parameter Estimation in Dynamic Power Systems Analytic-Core-plus-Learned-Residual (TR165) Design-Around]).
- [571] Kyeong-Yeong Lee, Sung-Guk Yoon, and Jin Kwon Hwang. “Inertia Estimation of Regional Power Systems Using Band-Pass Filtering of PMU Ambient Data.” *Energies*, vol. 19, no. 2, art. 424, 2026. doi:10.3390/en19020424. (TR521, [Certified Regional Inertia and Damping Recovery from Ambient PMU Data via Fokker-Planck-Ram Identification]).

11.4 Distribution Operations, DER Integration, Voltage, and Faults

- [572] Wilhiam de Carvalho, Florin Capitanescu, Cyril Rasic, Jean-François Toubéau, and François Vallée. “Robust Dynamic Operating Envelopes in Unbalanced Three-Phase Distribution Systems.” *arXiv preprint arXiv:2607.08578*, 2026. doi:10.48550/arxiv.2607.08578. (TR286, [A Ram-Transform Envelope Operator for Robust Dynamic Operating Envelopes in Unbalanced Three-Phase Distribution Feeders An Analytic GLRT+Panel Core with Learned Residual]).
- [573] Jiamin Lv, Ying Wang, Mingshen Wang, Qikai Zhao, and Manqian Yu. “Single-Ended Fault Location Method for DC Distribution Network Based on Bi-LSTM.” *Energies*, vol. 19, no. 8, art. 1866, 2026. doi:10.3390/en19081866. (TR523, [An Analytic-Core-Plus-Learned-Residual Ram Transform for Single-Ended Traveling-Wave Fault Location on DC Distribution Networks]).
- [574] Marcus Haywood-Alexander, Giacomo Arcieri, Antonios Kamariotis, and Eleni Chatzi. “Response estimation and system identification of dynamical systems via physics-informed neural networks.” *Advanced Modeling and Simulation in Engineering Sciences*, vol. 12, no. 1, art. 8, 2025. doi:10.1186/s40323-025-00291-9. (TR787, [Ram Local-Operator Response Estimation and System Identification for Structural Dynamics]).
- [575] Asjad Ali, Noor Izzri Abdul Wahab, Mohammad Lutfi Othman, Rizwan A. Farade, Husam S. Samkari, and Mohammed F. Allehyan. “Optimal μ -PMU Placement and Voltage Estimation in Distribution Networks: Evaluation Through Multiple Case Studies.” *MDPI AG*, 2025. doi:10.20944/preprints202509.2502.v1. (TR795, [Information-Monotone Graph-Local Ram Design for μ -PMU Placement and Voltage Estimation]).
- [576] Paolo Attilio Pegoraro, Carlo Sitzia, Antonio Vincenzo Solinas, Sara Sulis, Daniele Carta, and Andrea Benigni. “Improved Fault Detection and Location Method in Three-Phase Distribution Networks Leveraging Traceable PMU Measurements.” *IEEE Transactions on Instrumentation and Measurement*, vol. 74, pp. 1-12, 2025. doi:10.1109/tim.2025.3561427. (TR798, [Traceability-Aware Graph Inverse Methods for Fault Detection and Location in Three-Phase Distribution Networks Corrected, Extended, and Reproducibly Verified Formulation]).
- [577] Ahmad Bazzi and Marwa Chafii. “Low Dynamic Range for RIS-Aided Bistatic Integrated Sensing and Communication.” *IEEE Journal on Selected Areas in Communications*, vol. 43, no. 3, pp. 912-927,

2025. doi:10.1109/jsac.2025.3531533. (TR800, [Trust-Region Ram Surrogates for Low-Dynamic-Range RIS-Aided Bistatic Integrated Sensing and Communication Corrected, Extended, and Reproducibly Verified Formulation]).

- [578] Kuber Saxena, Subhransu Ranjan Samantaray, and Sarita Nanda. “Efficient Dynamic Phasor and Frequency Estimation Using Evolving Order Based Arctangent Affine Projection Algorithm.” *IEEE Transactions on Power Systems*, vol. 40, no. 5, pp. 4158-4169, 2025. doi:10.1109/tpwrs.2025.3550656. (TR803, [Conditioned Windowed-Exponential Ram Jets for Dynamic Phasor, Frequency, and ROCOF Estimation Corrected, Extended, and Reproducibly Verified Formulation]).
- [579] Sajay Krishnan Paruthiyil, Ali Bidram, Miguel Jimenez Aparicio, Javier Hernandez-Alvidrez, Andrew R. Dow, Matthew J. Reno, and Daniel Bauer. “Travelling wave-based fault detection and location in a real low-voltage DC microgrid.” *IET Smart Grid*, vol. 8, no. 1, art. e12207, 2025. doi:10.1049/stg2.12207. (TR808, [Event-Aligned Local Operators for Travelling-Wave Fault Features in Low-Voltage DC Microgrids Corrected, Extended, and Reproducibly Testable Formulation]).
- [580] Yue Chen, Soham Chakraborty, Ahmed Zamzam, and Jing Wang. “End-to-end microgrid protection using distributed data-driven methods.” *Applied Energy*, vol. 391, p. 125797, 2025. doi:10.1016/j.apenergy.2025.125797. (TR809, [Graph-Conditioned Physics Features for Distributed Data-Driven Microgrid Protection Corrected, Extended, and Reproducibly Testable Formulation]).

12 Riemann-Hypothesis and Mathematical Research

15 bibliography items.

12.1 Kernel, Spectral, and Trace-Functional Criteria

- [581] Shaimaa Said Soltan. “A Kernel-Lattice Criterion Equivalent to the Riemann Hypothesis.” *Journal of Mathematics Research*, vol. 18, no. 2, p. 45, 2026. doi:10.5539/jmr.v18n2p45. (TR202, [A Kernel-Lattice Criterion Equivalent to the Riemann Hypothesis: A Ram-Transform Reformulation and Verification Instrument (Honest Research-Program Note – NOT a Proof)]).
- [582] Uthit Lakkaew. “Local Spectral Rigidity of Weil Trace Functionals and Structural Reductions of the Riemann Hypothesis.” *OSF repository record*, 2026. doi:10.17605/osf.io/9sdlkp. (TR524, [Local Spectral Rigidity of Weil Trace Functionals and Structural Reductions of the Riemann Hypothesis]).
- [583] Uthit Lakkaew. “Local Spectral Rigidity of Weil Trace Functionals and Structural Reductions of the Riemann Hypothesis.” *OSF repository record*, 2026. doi:10.17605/osf.io/w8k5t. (TR525, [Local Spectral Rigidity of Weil Trace Functionals via Localized-Jet Ram Transforms: Structural Reductions of the Riemann Hypothesis (Honest Research-Program / Verification Instrument – NOT a Proof)]).
- [584] Thierry Marechal. “A Spectral Program for the Riemann Hypothesis.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.19139270. (TR526, [A Spectral Program for the Riemann Hypothesis: A Ram Functional-Calculus Instrument (Honest Research/Verification Program - Not a Proof)]).
- [585] Raphaël Villiers, Vincent Mons, Denis Sipp, Eric Lamballais, and Marcello Meldi. “Enhancing Unsteady Reynolds-Averaged Navier-Stokes Modelling from Sparse Data Through Sequential Data Assimilation and Machine Learning.” *Flow, Turbulence and Combustion*, vol. 115, no. 3, pp. 991-1029, 2025. doi:10.1007/s10494-024-00623-6. (TR782, [Conditioned Local Closure Jets within Sequentially Assimilated URANS Turbulence Models A Source-Verified Ram Calculus Reformulation]).
- [586] Driss BOURAKKADI. “The Mollified Moment Method and Zero-Density Theory for the Riemann Zeta Function.” *Zenodo repository record*, 2025. doi:10.5281/zenodo.17851857. (TR810, [Exact-Arithmetic and Interval Audit of a Mollified-Moment Zero-Density Research Program Corrected, Extended, and Reproducibly Testable Formulation]).

- [587] Jiajie Chen and Thomas Y. Hou. “Singularity formation in 3D Euler equations with smooth initial data and boundary.” *Proceedings of the National Academy of Sciences*, vol. 122, no. 27, art. e2500940122, 2025. doi:10.1073/pnas.2500940122. (TR811, [Conditioned Verification Operators for Nearly Self-Similar Axisymmetric Euler Blowup with a Smooth Boundary Corrected, Extended, and Reproducibly Testable Formulation]).
- [588] Diego Córdoba, Luis Martinez-Zorua, and Fan Zheng. “Finite Time Singularities to the 3D Incompressible Euler Equations for Solutions in $C^\infty(\mathbb{R}^3 \setminus \{0\}) \cap C^{1,\alpha} L^2$.” *Annals of PDE*, vol. 11, no. 2, art. 19, 2025. doi:10.1007/s40818-025-00214-2. (TR812, [Multiscale Annular Verification Operators for a Non-Self-Similar Euler Singularity Construction Corrected, Extended, and Reproducibly Testable Formulation]).
- [589] Tai-Ping Liu. “Singularity for Euler, Navier-Stokes, and Boltzmann equations.” *Japan Journal of Industrial and Applied Mathematics*, vol. 42, no. 4, pp. 1475-1498, 2025. doi:10.1007/s13160-025-00724-3. (TR813, [Layer-Resolved Verification Operators for Euler, Navier-Stokes, and Boltzmann Shock Formation Corrected, Extended, and Reproducibly Testable Formulation]).

12.2 Zero-Density, Pair-Gap, and Horizontal-Defect Programs

- [590] Jongmin Choi. “V26.7: Adaptive Jet Order and Pair-Gap Linkage for the Riemann Hypothesis.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.19028335. (TR527, [Adaptive Jet Order and Pair-Gap Linkage for the Riemann Hypothesis: A Zero-Density Verification Instrument (Restatement and Corpus Reconciliation of Target V26.7-RH-AdaptiveJet-PairGap-2026)]).
- [591] Byoungwoo Lee. “Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.20278618. (TR528, [Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros A Ram-Transform Panel/Domain-Decomposition Research-Program Instrument]).
- [592] Byoungwoo Lee. “Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.20370525. (TR529, [Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros A Ram-Transform Reading as a Per-Collar Moment-Matrix Accounting]).
- [593] Byoungwoo Lee. “Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.20352555. (TR530, [Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros A Ram-Transform Verification-Instrument Report]).
- [594] Byoungwoo Lee. “Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.20353466. (TR531, [Horizontal Defect Moments from Classical Zero-Density Estimates: A Collar-Split Export Calculus for Zeta Zeros]).

12.3 Euler and Navier-Stokes Geometric Analysis

- [595] José Salvador Sarga. “A conditional geometric obstruction to sustained exact alignment-cancellation in 3D Euler and Navier-Stokes flows.” *Zenodo repository record*, 2026. doi:10.5281/zenodo.21143815. (TR532, [A Ram-Transform Pipeline Assessment of a Conditional Geometric Obstruction to Sustained Exact Alignment-Cancellation in 3D Euler and Navier-Stokes Flows]).

13 Robotics, Trajectory Planning, and Control

68 bibliography items.

13.1 Contact-Rich Manipulation and Hybrid Dynamics

- [596] Mark Van der Merwe. “Joint Deformation and Contact Reasoning for Robotic Manipulation.” *Dissertation, University of Michigan, 2026*. doi:10.7302/dspace/29638. (TR534, [Joint Deformation and Contact Reasoning for Robotic Manipulation via Panelized Variable-Coefficient Ram Transforms with Block-Newton Contact Inversion]).
- [597] Zhe Zhang, Xingrong Diao, Haoxiang Liang, Han Yang, Bi-Ke Zhu, Dandan Zhang, and Jiankun Wang. “Simultaneous Contact Selection and Planning for Contact-Rich Manipulation with Cascaded Optimization.” *arXiv preprint arXiv:2605.27972, 2026*. doi:10.48550/arxiv.2605.27972. (TR535, [Ram-Jet Exact Sensitivity Refinement of the Continuous Inner Loop in Cascaded Contact-Selection Trajectory Optimization]).
- [598] H.Y. Lee, Yitaek Kim, Casper Hewson Rask, and Christoffer Sloth. “Manipulation via Force Distribution at Contact.” *arXiv preprint arXiv:2602.03350, 2026*. arXiv:2602.03350. (TR545, [Ram Transform Inversion of the Constrained Bilinear Contact-Force Functional for Manipulation via Distributed Force Sensing]).
- [599] Tommaso Belvedere, James Zhu, Marco Cognetti, and Paolo Robuffo Giordano. “Contact-Robust Trajectory Planning via Parametric Sensitivity Analysis for Hybrid Robotic Systems.” In *2026 IEEE International Conference on Robotics and Automation (ICRA 2026)*, 2026. online record. (TR547, [Robust Trajectory Planning via Hybrid-Mode Parametric Sensitivity: Saltation-Coupled Panel Ram-Jets with Certified Switching-Boundary Robustness Margins]).
- [600] C. O’Neill, J. Terrones, and H. H. Asada. “Koopman global linearization of contact dynamics for robot locomotion and manipulation enables elaborate control.” *Nature Communications*, 2026. doi:10.1038/s41467-026-72485-7. (TR552, [Multimodal Panel Ram Transforms for Contact Dynamics: An Analytic-Core-plus-Learned-Residual Alternative to Koopman Global Linearization in Robot Locomotion and Manipulation]).
- [601] Raturaj S. Sambhus, Kapi Ketan Mehta, Ali MirMohammad Sadeghi, Basit Muhammad Imran, Jeeseop Kim, Taizoon Chunawala, Vittorio Pastore, Sujith Vijayan, and Kaveh Akbari Hamed. “A Nonlinear MPC Framework for Loco-Manipulation of Quadrupedal Robots With Non-Negligible Manipulator Dynamics.” *IEEE Robotics and Automation Letters*, vol. 11, no. 4, pp. 4050-4057, 2026. doi:10.1109/lra.2026.3664229. (TR554, [Panel-Block-Newton Nonlinear MPC for Loco-Manipulation: A Ram-Jet Flow-Map Instance with an Explicit Base-to-Arm Coupling Block]).
- [602] Krzysztof Wojciechowski, Ege Gursoy, Arthur Haffemayer, Sebastien Kleff, Vincent Bonnet, Florent Lami-raux, and Nicolas Mansard. “Learning-Guided Force-Feedback Model Predictive Control with Obstacle Avoidance for Robotic Deburring.” *arXiv preprint arXiv:2604.06133, 2026*. doi:10.48550/arxiv.2604.06133. (TR564, [Learning-Guided Force-Feedback Model Predictive Control with Obstacle Avoidance for Robotic Deburring: A Ram-Jet Analytic-Core-plus-Learned-Residual Formulation]).
- [603] Yuki Shirai, Tong Zhao, H.J. Terry Suh, Huaijiang Zhu, Xinpei Ni, Jiuguang Wang, Max Simchowitz, and Tao Pang. “Is Linear Feedback on Smoothed Dynamics Sufficient for Stabilizing Contact-Rich Plans?” In *2025 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 11926-11932, 2025. doi:10.1109/icra55743.2025.11127776. (TR814, [Nonlinear Remainder and Contact-Mode Gates for Feedback on Smoothed Contact Dynamics Corrected, Extended, and Reproducibly Testable Formulation]).
- [604] Xintong Yang, Ze Ji, and Yu-Kun Lai. “Differentiable physics-based system identification for robotic manipulation of elastoplastic materials.” *The International Journal of Robotics Research*, vol. 44, no. 13, pp. 2126-2155, 2025. doi:10.1177/02783649251334661. (TR816, [Condition-Aware Ram Local Response Models for Differentiable System Identification of Elastoplastic Robotic Manipulation]).

- [605] Yaowei Chen, Jie Zhang, and Ming Lyu. “A Novel Contact-Implicit Trajectory Optimization Framework for Quadruped Locomotion without Fixed Contact Sequences.” *Advanced Intelligent Systems*, vol. 8, no. 3, art. e202500654, 2025. doi:10.1002/aisy.202500654. (TR825, [Adaptive Validated Derivative Interpolation for Hydroelastic Contact-Implicit Trajectory Optimization]).
- [606] John Z. Zhang, Taylor A. Howell, Zeji Yi, Chaoyi Pan, Guanya Shi, Guannan Qu, Tom Erez, Yuval Tassa, and Zachary Manchester. “Whole-Body Model-Predictive Control of Legged Robots with MuJoCo.” *arXiv preprint arXiv:2503.04613*, 2025. doi:10.48550/arxiv.2503.04613. (TR832, [Whole-Body Model-Predictive Control of Legged Robots via Ram-Jet Trajectory Optimization on MuJoCo/MJX Source-Faithful Analysis and a Contact-Aware Validated Derivative Extension]).
- [607] Yongpeng Jiang, Mingrui Yu, Xinghao Zhu, Masayoshi Tomizuka, and Xiang Li. “Robust Model-Based In-Hand Manipulation with Integrated Real-Time Motion-Contact Planning and Tracking.” *arXiv preprint arXiv:2505.04978*, 2025. doi:10.48550/arxiv.2505.04978. (TR838, [Ram-Jet Motion-Contact Planning for Robust Model-Based In-Hand Dexterous Manipulation: An Analytic-Core-plus-Residual Extension of Integrated Real-Time Planning and Tactile Tracking]).

13.2 Aerial, Cable, Crane, and Continuum Robots

- [608] Lu Lu, Qihua Xiao, Shikang Zhou, Xinhai Wang, and Yunhe Meng. “Physical Modeling and Data-Driven Hybrid Control for Quadrotor-Robotic-Arm Cable-Suspended Payload Systems.” *Drones*, vol. 10, no. 1, art. 51, 2026. doi:10.3390/drones10010051. (TR533, [Analytic-Core-plus-Learned-Residual Ram Transform Inversion for Quadrotor-Robotic-Arm Cable-Suspended Payload Systems A block-tridiagonal variable-coefficient jet formulation of coupled underactuated multi-body dynamics]).
- [609] Lingchong Gao, Zhiwei Wang, Jikun Xiao, Yixiao Nie, Michael Kleeberger, and Johannes Fottner. “Trajectory Planning of a Knuckle Boom Crane based on Implicit Differential Dynamic Programming.” *Research Square preprint*, 2026. doi:10.21203/rs.3.rs-9857938/v1. (TR536, [Ram-Jet Differential Dynamic Programming for a Knuckle-Boom Crane: A Dependent Embodiment of the Trajectory-Optimization Genus (P198)]).
- [610] Yanhua Han, Ruofan Li, and Yong Zhang. “Dynamics Modeling and Nonlinear Optimal Control of an Underactuated Dual-Unmanned Aerial Helicopters Slung Load System.” *Aerospace*, vol. 13, no. 4, art. 329, 2026. doi:10.3390/aerospace13040329. (TR546, [A Multi-Agent Panel-Jet Ram Transform for the Underactuated Dual-Helicopter Slung-Load Optimal-Control Problem: Cable-Constraint Block-Tridiagonal Sensitivity Inversion]).
- [611] Antonio Rapuano, Yaolei Shen, Federico Califano, Chiara Gabellieri, and Antonio Franchi. “Nonlinear Predictive Control of the Continuum and Hybrid Dynamics of a Suspended Deformable Cable for Aerial Pick and Place.” *arXiv preprint arXiv:2602.17199*, 2026. arXiv:2602.17199. (TR548, [A Panel-Jet Ram Transform for the Continuum and Hybrid Dynamics of a Suspended Deformable Cable: Certified High-Order Sensitivities for Aerial Pick-and-Place NMPC]).
- [612] Antonio Rapuano, Yaolei Shen, Federico Califano, Chiara Gabellieri, and Antonio Franchi. “Nonlinear Predictive Control of the Continuum and Hybrid Dynamics of a Suspended Deformable Cable for Aerial Pick and Place.” *arXiv preprint arXiv:2602.17199*, 2026. arXiv:2602.17199. (TR549, [Certified High-Order Sensitivity Maps for Nonlinear Predictive Control of the Continuum and Hybrid Dynamics of a Suspended Deformable Cable in Aerial Pick-and-Place A Panel-Jet Ram-Transform Derivation]).
- [613] Saumya Karan, Neerav Maram, Suraj Borate, and Madhu Vadali. “Dynamic Modeling and MPC for Locomotion of Tendon-Driven Soft Quadruped.” *arXiv preprint arXiv:2602.16371*, 2026. arXiv:2602.16371. (TR562, [Coordinate-Mapped Ram Jet-Maps and Distributed-Compliance Inversion for Model-Predictive Locomotion of Tendon-Driven Soft Quadrupeds]).
- [614] Saumya Karan, Neerav Maram, Suraj Borate, and Madhu Vadali. “Dynamic Modeling and MPC for Locomotion of Tendon-Driven Soft Quadruped.” *arXiv preprint arXiv:2602.16371*, 2026. doi:10.48550/arxiv.2602.16371. (TR563, [Panel Ram-Jet Trajectory Optimization for Tendon-Driven Soft-Quadruped Locomotion: A Variable-Coefficient Operator-Inversion MPC]).

13.3 Trajectory Planning and Scalable Dynamic Optimization

- [615] Josue N. Rivera, Bohang Liang, Chen Lv, and Yi-Xiang Wang. “Scalable Online Flight Trajectory Optimization via Sequential Quadratic Programming for Urban Air Mobility in Ultra Low-Altitude Airspace.” *arXiv preprint arXiv:2606.23008*, 2026. [arXiv:2606.23008](#). (**TR537**, [Certified Panel Ram-Jet Sensitivities for Scalable Online SQP Flight Trajectory Optimization in Ultra-Low-Altitude UAM Airspace]).
- [616] Yuichiro Aoyama, Oswin So, Augustinos D. Saravanos, and Evangelos A. Theodorou. “Second-order constrained dynamic optimization.” *The International Journal of Robotics Research*, art. 02783649251415417, 2026. [doi:10.1177/02783649251415417](#). (**TR538**, [Constrained Second-Order Dynamic Optimization via Exact Ram-Jet Flow Maps A Constrained Backward-Pass Extension of the TR198 Analytic-Jet Trajectory-Optimization Family]).
- [617] Simon Idoko, Prajyot Jadhav, and Arun Kumar Singh. “Flow-Opt: Scalable Centralized Multi-Robot Trajectory Optimization With Flow Matching and Differentiable Optimization.” *IEEE Transactions on Automation Science and Engineering*, vol. 23, pp. 10656-10675, 2026. [doi:10.1109/tase.2026.3696443](#). (**TR539**, [A Block-Banded Ram-Jet Core with a Flow-Matching Residual for Scalable Centralized Multi-Robot Trajectory Optimization]).
- [618] Lingxue Lyu and Zihui Liu. “Mismatch-Aware Adaptive Constraint Tightening for Bicycle-Model Trajectory Optimization.” *arXiv preprint arXiv:2605.09376*, 2026. [arXiv:2605.09376](#). (**TR540**, [Mismatch-Aware Adaptive Constraint Tightening for Bicycle-Model Trajectory Optimization via Panel-Coupled Ram-Jet Flow Maps]).
- [619] Elisa Alboni, Pietro Noah Crestaz, Elias Fontanari, and Andrea Del Prete. “CACTO-BIC: Scalable Actor-Critic Learning via Biased Sampling and GPU-Accelerated Trajectory Optimization.” *arXiv preprint arXiv:2602.19699*, 2026. [arXiv:2602.19699](#). (**TR541**, [Ram-Jet Trajectory Optimization with a Learned-Critic Residual: An Analytic-Core Reformulation of CACTO-BIC]).
- [620] Yilin Zou, Zhong Zhang, Maxime Robic, and Fanghua Jiang. “Parallel-in-Time Nonlinear Optimal Control via GPU-native Sequential Convex Programming.” *arXiv preprint arXiv:2603.10711*, 2026. [arXiv:2603.10711](#). (**TR543**, [Panel-Jet Block-Tridiagonal Ram Transforms for Parallel-in-Time Nonlinear Optimal Control: A GPU-native Sequential Convex Programming Framework]).
- [621] Seulchan Lee and Jinwoo Kim. “Manifold-Constrained MPPI: Real-Time Sampling-Based Control Under Hard Constraints.” *arXiv preprint arXiv:2605.24813*, 2026. [arXiv:2605.24813](#). (**TR550**, [Manifold-Constrained MPPI via Chart-Flat Rectification and Ram-Jet Control Variates A Narrow Design-Around under the Ram-Jet Trajectory-Optimization Umbrella (TR198/P198/TR203)]).
- [622] Wilson Jallet, Antoine Bambade, Etienne Arlaud, Sarah El-Kazdadi, Nicolas Mansard, and Justin Carpentier. “ProxDDP: Proximal Constrained Trajectory Optimization.” *IEEE Transactions on Robotics*, vol. 41, pp. 2605-2624, 2025. [doi:10.1109/tro.2025.3554437](#). (**TR817**, [Condition-Gated Flow Jets for Proximal Constrained Trajectory Optimization]).
- [623] Qin Li, Hongwen He, Manjiang Hu, and Yong Wang. “Spatio-Temporal Joint Trajectory Planning for Autonomous Vehicles Based on Improved Constrained Iterative LQR.” *Sensors*, vol. 25, no. 2, art. 512, 2025. [doi:10.3390/s25020512](#). (**TR819**, [Validated Local Flow Operators for Spatio-Temporal Constrained Vehicle Planning]).
- [624] Yue Wang, Haoyu Wang, and Zhaoxing Li. “Quattro: Transformer-Accelerated Iterative Linear Quadratic Regulator Framework for Fast Trajectory Optimization.” In *2025 IEEE 64th Conference on Decision and Control (CDC)*, pp. 6629-6636, 2025. [doi:10.1109/cdc57313.2025.11312329](#). (**TR820**, [Residual-Certified Gain Completion for Transformer-Accelerated iLQR]).
- [625] Marco Calì, Giulio Giacomuzzo, Ruggero Carli, and Alberto Dalla Libera. “Accelerating Model-Based Reinforcement Learning using Non-Linear Trajectory Optimization.” *arXiv preprint arXiv:2506.02767*, 2025. [doi:10.48550/arxiv.2506.02767](#). (**TR824**, [Validated Local Model Jets for iLQR-Assisted Model-Based Reinforcement Learning]).

- [626] Thomas Caleb, Roberto Armellin, Spencer Boone, and Stéphanie Lizy-Destrez. “Taylor polynomial-based constrained solver for fuel-optimal low-thrust trajectory optimisation.” *arXiv preprint arXiv:2502.00398*, 2025. doi:10.48550/arxiv.2502.00398. (TR826, [Constrained Fuel-Optimal Low-Thrust Trajectory Optimization via Panelized Ram-Jet Flow Maps and Bang-Bang Homotopy A Source-Faithful Analysis of DADDy and a Validated Local-Operator Extension]).
- [627] Thomas Caleb, Roberto Armellin, and Stéphanie Lizy-Destrez. “Non-linear stochastic trajectory optimisation.” *arXiv preprint arXiv:2508.13677*, 2025. doi:10.48550/arxiv.2508.13677. (TR827, [Stochastic Trajectory Optimization via Ram Jets: Fokker-Planck-Ram Identification and Block-Tridiagonal Panel Coupling over a Horizon A Source-Faithful SODA Reformulation with Component-Wise Validation]).
- [628] Alexander Du, Emre Adabag, Gabriel Bravo-Palacios, and Brian Plancher. “GATO: GPU-Accelerated and Batched Trajectory Optimization for Scalable Edge Model Predictive Control.” *arXiv preprint arXiv:2510.07625*, 2025. doi:10.48550/arxiv.2510.07625. (TR828, [A Ram-Jet Panel Formulation of GPU-Batched Edge Model-Predictive Control Source-Faithful Analysis of GATO’s SQP, Schur-PCG, and GPU Batch Structure]).
- [629] Junheng Li, Ziwei Duan, Junchao Ma, and Quan Nguyen. “Gait-Net-augmented Implicit Kino-dynamic MPC for Dynamic Variable-frequency Humanoid Locomotion over Discrete Terrains.” In *Robotics: Science and Systems XXI*, 2025. doi:10.15607/rss.2025.xxi.069. (TR829, [Panelized Trajectory-Jet Inversion for Gait-Net-Augmented Implicit Kino-dynamic MPC of Variable-Frequency Humanoid Locomotion over Discrete Terrain A Ram-Transform Core-plus-Residual Formulation]).
- [630] Apurva Patil. “Advancing Frontiers of Path Integral Theory for Stochastic Optimal Control.” *arXiv preprint arXiv:2504.17154*, 2025. doi:10.48550/arxiv.2504.17154. (TR834, [A Ram-Transform Formulation of Path-Integral Stochastic Optimal Control: Fokker-Planck-Ram Identification and Panel Trajectory-Jet Synthesis]).
- [631] Lorenzo Amatucci, João Sousa-Pinto, Giulio Turrise, Dominique Orban, Victor Barasuol, and Claudio Semini. “Primal-Dual iLQR for GPU-Accelerated Learning and Control in Legged Robots.” *IEEE Robotics and Automation Letters*, vol. 11, no. 1, pp. 1010-1017, 2026. doi:10.1109/lra.2025.3632610. (TR844, [Primal-Dual Ram-Jet Trajectory Optimization: Exact High-Order Constrained KKT Sensitivities for GPU-Accelerated Learning and Control in Legged Robots]).

13.4 Model-Predictive, Sampling-Based, and Learned Control

- [632] Sichao Wu, Jiang Wu, Xingyu Cao, Fawang Zhang, Guangyuan Yu, Junjie Zhao, Yue Qu, Fei Ma, and Jingliang Duan. “Transformer-based explicit model predictive control with variable prediction horizon.” *Engineering Applications of Artificial Intelligence*, vol. 172, p. 114345, 2026. doi:10.1016/j.engappai.2026.114345. (TR492, [Variable-Horizon Explicit MPC via Panel-Coupled Ram Jet Operators with an Analytic-Core-plus-Learned-Residual Architecture]).
- [633] Ricardo Gutierrez and Jesse B. Hoagg. “Receding-Horizon Nonlinear Optimal Control With Safety Constraints Using Constrained Approximate Dynamic Programming.” *arXiv preprint arXiv:2604.01956*, 2026. arXiv:2604.01956. (TR542, [Constrained Ram-Jet Approximate Dynamic Programming for Receding-Horizon Nonlinear Optimal Control with Certified Safety Margins]).
- [634] Akhil B. Krishna and Mangal Kothari. “Model Predictive Static Programming for Discrete-Time Optimal Control on Lie Groups.” *arXiv preprint arXiv:2605.03246*, 2026. arXiv:2605.03246. (TR544, [On-Manifold Model Predictive Static Programming via Ram-Jet Sensitivity Maps in Exponential Coordinates Exact High-Order Terminal-Constraint Sensitivities for Discrete-Time Optimal Control on Lie Groups]).
- [635] Victor Vantilborgh, Mohammad M. Filabadi, Frederik Ostyn, Guillaume Crevecoeur, and Tom Lefebvre. “Efficient Sampling Strategies for Nonlinear State Estimation and System Identification through Probabilistic Optimal Control.” *IEEE Transactions on Signal Processing*, pp. 1-14, 2026. doi:10.1109/tsp.2026.3703601. (TR551, [Analytic Local-Jet Propagation and Block-Newton Identification for Nonlinear State Estimation and System Identification via Probabilistic Optimal Control A Fokker-Planck-Ram Reformulation of Sampling-Based Estimators]).

- [636] Andrea Patrizi, Carlo Rizzardo, Arturo Laurenzi, Francesco Ruscelli, Luca Rossini, and Nikos G. Tsagarakis. “RL-Augmented MPC for Non-Gaited Legged and Hybrid Locomotion.” *IEEE Robotics and Automation Letters*, vol. 11, no. 5, pp. 5797-5804, 2026. doi:10.1109/lra.2026.3675839. (TR555, [Panelized Ram-Jet MPC with Certified Per-Contact-Mode Sensitivity Bounds for RL-Augmented Non-Gaited Legged Locomotion]).
- [637] Lorenzo Amatucci. “Scaling Model Predictive Control for High-Dimensional Robotic Systems.” *Dissertation, University of Genoa*, 2026. online record. (TR556, [Panel Ram-Jet Model Predictive Control: Exact-Sensitivity Flow Maps and Block-Tridiagonal Riccati Inversion for High-Dimensional Robotic Systems]).
- [638] Lorenzo Amatucci. “Scaling Model Predictive Control for High-Dimensional Robotic Systems.” *Dissertation, University of Genoa*, 2026. online record. (TR557, [Panel-Decomposed Ram-Jet Model Predictive Control: A Block-Tridiagonal Scaling Design for High-Dimensional Robotic Systems]).
- [639] Dongqi Wang, Zhenghan Chen, Jiyu Yu, Liang Zhang, Yue Wang, Haojian Lu, Shaoxing Qu, and Rong Xiong. “A hierarchical MPC for locomotion tracking control of humanoid robots.” *Robotic Intelligence and Automation*, vol. 46, no. 2, pp. 163-173, 2026. doi:10.1108/ria-03-2025-0083. (TR559, [Ram-Jet Exact-Sensitivity Formulation of Hierarchical MPC for Humanoid Locomotion Tracking Control: A Panelized Block-Tridiagonal DDP Derivation]).
- [640] Yongyan Cao. “Whole-Body Impedance Model Predictive Control for Safe Physical Human-Robot Interaction on Floating-Base Platforms.” *arXiv preprint arXiv:2606.14617*, 2026. arXiv:2606.14617. (TR560, [Whole-Body Impedance Model Predictive Control for Safe Physical Human-Robot Interaction on Floating-Base Platforms: A Ram-Jet Panelized Block-Newton Derivation]).
- [641] Sebin Jung, Abulikemu Abuduweili, Jiaxing Li, and Changliu Liu. “Whole-Body Safe Control of Robotic Systems with Koopman Neural Dynamics.” *arXiv preprint arXiv:2603.03740*, 2026. arXiv:2603.03740. (TR561, [Certified-Bound Koopman Whole-Body Safe Control via Ram-Jet Analytic Cores and Learned Residuals A Ram Transform Derivation and Algorithm]).
- [642] Yuhui Mao, Yaxing Zhang, and Longsen Gao. “Liquid-Augmented MPC in Quadrupedal Robot for Disturbance Learning.” *Electronics*, vol. 14, no. 24, art. 4843, 2025. doi:10.3390/electronics14244843. (TR784, [High-Order Conditioned Sensitivities for Liquid-Augmented Quadrupedal Model Predictive Control A Source-Verified Ram Calculus Reformulation]).
- [643] Corrado Pezzato, Chadi Salmi, Elia Trevisan, Max Spahn, Javier Alonso-Mora, and Carlos Hernández Corbato. “Sampling-Based Model Predictive Control Leveraging Parallelizable Physics Simulations.” *IEEE Robotics and Automation Letters*, vol. 10, no. 3, pp. 2750-2757, 2025. doi:10.1109/lra.2025.3535185. (TR815, [Conditioned Analytic Proposal Shaping for Sampling-Based MPC with Parallel Physics Simulation Corrected, Extended, and Reproducibly Testable Formulation]).
- [644] Yongce Liu and Zhongqiang Ren. “A Probabilistic Measure of Multi-Robot Connectivity and Ergodic Optimal Control.” In *Robotics: Science and Systems XXI*, 2025. doi:10.15607/rss.2025.xxi.100. (TR822, [Moment-Validated Local Operators for Probabilistic Multi-Robot Connectivity and Ergodic Search]).
- [645] Tommaso Belvedere, Marco Cognetti, Giuseppe Oriolo, and Paolo Robuffo Giordano. “Sensitivity-Aware Model Predictive Control for Robots With Parametric Uncertainty.” *IEEE Transactions on Robotics*, vol. 41, pp. 3039-3058, 2025. doi:10.1109/tro.2025.3554415. (TR823, [Validated Flow Jets for Closed-Loop Sensitivity-Aware Model Predictive Control]).
- [646] Emre Adabag, Marcus Greiff, John Subosits, and Thomas Lew. “Differentiable Model Predictive Control on the GPU.” *arXiv preprint arXiv:2510.06179*, 2025. doi:10.48550/arxiv.2510.06179. (TR835, [A Panel-Jet Ram-Transform View of Differentiable Model Predictive Control on the GPU Source-Faithful SQP/Implicit Differentiation and a Residual-Gated Local-Response Extension]).
- [647] João Sousa-Pinto and Dominique Orban. “Dual-Regularized Riccati Recursions for Interior-Point Optimal Control.” *arXiv preprint arXiv:2509.16370*, 2025. doi:10.48550/arxiv.2509.16370. (TR837, [Dual-Regularized Riccati Recursions as Block-Tridiagonal Ram Panel-Jet Operators for Interior-Point Optimal Control Sequential and Parallel Structured Solves with Explicit Conditioning and Truncation Requirements]).

- [648] David Leeftink, Çağatay Yıldız, Steffen Ridderbusch, Max Hinne, and Marcel van Gerven. “Optimal Control of Probabilistic Dynamics Models via Mean Hamiltonian Minimization.” *arXiv preprint arXiv:2504.02543*, 2025. doi:10.48550/arxiv.2504.02543. (TR839, [Optimal Control of Probabilistic Dynamics Models via Mean-Hamiltonian Minimization with Ram-Jet Exact Sensitivities]).
- [649] Fabian Schramm, Pierre Antoine Fabre, Nicolas Perrin-Gilbert, and Justin Carpentier. “Reference-Free Sampling-Based Model Predictive Control.” *arXiv preprint arXiv:2511.19204*, 2025. arXiv:2511.19204. (TR841, [An Analytic Ram-Jet Deterministic Replacement for Reference-Free Sampling-Based Model Predictive Control Exact Horizon-Coupled Sensitivities within Smooth Trust Regions]).
- [650] Yuanji Liu, Haiming Mou, Hao Jiang, Qingdu Li, and Jianwei Zhang. “An Improved Hierarchical Optimization Framework for Walking Control of Underactuated Humanoid Robots Using Model Predictive Control and Whole Body Planner and Controller.” *Mathematics*, vol. 13, no. 1, art. 154, 2025. doi:10.3390/math13010154. (TR846, [Matrix-Exponential Hierarchical Optimization for Walking Control A Source-Faithful Ram-Calculus Reformulation and Validation Protocol]).
- [651] Deok Ha Kim, Jaeuk Cho, and Jong Hyeon Park. “Model Predictive Impedance Control and Gait Optimization for High-Speed Quadrupedal Running.” *Applied Sciences*, vol. 15, no. 16, art. 8861, 2025. doi:10.3390/app15168861. (TR847, [Model-Predictive Impedance Control and Gait Optimization Exact ZOH Structure, Conditional Sensitivities, and a Local Residual Extension]).

13.5 State Estimation, Identification, and General Robotic Modeling

- [652] Karthik Shaji, Sreeranj Jayadevan, Bo Yuan, Hongzhe Yu, and Yongxin Chen. “Path Integral Particle Filtering for Hybrid Systems via Saltation Matrices.” *arXiv preprint arXiv:2603.01176*, 2026. arXiv:2603.01176. (TR553, [The Saltation-Jet Estimator: Exact Local Ram-Jet Propagation of Particle Sensitivities and Covariance Across Guard Discontinuities A Path-Integral Particle Filter for Hybrid Systems]).
- [653] Sahand Farghdani, Omar Abdelrahman, and Robin Chhabra. “Fast and modular whole-body Lagrangian dynamics of legged robots with changing morphology.” *Nonlinear Dynamics*, vol. 114, no. 10, art. 703, 2026. doi:10.1007/s11071-026-12594-6. (TR558, [Panel-Jet Ram Transform for Fast and Modular Whole-Body Lagrangian Dynamics of Legged Robots with Changing Morphology Block-Tridiagonal (Thomas) Segment Coupling with Reconfiguration as Panel Add/Remove/Relink]).
- [654] Ye Zhang, Qi Chen, Longsen Gao, Rui Liu, Linyue Chu, Kangtong Mo, Zhengjian Kang, Wenyou Huang, and Xingyu Zhang. “Invertible liquid neural network-based learning of inverse kinematics and dynamics for robotic manipulators.” *Scientific Reports*, vol. 15, no. 1, art. 42311, 2025. doi:10.1038/s41598-025-26422-1. (TR783, [Conditioned Analytic Local Cores and Liquid Residuals for Manipulator Inverse Kinematics and Dynamics A Source-Verified Ram Calculus Reformulation]).
- [655] Yoshihiro Iwanaga and Yasutaka Fujimoto. “Enhancing computational efficiency of iLQR and DDP via the parametric representation of control inputs.” *Results in Control and Optimization*, vol. 20, p. 100587, 2025. doi:10.1016/j.rico.2025.100587. (TR818, [Rank-Aware Local Sensitivities for Parametric-Control iLQR and DDP]).
- [656] Junheng Li, Ziwei Duan, Junchao Ma, and Quan Nguyen. “Gait-Net-augmented Implicit Kino-dynamic MPC for Dynamic Variable-frequency Humanoid Locomotion over Discrete Terrains.” *In Robotics: Science and Systems XXI*, 2025. doi:10.15607/rss.2025.xxi.069. (TR821, [Condition-Gated Local Models for Gait-Net-Augmented Kino-Dynamic MPC]).
- [657] Sangli Teng. “Optimization-based Robot Control and State Estimation on Matrix Lie Groups.” *Dissertation, University of Michigan*, 2025. doi:10.7302/25629. (TR830, [Manifold-Native Ram-Jet Exact Sensitivities and Graph-Local Ram Operators for Optimization-Based Robot Control and State Estimation on Matrix Lie Groups]).

- [658] Hardik Parwana. “Online Adaptation for Safe Control of Constrained Dynamical Systems.” *Dissertation, University of Michigan*, 2025. doi:10.7302/25493. (TR831, [Online Adaptation for Safe Control of Constrained Nonlinear Dynamical Systems via Ram-Jet Operators A Ram Transform Analytic-Core-plus-Learned-Residual Formulation]).
- [659] Juraj Lieskovský, Jaroslav Bušek, and Tomáš Vyhlídal. “Continuous-time iterative linear-quadratic regulator.” *arXiv preprint arXiv:2505.15525*, 2025. doi:10.48550/arxiv.2505.15525. (TR833, [Continuous-Time iLQR via Exact Ram-Jet Flow Maps: Variable-Coefficient Riccati/Costate Operator Inversion with Certified Per-Panel Sensitivity Bounds Source-Faithful Continuous-Time iLQR and a Defect-Validated Local-Series Extension]).
- [660] Nicola Scianca and Enrico Mingo Hoffman. “CPC: Cascaded Predictive Control.” In *2025 IEEE-RAS 24th International Conference on Humanoid Robots (Humanoids)*, pp. 237-244, 2025. doi:10.1109/humanoids65713.2025.11203075. (TR840, [A Cascade-Coupling Ram-Jet Operator for Hierarchical Predictive Control of Humanoids Nested Panel Jets with Structured Inter-Stage Coupling]).
- [661] Juan Alvarez-Padilla, John Z. Zhang, Sofia Kwok, John M. Dolan, and Zachary Manchester. “Real-Time Whole-Body Control of Legged Robots with Model-Predictive Path Integral Control.” In *2025 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 14721-14727, 2025. doi:10.1109/icra55743.2025.11128271. (TR842, [A Fokker-Planck-Ram Analytic Core for Sampling-Based Whole-Body Model-Predictive Path-Integral Control of Legged Robots]).
- [662] Thomas Corbères, Carlos Mastalli, Wolfgang Merkt, Jaehyun Shim, Ioannis Havoutis, Maurice Fallon, Nicolas Mansard, Thomas Flayols, Sethu Vijayakumar, and Steve Tonneau. “Perceptive Locomotion Through Whole-Body MPC and Optimal Region Selection.” *IEEE Access*, vol. 13, pp. 69062-69080, 2025. doi:10.1109/access.2025.3558093. (TR843, [Panel-Jet Whole-Body MPC with Mode-Switch Coupling for Perceptive Locomotion and Optimal Region Selection A Ram-Transform Extension with Per-Region Local Jets]).
- [663] Han Jiang, Teng Chen, Guoteng Zhang, Xuwen Rong, and Yibin Li. “A Nonlinear MPC and Hybrid Whole-body Control Framework for Optimizing Agile Motions in Quadruped Robots.” *International Journal of Control, Automation and Systems*, vol. 23, no. 9, pp. 2666-2677, 2025. doi:10.1007/s12555-025-0059-9. (TR845, [A Ram-Jet Nonlinear MPC and Hybrid Panel-Jet Whole-Body Control Framework for Agile Quadruped Locomotion]).

14 Graph Learning and Network Inference

23 bibliography items.

14.1 Factor-Graph Optimization

- [664] Jaeho Shin, Maani Ghaffari, and Yulun Tian. “Learning Adaptive Solvers for Distributed Factor Graph Optimization on Matrix Lie Groups.” *arXiv preprint arXiv:2607.08735*, 2026. doi:10.48550/arxiv.2607.08735. (TR213, [Analytic Local Ram Message/Covariance Jets on Matrix Lie Groups for Distributed Factor-Graph Optimization An Analytic-Core-plus-Learned-Residual Alternative to Black-Box Learned Solvers]).

14.2 Dynamical-Process and Network Inference

- [665] Javier Ureña-Carrion, Tiago P. Peixoto, and Gerardo Iñiguez. “Statistical inference of dynamical processes on networks.” *arXiv preprint arXiv:2607.08672*, 2026. doi:10.48550/arxiv.2607.08672. (TR285, [A Ram-Transform Identification Framework for Statistical Inference of Dynamical Processes on Networks]).

14.3 Graph Neural Networks and Spectral Representation Learning

- [666] Gongpei Zhao, Tao Wang, Yi Jin, Congyan Lang, Yidong Li, and Haibin Ling. “GrassNet: State space model meets graph neural network.” *Pattern Recognition*, vol. 176, p. 113197, 2026. doi:10.1016/j.patcog.2026.113197. (TR565, [A Graph-Global Ram Transform View of GrassNet: SSM Graph Filters as Functional-Calculus Master-Atom Instances]).
- [667] Idowu Paul Okuwobi, Jingyuan Liu, Olayinka Susan Raji, and Olusola Funsho Abiodun. “SGNet: Spectral-geometric neural network for structured representation learning.” *Neural Networks*, vol. 203, p. 109135, 2026. doi:10.1016/j.neunet.2026.109135. (TR566, [SGNet as an Instance of the Graph-Global Ram Transform: Analytic Spectral Core plus Learned Geometric Residual A derivation showing that the spectral-geometric filter of SGNet is recovered exactly by the GGRT restriction theorem (TR190-TR191), with its geometric coupling isolated as a double-domain panel (TR192) or a learned residual (TR165)]).
- [668] Niloofar Azizi, Nils M. Kriege, Nicholas J. A. Harvey, and Horst Bischof. “Spectral Basis Learning for Expressive Graph Neural Networks in Link Prediction.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, no. 24, pp. 19640-19648, 2026. doi:10.1609/aaai.v40i24.39044. (TR568, [A Graph-Global Ram Transform (GGRT) Re-derivation of Learned Spectral-Basis Graph Neural Networks for Link Prediction Analytic Core plus Supervised Spectral Residual (TR165 umbrella)]).
- [669] Daozheng Qu and Yanfei Ma. “F2-CommNet: Fourier-Fractional neural networks with Lyapunov stability guarantees for hallucination-resistant community detection.” *Frontiers in Computational Neuroscience*, vol. 19, art. 1731452, 2026. doi:10.3389/fncom.2025.1731452. (TR572, [Graph-Global Ram Transform Analysis of F2-CommNet: Fourier-Fractional Spectral Filtering as an Exact GGRT Instance with a Lyapunov-Certified Core-plus-Residual Recasting]).
- [670] Jeongwhan Choi, Seungjun Park, Sumin Park, Sung-Bae Cho, and Noseong Park. “Are Graph Transformers Necessary? Efficient Long-Range Message Passing with Fractal Nodes in MPNNs.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, no. 25, pp. 20553-20561, 2026. doi:10.1609/aaai.v40i25.39191. (TR574, [A Ram-Transform Re-Derivation of Fractal-Node Long-Range Message Passing as a Composite GLRT+GGRT Operator]).
- [671] Mohamed Ilyas El Harrak, Omar Bahou, Karim El Moutaouakil, Ahmed Nuino, Eddakir Abdellatif, and Alina-Mihaela Patriciu. “Fractional Variational Graph Autoencoders for Enhancing Non-Local Representation Learning on Graphs.” *Information*, vol. 17, no. 5, art. 446, 2026. doi:10.3390/info17050446. (TR575, [A Fractional-Order Graph-Global Ram Transform Core with a Learned Variational Residual for Non-Local Graph Representation Learning]).
- [672] Ming Jin, Guangsi Shi, Yuan-Fang Li, Bo Xiong, Tian Zhou, Flora D. Salim, Liang Zhao, Lingfei Wu, Qingsong Wen, and Shirui Pan. “Towards Expressive Spectral-Temporal Graph Neural Networks for Time Series Forecasting.” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 47, no. 6, pp. 4926-4939, 2025. doi:10.1109/tpami.2025.3545671. (TR848, [Expressive Spectral-Temporal Graph Networks for Forecasting Tensor-Product Operator Derivation, Adjoint, Conditioning, and Local Polynomial Reformulation]).
- [673] Jianbo Zheng, Chao Yang, Tairui Zhang, Longbing Cao, Bin Jiang, Xuhui Fan, Xiao-ming Wu, and Xianxun Zhu. “Dynamic Spectral Graph Anomaly Detection.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 39, no. 12, pp. 13410-13418, 2025. doi:10.1609/aaai.v39i12.33464. (TR849, [Dynamic Spectral Graph Anomaly Detection Adaptive Beta-Wavelet Operators, Frame Conditioning, and a Source-Faithful Ram Reformulation]).

- [674] Burak Karabulut, Carlo Manna, and Chris Develder. “Generalization of Graph Neural Network Models for Distribution Grid Fault Detection.” In *2025 IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (SmartGridComm)*, pp. 1-7, 2025. doi:10.1109/smartgridcomm65349.2025.11204594. (TR851, [Generalization of GNN Fault Detectors Across PMU Deployments Source-Faithful GRU-Graph Operators and a Conditional Analytic Preprocessor]).
- [675] Min Pang, Erhu Du, and Chunmiao Zheng. “Contaminant Transport Modeling and Source Attribution With Attention-Based Graph Neural Network.” *Water Resources Research*, vol. 60, no. 6, art. e2023WR035278, 2024. doi:10.1029/2023wr035278. (TR975, [Analytic Graph-Transport Core plus Learned Attention Residual for Contaminant Source Attribution: A Ram Transform (GGRT) Derivation and Inverse-Source Read-Out A Design-Around Under the TR165 / TR190-192 Genus]).
- [676] Gregory Duthé, Francisco de N Santos, Imad Abdallah, Wout Weijtjens, Christof Devriendt, and Eleni Chatzi. “Flexible multi-fidelity framework for load estimation of wind farms through graph neural networks and transfer learning.” *Data-Centric Engineering*, vol. 5, art. e29, 2024. doi:10.1017/dce.2024.35. (TR978, [An Analytic-Core Graph Ram Transform for Multi-Fidelity Wind-Farm Load Estimation: Local Exact Inversion, Certified Error Bounds, and Learned-Residual Fusion]).

14.4 Hypergraph, Sheaf, and Higher-Order Network Learning

- [677] Ming Li, Yujie Fang, Dongrui Shen, Han Feng, Xiaosheng Zhuang, Kelin Xia, and Pietro Lio. “High-Pass Matters: Theoretical Insights and Sheaflet-Based Design for Hypergraph Neural Networks.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, no. 27, pp. 23039-23046, 2026. doi:10.1609/aaai.v40i27.39469. (TR570, [A Graph-Global Ram Transform Formulation of Hypergraph-Sheaf High-Pass (Sheaflet) Filter Banks: Extending the GGRT Restriction Theorem to Hypergraph Incidence and Cellular-Sheaf Coboundary Operators]).
- [678] Ming Li, Yi Wang, Chengling Gao, Lu Bai, Yujie Fang, Xiaosheng Zhuang, and Pietro Lio. “Permutation Equivariant Framelet-based Hypergraph Neural Networks.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, no. 27, pp. 23079-23086, 2026. doi:10.1609/aaai.v40i27.39474. (TR571, [A Graph-Global Ram Transform Formulation of Permutation-Equivariant Framelet Hypergraph Neural Networks Analytic Tight-Frame Core plus Learned Per-Band Residual]).

14.5 Graph Signal Processing and Spectral Transforms

- [679] Harry H. Behjat, Carl-Fredrik Westin, Rik Ossenkoppele, and Dimitri Van De Ville. “Signal-Adapted Decomposition of Graph Signals.” In *Signals and Communication Technology*, pp. 189-223, Springer Nature Switzerland, 2026. doi:10.1007/978-3-032-16589-3_4. (TR576, [Signal-Adapted Decomposition of Graph Signals as a Restriction Instance of the Graph-Global Ram Transform (GGRT) with an Analytic-Core-Plus-Learned-Residual Master Atom]).
- [680] Daxiang Li and Zhichao Zhang. “Graph Fractional Hilbert Transform: Theory and Application.” *Fractal and Fractional*, vol. 10, no. 2, art. 74, 2026. doi:10.3390/fractalfract10020074. (TR577, [The Graph Fractional Hilbert Transform as a Restriction Instance of the Graph-Global Ram Transform (GGRT) A Master-Atom Derivation, Five-Tier Analytic Inverse, and Scalable Localized Realization]).
- [681] Yifang Qin, Wei Ju, Yiyang Gu, Ziyue Qiao, Zhiping Xiao, and Ming Zhang. “PolyCF: Towards Optimal Spectral Graph Filters for Collaborative Filtering.” *ACM Transactions on Information Systems*, vol. 43, no. 4, pp. 1-28, 2025. doi:10.1145/3728464. (TR850, [PolyCF Spectral Graph Filters for Collaborative Filtering Weighted Adjoints, Polynomial Recurrences, Identifiability, and Conditional Reconstruction]).

14.6 Graph Applications, Spatiotemporal Prediction, and Anomaly Detection

- [682] Die Liu, Jianxi Yang, Jianming Li, Jingyuan Shen, Youjia Zhang, Lihua Chen, and Lei Zhou. “LGSTA-GNN: A Local-Global Spatiotemporal Attention Graph Neural Network for Bridge Structural Damage Detection.” *Buildings*, vol. 16, no. 2, art. 348, 2026. doi:10.3390/buildings16020348. (TR567, [Analytic-Core Spatiotemporal Graph Inverse-Identification for Bridge Structural Damage Detection: A GGRT+GLRT Ram Transform Reformulation of LGSTA-GNN]).
- [683] Seyed-Majid Hosseini, S. Mozghan Rahmatinia, and Seyed-Amin Hosseini-Seno. “Integrated spatio-temporal modeling with hybrid graph convolutions and the graph fourier neural operator for traffic prediction.” *Scientific Reports*, vol. 16, no. 1, art. 12945, 2026. doi:10.1038/s41598-026-38563-y. (TR569, [A Graph-Global Ram Transform with Panelized Temporal Inversion for Spatio-Temporal Traffic Prediction: Recovering the Graph Fourier Neural Operator as an Exact Restriction Instance]).
- [684] Wei Zhao and Hao Chen. “Learning frequency-aware graph fraud detection.” *Neural Networks*, vol. 198, p. 108600, 2026. doi:10.1016/j.neunet.2026.108600. (TR578, [Frequency-Aware Graph Fraud Detection as a Restriction Instance of the Graph-Global Ram Transform: An Analytic-Core-Plus-Learned-Residual Formulation]).
- [685] Dongyue Guo, Zheng Zhang, Jiayi Liu, Jianwei Zhang, and Yi Lin. “Multi-horizon flight trajectory prediction enabled by time-frequency wavelet transform.” *Nature Communications*, vol. 17, no. 1, art. 633, 2025. doi:10.1038/s41467-025-67399-9. (TR852, [Wavelet-Enabled Multi-Horizon Flight Trajectory Prediction Perfect-Reconstruction Conditions, Forecast Error Decomposition, and an Analytic Trend Residual]).
- [686] Shaodan Zhi, Yuli Niu, Limei Ma, Hengshan Wu, Haikuo Shen, and Tianyang Wang. “Local Entropy Selection Scaling-extracting Chirplet Transform for Enhanced Time-Frequency Analysis and Precise State Estimation in Reliability-Focused Fault Diagnosis of Non-stationary Signals.” *Eksploatacja i Niezawodność - Maintenance and Reliability*, 2025. doi:10.17531/ein/205977. (TR853, [Local-Entropy-Selected Scaling-Extracting Chirplet Analysis Selection Stability, Frame Conditioning, and a Local Polynomial-Phase Reformulation]).

15 Power Electronics and Converter Systems

107 bibliography items.

15.1 Dual-Active-Bridge Modulation, ZVS, and Optimization

- [687] Xinze Li, Xin Zhang, Fanfan Lin, Changjiang Sun, and Kezhi Mao. “Artificial-Intelligence-Based Hybrid Extended Phase Shift Modulation for the Dual Active Bridge Converter With Full ZVS Range and Optimal Efficiency.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 11, no. 6, pp. 5569-5581, 2023. doi:10.1109/jestpe.2022.3185090. (TR203, [A Panel-Jet Analytic Core with a Learned Residual for Full-ZVS, Optimal-Efficiency Extended-Phase-Shift Modulation of the Dual Active Bridge Converter]).
- [688] Payam Morsali, Saikat Dey, Ayan Mallik, and Akin Akturk. “Switching Modulation Optimization for Efficiency Maximization in a Single-Stage Series Resonant DAB-Based DC-AC Converter.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 11, no. 5, pp. 5454-5469, 2023. doi:10.1109/jestpe.2023.3302839. (TR204, [A Two-Timescale Panel-Jet Ram Transform for Series-Resonant DAB DC-AC Converters: Exact-Sensitivity Modulation Optimization for Efficiency Maximization]).
- [689] Dingsihao Lyu, Coen Straathof, Thiago Batista Soeiro, Zian Qin, and Pavol Bauer. “ZVS-Optimized Constant and Variable Switching Frequency Modulation Schemes for Dual Active Bridge Converters.” *IEEE Open Journal of Power Electronics*, vol. 4, pp. 801-816, 2023. doi:10.1109/ojpe.2023.3319970. (TR205, [Panel-Jet Ram Transform for ZVS-Optimized Constant- and Variable-Frequency Modulation of Dual Active Bridge Converters]).

- [690] Xinze Li, Josep Pou, Jiaxin Dong, Fanfan Lin, Changyun Wen, Suvajit Mukherjee, and Xin Zhang. “Data-Driven Modeling With Experimental Augmentation for the Modulation Strategy of the Dual-Active-Bridge Converter.” *IEEE Transactions on Industrial Electronics*, vol. 71, no. 3, pp. 2626-2637, 2024. doi:10.1109/tie.2023.3265027. (TR206, [Analytic-Core-Plus-Learned-Residual Ram Transform for Dual-Active-Bridge Modulation-Strategy Modeling A Panel-Jet Switching-Waveform Operator with Semi-Blind Residual Calibration]).
- [691] Fanfan Lin, Xin Zhang, Xinze Li, Changjiang Sun, Gabriel Zsurzsan, Wenjian Cai, and Chang Wang. “AI-Based Design With Data Trimming for Hybrid Phase Shift Modulation for Minimum-Current-Stress Dual Active Bridge Converter.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 12, no. 2, pp. 2268-2280, 2024. doi:10.1109/jestpe.2022.3232534. (TR207, [Analytic-Core-plus-Certified-Optimizer Ram Panel-Jet Operator for Minimum-Current-Stress Hybrid Phase-Shift Modulation of the Dual-Active-Bridge Converter A design-around of AI-based data-trimming modulation selection]).
- [692] Grzegorz Wrona, Mariusz Zdanowski, Przemysław Trochimiuk, Jacek Rąbkowski, and Radosław Sobieski. “Experimental Validation of 40 kW EV Charger Based on Vienna Rectifier and Series-Resonant Dual Active Bridge.” *Energies*, vol. 16, no. 15, art. 5797, 2023. doi:10.3390/en16155797. (TR208, [Analytic Panel-Jet Ram Operators for a Two-Stage 40 kW EV Fast Charger: Vienna-Rectifier PFC Front End Cascaded with a Series-Resonant Dual Active Bridge]).
- [693] Biaoguang Sun and Zhenfeng Liu. “A Hybrid Optimal Modulation Strategy for Dual-Side Asymmetric Duty Cycles in a Dual-Active-Bridge Converter.” *Energies*, vol. 19, no. 5, art. 1365, 2026. doi:10.3390/en19051365. (TR580, [A Panel-Jet Ram Transform for Dual-Side Asymmetric-Duty Modulation in Dual-Active-Bridge Converters Exact Piecewise-Analytic Period Maps and Jet-Based Optimal Modulation]).
- [694] Tae-Hyeon Lim, Jin-Su Jang, and Gi-Young Lee. “Modeling and Control Gain Design Method for Dual Active Bridge Converter With Dual-Phase-Shift Modulation.” *IEEE Access*, vol. 14, pp. 12337-12353, 2026. doi:10.1109/access.2026.3655399. (TR581, [Panel-Jet Ram Transform for Dual-Phase-Shift Dual Active Bridge Converters: Closed-Form Modeling and Control-Gain Design]).
- [695] Hao Yang, Kunhui Xu, Song Qiu, and Qingxiang Liu. “Dynamic Response Control of Dual Active Bridge Converters Incorporating Current Stress Optimization.” *Actuators*, vol. 15, no. 3, art. 153, 2026. doi:10.3390/act15030153. (TR582, [Jet-Based Dynamic-Response Control of Dual Active Bridge Converters with Certified Current-Stress Bounds A Panel-Jet Ram-Transform Extension of the Closed-Form Switching-Waveform Operator into the Transient Control Layer]).
- [696] Luming Liu and Zhiqiang Guo. “Control Strategy and Modulation Scheme of Three-Phase Quasi-Single-Stage Isolated AC-DC Converter Based on Dual Active Bridge.” *IEEE Transactions on Power Electronics*, vol. 41, no. 6, pp. 10025-10040, 2026. doi:10.1109/tpe.2026.3653803. (TR583, [Panel-Jet Ram Transform for Closed-Form Modulation Synthesis of Three-Phase Quasi-Single-Stage Isolated AC-DC DAB Converters Analytic-Core-plus-Learned-Residual Class (TR165) Power-Electronics Panel-Jet Class (TR197)]).
- [697] Tao Jin, Lingxiang Chen, Minxin Lin, and Chang Qiu. “Transient DC Bias Suppression Strategy and Zero-Voltage Switching Boundary Analysis for Three-Level Dual-Active-Bridge Converter.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, pp. 1-1, 2026. doi:10.1109/jestpe.2026.3686220. (TR584, [Panel-Jet Ram Transform for Three-Level Dual-Active-Bridge Converters: Closed-Form Transient DC-Bias Suppression and Certified Analytic ZVS-Boundary Analysis]).
- [698] Imad Hussain, Yigang He, Muhammad Mansoor Khan, Atta Ullah Khan, Aftab Ali Samejo, and Andres Anuk. “Optimal design and sensitivity analysis of a dual active bridge converter for electrolyzer-based hydrogen production.” *Journal of Power Sources*, vol. 676, p. 239923, 2026. doi:10.1016/j.jpowsour.2026.239923. (TR585, [Panel-Jet Ram Transform for Optimal Design and Sensitivity Analysis of a Dual-Active-Bridge Converter Feeding a Nonlinear Electrolyzer Load: A Periodic Block-Tridiagonal Steady-State Formulation with Exact Ram-Jet Sensitivities and Butler-Volmer Boundary Coupling]).
- [699] Haoyu Wang, Tong Jiang, and Shiwei Xia. “Coherency Identification and Aggregation Algorithms for Parallel DAB Systems in DC Microgrids.” *IET Renewable Power Generation*, vol. 20, no. 1, art. e70203,

2026. doi:10.1049/rpg2.70203. (TR587, [Coherency Identification and Dynamic Aggregation of Parallel Dual-Active-Bridge (DAB) Converter Clusters in DC Microgrids: A Panel-Jet plus Graph-Global Ram Transform Approach]).
- [700] Camilo Suarez-Buitrago, Diego Gerardo Bernal Cobaleda, and Wilmar Martinez. “Virtual Switched Inductor Modulation for DAB Converters.” In *2026 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 2022-2028, 2026. doi:10.1109/apec51134.2026.11516699. (TR590, [Panel-Jet Ram Transform Instance for Virtual Switched-Inductor Modulation (VSIM) in Dual-Active-Bridge Converters A Narrow Power-Electronics Application of the TR197 Switching-Waveform Operator Family]).
- [701] Vicente Esteve, José Jordán, Alfredo Pomar, and Víctor Pérez. “Bidirectional Dual Active Bridge Converter with Extended Voltage Range for HEMS Applications.” *Electronics*, vol. 15, no. 7, art. 1391, 2026. doi:10.3390/electronics15071391. (TR591, [Panel-Jet Ram Transforms for the Extended-Voltage-Range Bidirectional Dual Active Bridge Converter in HEMS Applications An Application Instance of the TR197/P197 Switching-Waveform Operator with Block-Tridiagonal Multi-Mode Boundary Coupling]).
- [702] Jamil Hassan, Aswin Palanisamy, Minsung Kim, Dylan Lu, and Yam P. Siwakoti. “Symmetric Unipolar Pulse Width Modulation for Dual Active Bridge Converters.” *IEEE Transactions on Power Electronics*, pp. 1-12, 2026. doi:10.1109/tpel.2026.3660729. (TR592, [A Panel-Jet Ram Transform for Symmetric Unipolar PWM Dual Active Bridge Converters Closed-Form Switching-Waveform Operators, Block-Tridiagonal Steady-State Closure and a Patentability Assessment relative to TR197/P197]).
- [703] Gengning Ying, Jun Zeng, Ningrui Yang, Junfeng Liu, and Zhixing Yan. “Synchronous PWM Modulation to Eliminate Circulating Power in Bidirectional Dual-Active-Bridge Converter.” *CSEE Journal of Power and Energy Systems*, vol. 12, no. 1, pp. 294-305, 2026. doi:10.17775/cseejpes.2022.00800. (TR593, [Panel-Jet Ram Transform for Circulating-Power Elimination in Synchronous-PWM Bidirectional Dual-Active-Bridge Converters A Circulating-Power Functional Operator with Exact Modulation-Parameter Sensitivities]).
- [704] Hui Cao, Peyman Darvish, Xianfeng Jiang, and Yue Zhao. “A Generic Transient DC Bias Elimination Method for Dual- and Triple-Active Bridge Converters.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, pp. 1-1, 2026. doi:10.1109/jestpe.2026.3670321. (TR594, [A Panel-Jet Ram Transform for Exact Transient DC-Bias Elimination in Dual- and Triple-Active-Bridge Converters]).
- [705] Conrado G. Marques, João P. S. Cipriani, Leandro Roggia, Marina S. Perdigão, Jonas R. Tibola, and Álysson R. Seidel. “Efficiency Optimization of a Dual Active Bridge Converter with a Variable Inductor for Battery Charging Applications.” *Eletrônica de Potência*, vol. 31, art. e202622, 2026. doi:10.18618/rep.e202622. (TR595, [Panel-Jet Ram Transform for a Dual Active Bridge Converter with a Current-Dependent (Variable) Inductor: Closed-Form Waveforms and Certified Efficiency Optimization Design-around / continuation of TR197 (panel-jet DAB) anchored on TR182 (variable-coefficient inversion) and TR198 (jet sensitivities)]).
- [706] Mohamed R. Farid, Ahmed L. Elrefai, and Sobhy M. Abdelkader. “Comparative Analysis of Single-Phase Shift and Extended Phase Shift Modulations in Dual Active Bridge Converters for Fast EV Charging.” *Renewable Energies, Environment and Power Quality Journal*, vol. 25, no. 4, pp. 393-398, 2026. doi:10.24084/reepqj25-567. (TR597, [Panel-Jet Ram Transform Analysis of Single-Phase-Shift and Extended-Phase-Shift Modulation in Dual Active Bridge Converters for Fast EV Charging]).
- [707] Jiawei Zhang, Jiaxiong Xu, Miao Yu, Xin Zhang, and Huai Wang. “A Novel State-Attention-Based Hybrid RNN Controller for Dual Active Bridge Converter With Multiple Degrees of Freedom Modulation.” *IEEE Transactions on Industrial Electronics*, vol. 73, no. 7, pp. 10605-10617, 2026. doi:10.1109/tie.2026.3656990. (TR598, [Analytic-Core-Plus-Learned-Residual Control of a Multi-DOF Dual Active Bridge Converter via Panel-Jet Ram Transforms]).
- [708] Zhaoxin Wang, Shuke Luo, and Peng Liu. “Frequency-Domain-Based Variable-Frequency Phase-Shift Modulation Strategy for Dual-Active-Bridge Converters.” *Electronics*, vol. 15, no. 10, art. 1980, 2026. doi:10.3390/electronics15101980. (TR599, [A Panel-Jet Ram Transform for Variable-Frequency Phase-Shift Modulation of Dual-Active-Bridge Converters: Closed-Form Waveform, Harmonic, and Inverse-Design Operators]).

- [709] Zhiyi Zhao, Long Jing, Wenzheng Xu, and Xianglu Liu. “RMS current characteristics and optimized control of dual-active-bridge converters based on triple-phase-shift modulation.” *Electric Power Systems Research*, vol. 260, p. 113301, 2026. doi:10.1016/j.epsr.2026.113301. (TR600, [Panel-Jet Segment Integrals for RMS-Current Characterization and Optimized Triple-Phase-Shift Control of Dual-Active-Bridge Converters]).
- [710] Yueshi Guan, Huan Liu, Yiliang Li, Yijie Wang, and Dianguo Xu. “A Three-Phase Dual Active Bridge Converter with Switch Devices Sharing.” In *Lecture Notes in Electrical Engineering*, pp. 712-720, Springer Nature Singapore, 2026. doi:10.1007/978-981-95-4294-9_75. (TR601, [A Panel-Jet Ram Transform for Three-Phase Device-Sharing Dual Active Bridge Converters: A Block-Tridiagonal Multi-Panel Extension of TR197/P197]).
- [711] Lili Xu, Yuting Yu, Muhamad Nabil Hidayat, Nik Hakimi Nik Ali, Muhammad Umair, and Ezmin Abdullah. “A fundamental optimal modulation strategy for DAB converters based on a unified phase-shift control model.” *International Journal of Electronics*, vol. 113, no. 8, pp. 1542-1568, 2026. doi:10.1080/00207217.2026.2630813. (TR602, [A Ram-Transform Panel-Jet Formulation of Optimal Modulation for Dual-Active-Bridge Converters under a Unified Phase-Shift Model: Analytic-Core Panel Waveform Operators with Certified Ram-Jet Sensitivities]).
- [712] Xinming Shao, Yu Xiao, Jiayu Fan, Chuang Liu, Wei Xu, Zhonghao Dongye, and Dongsheng Yang. “The Dual-Voltage Match Modulation and Control Method for Inductor RMS Current Optimization in the Three-Port MMDC DAB Converter.” *IEEE Transactions on Industrial Electronics*, vol. 73, no. 6, pp. 8703-8715, 2026. doi:10.1109/tie.2026.3651387. (TR603, [Panel-Jet Ram Transform for Inductor-RMS-Current-Optimal Dual-Voltage-Match Modulation in the Three-Port MMDC DAB Converter A Closed-Form Switching-Waveform Operator with Certified Optimality]).
- [713] Hean Ming Kang, Jaydeep Saha, Yeh Ting, Sanjib Kumar Panda, and Dipti Srinivasan. “Closed-form Solution for Conduction Loss Minimization in Dual-Active-Bridge Converter for Satellite Payload Application.” In *2026 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 37-44, 2026. doi:10.1109/apec51134.2026.11517047. (TR604, [Panel-Jet Ram Transform for Closed-Form Conduction-Loss Minimization in a Dual-Active-Bridge Converter A Specialization of the TR197 DAB Panel-Jet Operator to a Satellite-Payload Loss Objective]).
- [714] Mohamad Fathi Mohamad Elias, Intan Mastura Saadon, and Norridah Amin. “Design and performance analysis of a simplified hybrid modulation method for dual active bridge powering inverters.” *PLOS One*, vol. 21, no. 2, art. e0341443, 2026. doi:10.1371/journal.pone.0341443. (TR605, [A Panel-Jet Ram Transform for Simplified Hybrid Modulation in Dual-Active-Bridge Converters Powering Inverter Stages A Specialization of the P197 Closed-Form Switching-Waveform Operator Family]).
- [715] Naveed Ishraq, Wriddik Dutta, Ayan Mallik, Saikat Dey, and Changkyu Bai. “Non-linear Discrete Time Modeling of a 1 MHz Dual Active Bridge Converter.” In *2026 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 1192-1199, 2026. doi:10.1109/apec51134.2026.11516816. (TR606, [Nonlinear Discrete-Time Modeling of a 1 MHz Dual Active Bridge Converter via Panel-Jet Ram Transforms with Exact Sensitivities]).
- [716] Martin Scohier, Miguel López Gajardo, Olivier Deblecker, Tomislav Dragičević, and Bashir Bakhshideh Zad. “An Informed Modulation Strategy for Stability Enhancement of DAB Converters Connected to a DC Railway Grid.” *IEEE Journal of Emerging and Selected Topics in Industrial Electronics*, vol. 7, no. 2, pp. 641-652, 2026. doi:10.1109/jestie.2026.3665345. (TR607, [Panel-Jet Ram Transform for Informed Modulation and Stability Enhancement of DAB Converters Connected to a DC Railway Grid]).
- [717] Hao Li, Xianrui Sun, Chonghui Song, Longfei Guan, Guangdi Li, Dongsheng Yang, Naizhe Diao, and Nie Hou. “A Simple Direct-Duty-Cycle-Based Asymmetric Triple Phase Shift Modulation to Enhance Efficiency for Dual Active Bridge Converters.” *IEEE Transactions on Transportation Electrification*, pp. 1-1, 2026. doi:10.1109/tte.2026.3677084. (TR608, [An Invertible Panel-Jet Ram Transform for Direct-Duty-Cycle Asymmetric Triple-Phase-Shift Modulation of Dual-Active-Bridge Converters: Closed-Form Currents, Certified Sensitivities and Efficiency-Optimal Operating-Point Selection]).

- [718] Jiayun Liu, Qianming Xu, Jiayu Hu, Peng Guo, Qiaopo Xiong, Nan Mo, Guanqing Zhou, Zhikang Shuai, and An Luo. “Analysis and Optimization of 3/2LNPC-DAB Converters to Minimize Current Stress With Four-Degree-of-Freedom Modulation.” *IEEE Transactions on Power Electronics*, pp. 1-17, 2026. doi:10.1109/tpel.2026.3659031. (TR609, [A Panel-Jet Ram Transform Formulation of Four-Degree-of-Freedom Modulation for Current-Stress Minimization in 3/2LNPC-DAB Converters]).
- [719] Harikesh V. Kurup, Shelas Sathyan, and Praveen Kumar K. S.. “Reconfigurable DAB Converter With Variable Transformer Turns for Wide Voltage Range Using Hybrid EPS Modulation.” *IEEE Transactions on Industrial Electronics*, pp. 1-12, 2026. doi:10.1109/tie.2026.3675087. (TR610, [Multimodal Panel-Jet Ram Transform for the Reconfigurable-Turns Dual-Active-Bridge Converter with Hybrid Extended-Phase-Shift Modulation]).
- [720] Zihao Zhu, Chengming Zhang, Yiming Sun, and Liyi Li. “Modulation Optimization of NFFB-DAB Converter to Minimize RMS Current for Aircraft Onboard Energy Storage Applications.” *Journal of Physics: Conference Series*, vol. 3214, no. 1, art. 012076, 2026. doi:10.1088/1742-6596/3214/1/012076. (TR613, [Panel-Jet Ram Transform for RMS-Current Modulation Optimization of the NFFB-DAB Converter in Aircraft Onboard Energy Storage: A Closed-Form Piecewise-Analytic Waveform Operator with Exact Sensitivities for Certified-Optimal Modulation]).
- [721] Anirudh Ashok Pise, Rahul Birari, Nasser Kutkut, and Issa Batarseh. “Analytical Modeling and Optimal Dual Phase Shift Modulation of High-Gain Dual Active Bridge with Stacked Secondary Phases.” In *2026 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 2076-2081, 2026. doi:10.1109/apec51134.2026.11517008. (TR615, [Multimodal Panel-Jet Ram Transform and Certified-Sensitivity Optimal Dual-Phase-Shift Modulation for High-Gain Dual Active Bridge with Stacked Secondary Phases]).
- [722] Jahangeer Ahmad Dar and Mukesh Kumar Pathak. “Optimal Control Scheme for Minimum Backflow Power and Extended ZVS range for Dual Active Bridge Converter.” *SSRN working paper*, 2026. doi:10.2139/ssrn.6536134. (TR616, [Certified-Bound Optimal Modulation for the Dual Active Bridge Converter via Panel-Jet Waveform Operators and Ram-Jet Trajectory Optimization Minimum Backflow Power and Extended ZVS Range as an Analytic-Core Ram Transform Composition]).
- [723] Jajjala Bikash Kashyap and E S N Raju P. “Comparative Analysis of Single, Dual, and Triple Phase-Shift Control Strategies for Dual Active Bridge DC-DC Converters.” In *2026 4th Odisha International Conference on Electrical Power Engineering, Communication and Computing Technology (ODICON)*, pp. 1-6, 2026. doi:10.1109/odicon66687.2026.11470812. (TR618, [Panel-Jet Ram Operators for Single-, Dual-, and Triple-Phase-Shift Control of Dual Active Bridge DC-DC Converters: A Comparative Derivation]).
- [724] Gayoung Park, Hwigoon Kim, Byung-Geuk Cho, and Shenghui Cui. “ZVS-Enhanced and RMS-Current-Minimized Optimal Modulation Scheme of Dual-Active Bridge Converter With Comprehensive ZVS Analysis.” *IEEE Transactions on Power Electronics*, vol. 40, no. 7, pp. 9004-9018, 2025. doi:10.1109/tpel.2025.3541847. (TR854, [ZVS-Enhanced, RMS-Current-Minimized Modulation of a DAB Converter Exact Panel Maps, Nonlinear Commutation Charge, and Conditional Sensitivities]).
- [725] Guanqun Qiu and Vinod Khadkikar. “Six-Degree-of-Freedom Modulation Technique for Dual Active Bridge DC-DC Converter.” *IEEE Transactions on Power Electronics*, vol. 40, no. 9, pp. 12739-12753, 2025. doi:10.1109/tpel.2025.3563783. (TR855, [Six-Degree-of-Freedom Modulation for a Dual Active Bridge Frequency-Aware Panel Maps, Loss Functionals, and Rank-Aware Optimization]).
- [726] Junrui Wang, Xuanjing Qiao, Linhui Li, and Ruiqi Li. “An optimal control for dual active bridge converter in battery charging applications.” *IET Power Electronics*, vol. 18, no. 1, art. e12850, 2025. doi:10.1049/pe12.12850. (TR856, [Panel-Jet and Ram-Jet Optimal Control of the Dual Active Bridge Converter for Battery-Charging Applications A Local-Analytic (Ram Transform) Formulation of the Switched Optimal-Control BVP with Certified Sensitivities]).
- [727] Tarek Younis, Fahad Saleh Al-Ismail, Syed Muhammad Amrr, and S. M. Suhail Hussain. “Optimization Strategies for Triple-Phase-Shift Modulation in Dual-Active-Bridge Converters: A Comprehensive Review.” *IEEE Access*, vol. 13, pp. 152748-152761, 2025. doi:10.1109/access.2025.3603104. (TR857, [Ram-Jet Panel

Operators for Triple-Phase-Shift (TPS) Modulation in Dual-Active-Bridge Converters: Prior-Corpus Coverage Assessment and Design-Around Confirmation)).

- [728] Yipeng Yan, Quanming Luo, Ting Luo, Jia Li, Jianglin Xiong, and Hang Xiao. “Current Stress Optimized Strategy for the Dual-Active-Bridge Converter With Triple-Phase-Shift and Variable DC-Link Voltage Control.” *IEEE Transactions on Power Electronics*, vol. 40, no. 6, pp. 8344-8355, 2025. doi:10.1109/tpel.2025.3536467. (TR858, [Panel-Jet Ram Transform for Triple-Phase-Shift Dual-Active-Bridge Converters with Variable DC-Link Voltage: Closed-Form Inductor-Current Waveforms and Certified-Sensitivity Current-Stress Optimization]).
- [729] Junrui Wang, Lu Tan, Jin Li, and Changjiang Ji. “Research on model predictive control strategy of three-level dual-active bridge DC-DC converter.” *Scientific Reports*, vol. 15, no. 1, art. 10622, 2025. doi:10.1038/s41598-025-89079-w. (TR859, [Multimodal / Multi-Panel Ram Transform Operators for the Three-Level Dual-Active-Bridge DC-DC Converter, with Certified-Sensitivity Model Predictive Control]).
- [730] Minxin Lin, Chuanxin Feng, Yin Chen, Haibin Li, and Tao Jin. “Hybrid Current Stress Optimization Strategy for Three-Level Dual Active Bridge Adapted to Wide Voltage Ranges.” *IEEE Transactions on Power Electronics*, vol. 40, no. 11, pp. 17091-17104, 2025. doi:10.1109/tpel.2025.3578377. (TR860, [Panel-Jet Ram Transform for Wide-Voltage-Range Three-Level Dual-Active-Bridge Current-Stress Optimization A Closed-Form Per-Mode Waveform Operator with Mode-Boundary Jet-Matching and Certified Sensitivities]).
- [731] Yang Leng, Rongwu Zhu, Yi Liu, Peter Adam Hoehner, and Marco Liserre. “Power and Communication Decoupling for a Dual-Active-Bridge Converter With FSK-Based Talkative Power Conversion.” *IEEE Transactions on Power Electronics*, vol. 40, no. 10, pp. 15292-15305, 2025. doi:10.1109/tpel.2025.3574346. (TR861, [Analytic Power/Communication Decoupling for FSK-Based Talkative Dual-Active-Bridge Conversion via a Switching-Jet Windowed-Exponential Ram Transform]).
- [732] Chaochao Song, Ning Wang, Ariya Sangwongwanich, Frede Blaabjerg, and Pooya Davari. “Overview of Efficient and Reliable Control Strategies for Three-Level NPC-Based DAB Converters.” *IEEE Transactions on Power Electronics*, vol. 41, no. 2, pp. 2561-2591, 2026. doi:10.1109/tpel.2025.3608789. (TR862, [Panel-Jet Ram Transform for Three-Level NPC-Based Dual-Active-Bridge Converters: Exact Piecewise-Analytic Waveform Operators and Ram-Jet Control Synthesis]).
- [733] Haoyu Zhang, Jiawei Liang, Junrui Liang, Minfan Fu, and Haoyu Wang. “Wide Voltage Range Efficiency Enhancement Scheme for Input-Parallel-Output-Series DAB Converters in 800 V DC Microgrids.” *IEEE Transactions on Power Electronics*, vol. 40, no. 9, pp. 13716-13729, 2025. doi:10.1109/tpel.2025.3569084. (TR863, [Panel-Jet Ram Transform for Input-Parallel-Output-Series DAB Converters: Wide-Voltage-Range Efficiency Optimization with Block-Tridiagonal Voltage-Sharing Coupling]).
- [734] Ziheng Xiao, Zhigang Yao, Fei Deng, Yu Zhang, and Yi Tang. “Exploring the Extreme Dynamic Transition Response of Dual Active Bridge Converters.” *IEEE Transactions on Power Electronics*, vol. 40, no. 5, pp. 6988-7001, 2025. doi:10.1109/tpel.2025.3532400. (TR864, [Certified Panel-Jet Transition Maps for the Extreme Dynamic-Transition Response of Dual Active Bridge Converters A Ram-Transform Derivation with Block-Tridiagonal Continuity and Jet-Based Transition Optimization]).
- [735] James Sora and Ioan Serban. “A Hybrid Modulation Strategy of Dual Active Bridge Converters for Electric Vehicle Charging in Microgrid Applications.” In *2025 International Aegean Conference on Electrical Machines and Power Electronics (ACEMP) & 2025 International Conference on Optimization of Electrical and Electronic Equipment (OPTIM)*, pp. 1-6, 2025. doi:10.1109/optim-acemp62776.2025.11075280. (TR865, [Panel-Jet Ram-Transform Operators for Hybrid-Modulation Dual-Active-Bridge Converters in EV-Charging Microgrids A Closed-Form Modulation-Variable Inversion with Mode-Transition Block Coupling]).
- [736] Saikat Dey and Ayan Mallik. “Physics Informed Neural Network-Estimated Circuit Parameter Adaptive Modulation of DAB.” *IEEE Transactions on Power Electronics*, vol. 40, no. 10, pp. 14821-14841, 2025. doi:10.1109/tpel.2025.3574873. (TR866, [Analytic-Core Ram Parameter Identification and Adaptive Modulation for Dual-Active-Bridge Converters]).

- [737] Yun Zhang, Mingqi Xu, Tong Li, Zhen Huang, Zhihang Yu, and Xingjiang Liu. “Extended Dual Side Asymmetric Phase Shift Modulation and Smooth Mode Transition Method for Dual Active Bridge Converter.” *IEEE Transactions on Power Electronics*, vol. 41, no. 1, pp. 994-1004, 2026. doi:10.1109/tpe.2025.3597291. (TR867, [Panel-Jet Ram Transform for Extended Dual-Side Asymmetric Phase-Shift Modulation of the Dual-Active-Bridge Converter, with a Conditioned Smooth Mode-Transition Operator]).
- [738] Armin Miremad and Suzan Eren. “A Three-Level Current-Fed Dual-Active Bridge DC-DC Converter Under Dual-Phase-Shift Control.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 13, no. 4, pp. 4691-4709, 2025. doi:10.1109/jestpe.2025.3561696. (TR868, [Panel-Jet Ram Transform Analysis of a Three-Level Current-Fed Dual-Active-Bridge DC-DC Converter Under Dual-Phase-Shift Control]).
- [739] Prosen Dey, Sayan Paul, and Kaushik Basu. “Analytical Closed-Form ZVS Boundaries of Triple-Phase-Shift Modulated Dual Active Bridge Converter.” *IEEE Transactions on Power Electronics*, vol. 40, no. 11, pp. 16870-16893, 2025. doi:10.1109/tpe.2025.3589663. (TR869, [Panel-Jet Ram Transform Derivation of Closed-Form ZVS Current-Pair Boundaries for Triple-Phase-Shift Dual Active Bridge Converters]).
- [740] Priyatosh Jena, Rajeev Kumar Singh, and Vivek Nandan Lal. “Improving Light-Load Performance in Bidirectional AC-DC DAB Using Asymmetric Semivariable Frequency Modulation.” *IEEE Transactions on Power Electronics*, vol. 40, no. 5, pp. 7015-7028, 2025. doi:10.1109/tpe.2025.3525837. (TR870, [A Panel-Jet Ram Transform for Asymmetric Semivariable-Frequency Modulation of Bidirectional AC-DC Dual-Active-Bridge Converters: Conditioned Forward Analysis and Light-Load Modulation Synthesis]).
- [741] Jiahui Zhu, Ziang Li, Shuo Zhang, Peng Sun, and Yuqi Wei. “A Multi-Mode Hybrid Modulation Strategy for Dual Active Bridge Converter With Wide Voltage and Power Range.” *IEEE Transactions on Industry Applications*, vol. 62, no. 1, pp. 1469-1483, 2026. doi:10.1109/tia.2025.3603534. (TR871, [Multimodal Panel-Jet Ram Transform for Wide-Range Multi-Mode Dual-Active-Bridge Modulation State-Aware Analysis, Optimization, and Topology Transition]).
- [742] Zhenyu Wang, Dong Jiang, Xuan Zhao, and Wei Sun. “Zero-Common-Mode Modulation of ISOP-Based Dual-Active-Bridge Converter With Power Balance.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 13, no. 2, pp. 2372-2384, 2025. doi:10.1109/jestpe.2025.3551132. (TR872, [A Block-Coupled Panel-Jet Ram Transform for Zero-Common-Mode, Power-Balanced Modulation of ISOP Dual-Active-Bridge Converters]).
- [743] Mohamed R. Farid, Ahmed L. Elrefai, and Sobhy M. Abdelkader. “Comparative Analysis of Single-Phase Shift and Extended Phase Shift Modulations in Dual Active Bridge Converters for Fast EV Charging.” *Renewable Energy and Power Quality Journal*, vol. 24, no. 1, pp. 40-45, 2026. doi:10.52152/4559. (TR873, [Panel-Jet Ram Transforms for Dual Active Bridge Converters: Exact Forward and Conditioned Inverse Modulation Operators for Single-Phase-Shift and Extended-Phase-Shift Control in Fast EV Charging]).
- [744] Yongjia Dong, Linfeng Zheng, Zhijian Lv, and Zikun Xu. “Current Stress Minimization for DAB Converters using DPS Modulation.” In *2025 6th International Conference on Electrical, Electronic Information and Communication Engineering (EEICE)*, pp. 1228-1232, 2025. doi:10.1109/eeice65049.2025.11034300. (TR874, [Exact Panel-Jet Waveform Operators and Exact-Sensitivity Optimization for Current-Stress Minimization in Dual-Active-Bridge Converters under Dual-Phase-Shift Modulation]).
- [745] Armin Miremad and Suzan Eren. “A Four-Level Modulation Strategy for NPC DAB Converter With Extended ZVS Range and Reduced Voltage Stress.” *IEEE Transactions on Power Electronics*, vol. 41, no. 2, pp. 2057-2073, 2026. doi:10.1109/tpe.2025.3597590. (TR875, [A Panel-Jet Ram Transform for Four-Level NPC-DAB Modulation State-Complete Steady-State Waveforms, Extended-ZVS, and Voltage-Stress Feasibility Operators]).
- [746] Hongwei Zhang and Zeng Liu. “Enhanced Modulation Strategy and Magnetic Component Parameter Design for Dual Active Bridge Converters to Improve Efficiency Under Variable Load Conditions.” *IEEE Transactions on Power Electronics*, vol. 40, no. 8, pp. 11641-11654, 2025. doi:10.1109/tpe.2025.3558396. (TR876, [Condition-Gated Ram Panel Models for Joint Modulation and Magnetic-Parameter Design of Dual-Active-Bridge Converters]).

- [747] Yuying He, Zhenyi Li, Jingxin Hu, Haojie Xie, Mingwei Lu, and Guixin Zhu. “Adaptive Dual-Side Phase-Shift Modulation for Complete and Decoupled Elimination of Transient DC Bias in DAB Converter.” *IEEE Transactions on Power Electronics*, vol. 40, no. 10, pp. 14331-14336, 2025. doi:10.1109/tpel.2025.3584254. (TR877, [Panel-Jet Ram Transform for Adaptive Dual-Side Phase-Shift Modulation with Decoupled Elimination of Transient DC Bias in Dual-Active-Bridge (DAB) Converters]).
- [748] Yaoqiang Wang, Wuqing Yan, Shida Zhang, Fuquan Nie, and Jun Liang. “Optimized Modulation for Single-Stage Dual-Active-Bridge AC-DC Converter Under Wide Voltage Range.” *IEEE Transactions on Industrial Electronics*, vol. 72, no. 9, pp. 9005-9015, 2025. doi:10.1109/tie.2025.3539377. (TR878, [Two-Time-Scale Panel-Jet Ram Transform for Optimized Modulation of the Single-Stage Dual-Active-Bridge AC-DC Converter Under Wide Voltage Range]).
- [749] Marina Vitali and Andrea Cervone. “Optimal Triple-Phase Shift Modulation for Half Bridge Based Dual-Active-Bridge Converters.” In *IECON 2025 - 51st Annual Conference of the IEEE Industrial Electronics Society*, pp. 1-8, 2025. doi:10.1109/iecon58223.2025.11221816. (TR879, [Panel-Jet Ram Operators and Ram-Jet Sensitivity Optimization for Optimal Triple-Phase-Shift Modulation of Half-Bridge Dual-Active-Bridge Converters]).
- [750] Henar Mike O. Canilang, Shuai Wang, Ning Zhu, Patrick Palmer, and Jiacheng Wang. “Dual Active Bridge Switching Modes for Interfacing Supercapacitors.” In *2025 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE)*, pp. 688-692, 2025. doi:10.1109/ccece64018.2025.11364470. (TR880, [Panel-Jet Ram Transform for Dual-Active-Bridge Switching Modes Interfacing Supercapacitors over a Wide Voltage Envelope]).
- [751] Haoyuan Jin, Yunqing Pei, Laili Wang, Gan Wang, Xiaobo Dong, and Qi Zhou. “Multiobjective Optimization for Dual Active Bridge Converter Under Variable-Frequency Single-Phase-Shift Modulation.” *IEEE Transactions on Power Electronics*, vol. 41, no. 2, pp. 2685-2702, 2026. doi:10.1109/tpel.2025.3617657. (TR881, [Exact Panel-Jet Ram Operators for Variable-Frequency Single-Phase-Shift Dual-Active-Bridge Converters: Closed-Form Waveform Maps and Exact-Sensitivity Multiobjective Optimization]).
- [752] Marzio Barresi, Riccardo Mandrioli, Mattia Ricco, and Samuele Grillo. “Modular Multilevel Converter with Interleaved Submodule based on Current-Fed Dual Active Bridge.” In *2025 International Conference on Clean Electrical Power (ICCEP)*, pp. 175-180, 2025. doi:10.1109/iccep65222.2025.11143676. (TR882, [Panel-Jet Ram Transform for Modular Multilevel Converters with Interleaved Current-Fed Dual-Active-Bridge Submodules: Block-Tridiagonal Arm-Coupling Operators and Exact Local Inversion]).
- [753] Hang Ren, Hanwen Zhang, Yanbo Wang, Haoyuan Yu, Pingyang Sun, and Zhe Chen. “A Multidimensional Design for Dual Active Bridge Converters in Low-Voltage DC Systems.” *IEEE Transactions on Industrial Electronics*, vol. 73, no. 2, pp. 2264-2275, 2026. doi:10.1109/tie.2025.3603045. (TR883, [Certified Multidimensional Design-Space Optimization for Dual Active Bridge Converters in Low-Voltage DC Systems via Panel-Jet Waveform Operators and Ram-Jet Sensitivities A Panel / Domain-Decomposition Ram Transform with Analytic-Core-Plus-Learned-Residual Design Map]).
- [754] Francesco Romano, Elisabetta Moissello, Alessandro Liotta, Pietro Giannelli, Giovanni Frattini, Edoardo Bonizzoni, and Piero Malcovati. “Controlled Single-Phase-Shift Modulation Method for a Fully Integrated Dual Active Bridge Converter.” In *2025 IEEE International Symposium on Circuits and Systems (ISCAS)*, pp. 1-5, 2025. doi:10.1109/iscas56072.2025.11043855. (TR884, [A Panel-Jet Ram Transform for Single-Phase-Shift Dual Active Bridge Control-Law Inversion Closed-Form Phase-Shift-to-Output Map and Its Analytic Inverse for a Fully Integrated DAB Converter]).
- [755] Ronald Carmona, Christian A. Rojas, Alejandro Stowhas-Villa, Alan H. Wilson-Veas, Alejandro Peralta, Hugues Renaudineau, and Sebastian Rivera. “Reconfigurable Full and Partial Power Processing GaN-FET-Based T-Type DAB DC-DC Converter.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, vol. 13, no. 6, pp. 7049-7062, 2025. doi:10.1109/jestpe.2025.3585562. (TR886, [Panel-Jet Ram Transform for the Reconfigurable Full/Partial-Power GaN-FET T-Type Dual-Active-Bridge DC-DC Converter: Mode-Dependent Switched-Jet Coupling and Periodic-Steady-State Closure]).

- [756] Kun Wang, Ian Laird, and Jun Wang. “Multi-Objective Efficiency-Oriented Optimization for DAB Converters Minimizing Current Stress and Backflow Power with Soft-Switching Assurance.” In *2025 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 2088-2095, 2025. doi:10.1109/apec48143.2025.10977239. (TR887, [Exact Ram-Jet Multi-Objective Efficiency Optimization for Dual-Active-Bridge Converters: Joint Current-Stress and Backflow-Power Minimization under Soft-Switching Constraints]).
- [757] Ningzhi Jin, Yiding Ding, Zeyu Chen, Bowen Yu, and Kai Zhou. “Optimal Control of Efficiency and Dynamic Performance for DAB Converter in Electric Vehicle.” *International Journal of Circuit Theory and Applications*, vol. 54, no. 5, pp. 2458-2471, 2025. doi:10.1002/cta.70135. (TR888, [Ram Panel-Jet Optimal Control of Efficiency and Dynamic Performance for Dual-Active-Bridge DC-DC Converters in Electric Vehicles]).
- [758] Muhammet Beşer Tezgel and Ahmet Karaarslan. “Hybrid PSM-PWM Combined Modulation Applied to Bidirectional Dual Active Bridge CLLC Resonant Converter.” *Journal of Engineering Technology and Applied Sciences*, vol. 10, no. 1, pp. 1-19, 2025. doi:10.30931/jetas.1571579. (TR889, [A Panel-Jet Ram Transform for the Hybrid PSM+PWM Bidirectional CLLC Resonant Converter: Closed-Form Switching-Waveform Operators and Exact Local Inversion for Control Synthesis]).
- [759] Longfei Guan, Jingchen Pan, Hao Li, Chonghui Song, Zhengkuo Jiao, Xianrui Sun, Ruiwang Sun, Xudong Wang, and Yunlong Qiu. “Dual-variable asymmetric modulation with a simplified duty optimization scheme for DAB converters to improve efficiency.” *Electrical Engineering*, vol. 107, no. 10, pp. 14037-14053, 2025. doi:10.1007/s00202-025-03248-8. (TR890, [A Panel-Jet Ram Transform for Dual-Variable Asymmetric Modulation and Simplified Duty Optimization in Dual-Active-Bridge Converters: Exact Per-Panel Switching-Waveform Operators with Qualified Optimality Bounds]).
- [760] Hui Ma, Jianhua Lei, Geng Qin, Zhihua Guo, and Chuantong Hao. “Efficiency Optimization Control Strategies for High-Voltage-Ratio Dual-Active-Bridge (DAB) Converters in Battery Energy Storage Systems.” *Energies*, vol. 18, no. 10, art. 2650, 2025. doi:10.3390/en18102650. (TR891, [Panel-Jet Ram Transform for Efficiency-Optimal Modulation of High-Voltage-Ratio Dual-Active-Bridge Converters in Battery Energy Storage Systems]).
- [761] Longfei Cui, Yiming Zhang, Xuhong Wang, and Dong Zhang. “An Enhanced Integrated Optimization Strategy for Wide ZVS Operation and Reduced Current Stress Across the Full Load Range in DAB Converters.” *Applied Sciences*, vol. 15, no. 13, art. 7413, 2025. doi:10.3390/app15137413. (TR892, [Ram-Jet Exact-Sensitivity Constrained Optimization of DAB Modulation for Wide-Range ZVS and Reduced Current Stress]).
- [762] Jiawei Zhang, Jiaxiong Xu, Yile Dai, Miao Yu, Xin Zhang, and Huai Wang. “Artificial Intelligence-Based Modeling and Control Strategy for Dual Active Bridge Converter With Triple Phase Shift Modulation.” *IEEE Transactions on Power Electronics*, vol. 41, no. 1, pp. 494-513, 2026. doi:10.1109/tpe.2025.3594613. (TR893, [An Analytic Ram Panel-Jet Core with Learned Residual for Triple-Phase-Shift Dual-Active-Bridge Modeling and Control]).
- [763] Mattia Vogni, Juan L. Bellido, Fausto Stella, Leonardo Stefanini, Claudio Bianchini, and Vicente Esteve. “Application and Development of a Double Asymmetric Voltage Modulation on a Resonant Dual Active Bridge.” *Electronics*, vol. 14, no. 23, art. 4625, 2025. doi:10.3390/electronics14234625. (TR894, [Panel-Jet Ram Transform for Double Asymmetric Voltage Modulation on a Resonant Dual Active Bridge: Forward Waveform Operator and Inverse Modulation-Synthesis Operator]).

15.2 Resonant Converters, EV Charging, and Solid-State Transformers

- [764] Wei Xu, Sanjay Rajendran, Zhicheng Guo, Adithyan Vetrivelan, and Alex Q. Huang. “7.2kV/100kVA Solid State Transformer Based on Half Bridge LLC Resonant Converter and 15kV SiC AC Switch.” In *2023 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 1516-1522, 2023. doi:10.1109/apec43580.2023.10131549. (TR209, [Panel-Jet Ram Transform Formulation of a 7.2 kV / 100 kVA Half-Bridge LLC Solid-State Transformer with 15 kV SiC AC Switch]).
- [765] Ting Ge, Zichao Ye, and Robert C. N. Pilawa-Podgurski. “Geometrical State-Plane Analysis of Resonant Switched-Capacitor Converters: Demonstration on the Cascaded Multiresonant Converter.” *IEEE Transactions on Power Electronics*, vol. 38, no. 9, pp. 11125-11140, 2023. doi:10.1109/tpe.2023.3259951. (TR210, [Panel-Jet Ram Transform for State-Plane Analysis of Resonant Switched-Capacitor Converters]).
- [766] Bram Oude Aarninkhof, Dingsihao Lyu, Thiago Batista Soeiro, and Pavol Bauer. “A Reconfigurable Two-Stage 11 kW DC-DC Resonant Converter for EV Charging With a 150-1000 V Output Voltage Range.” *IEEE Transactions on Transportation Electrification*, vol. 10, no. 1, pp. 509-522, 2024. doi:10.1109/tte.2023.3279211. (TR211, [Wide-Output-Range Panel-Jet Ram Transform for a Reconfigurable Two-Stage 11 kW LLC/Resonant EV DC-DC Converter (150-1000 V Output) A TR197 Continuation: Per-Mode Analytic Switching-Waveform Operators Block-Tridiagonal Panel Coupling, and V_{out} Parametrized Gain Jets]).
- [767] Jingtao Xu, Sirui Huang, and Lulin Zhang. “Wide Range Dual Active Half-Bridge Resonant Converter with PWM Control and Load-Independent Voltage Gain Characteristics.” *Electronics*, vol. 15, no. 2, art. 346, 2026. doi:10.3390/electronics15020346. (TR586, [Panel-Jet Ram Transform for a Wide-Range Dual Active Half-Bridge Resonant Converter with PWM Control and Load-Independent Voltage Gain: Forward/Inverse Switching-Waveform Operators within the TR197 Panel-Jet Umbrella]).
- [768] Tiancheng Cao, Junjie Zhu, Yumeng Guo, Yi Han, Bo Wu, and Dayi Li. “Utilizing the Intrinsic CC/CV Characteristics of a CLLC Converter for Battery Charging with ZVS Operation.” *Electronics*, vol. 15, no. 5, art. 1128, 2026. doi:10.3390/electronics15051128. (TR588, [A Panel-Jet Ram Transform for the Bidirectional CLLC Converter: Closed-Form Inversion for Intrinsic CC/CV Charging with ZVS Operation]).
- [769] Qichen Liu and Zhengquan Zhang. “A Single-Stage Three-Phase AC-DC LLC Resonant Converter with Planar Magnetics and Trajectory-Based PFM Control.” *Electronics*, vol. 15, no. 5, art. 1095, 2026. doi:10.3390/electronics15051095. (TR589, [Panel-Jet and Ram-Jet Formulation of a Single-Stage Three-Phase AC-DC LLC Resonant Converter with Planar Magnetics and Trajectory-Based PFM Control]).
- [770] Rui Wang, Xiaodong Li, Shi-Yuan Liu, Song Hu, and Hao Chen. “A Hybrid Voltage Level Modulation for Dual Transformer LCL Immittance Network Resonant Dual-Active-Bridge Converter.” *IEEE Transactions on Industrial Electronics*, pp. 1-12, 2026. doi:10.1109/tie.2026.3675156. (TR596, [Panel-Jet Ram Transform for the LCL Immittance-Network Dual-Transformer Resonant Dual-Active-Bridge Converter under Hybrid Voltage-Level Modulation]).
- [771] Ruibang Liu, Sinian Yan, Zhiqiang Chen, Jinghong Zhao, Baolong Liu, Yaoqiang Wang, and Yiyong Xiong. “Research on Distributed Parameter Characteristics of High Frequency Transformer Based on Dual Active Bridge Converter.” In *Lecture Notes in Electrical Engineering*, pp. 732-744, Springer Nature Singapore, 2026. doi:10.1007/978-981-95-4286-4_75. (TR612, [A Distributed-Parameter Ram Transform for High-Frequency Dual-Active-Bridge Transformer Windings: Panelized Telegrapher-PDE Inversion Coupled to the P197 Switching-Waveform Operator]).
- [772] Xianjin Huang. “Research on Dead Time Optimization Characteristics of High-Power Tri-phase LLC Resonant Converter.” *CPSS Transactions on Power Electronics and Applications*, vol. 10, no. 2, 2025. doi:10.24295/cpsstpea.2025.00017. (TR896, [Panel-Jet Ram-Transform Derivation for Dead-Time Optimization in High-Power Tri-Phase LLC Resonant Converters]).
- [773] Shuo Zhang, Ziang Li, Mochen Xu, Ting Luo, Peng Sun, Quanming Luo, Jinjun Liu, and Yuqi Wei. “An Accurate Dynamic Time-Domain Model for LLC Resonant Converter by Considering Nonideal Components, Various Modulation Strategies, and Dynamic Process.” *IEEE Journal of Emerging and Selected Topics in*

Power Electronics, vol. 13, no. 3, pp. 3119-3137, 2025. doi:10.1109/jestpe.2025.3558288. (TR897, [A Dynamic, Nonideal, Multimodal Panel-Jet Ram Transform for LLC Resonant Converters Across Modulation Strategies]).

- [774] Kajanan Kanathipan, Mehdi Abbasi, Muhammad Ali Masood Cheema, and John Lam. “Modular Power-Balanced Resonant Converters for MVdc Distributed PV Systems.” *IEEE Power Electronics Magazine*, vol. 12, no. 2, pp. 60-68, 2025. doi:10.1109/mpel.2025.3563068. (TR898, [Block-Tridiagonal Panel-Jet Ram Transforms for Modular Power-Balanced Resonant Converters in MVdc Distributed PV Systems A Domain-Decomposition Extension of the TR197/P197 Panel-Jet Switching-Waveform Operator]).
- [775] Qingqing He, Shun Tang, Dan Ren, Zhaoyang Tang, Qisheng Zhu, Chao Tang, and Kelian Zhou. “A Novel Wide-Gain-Range Variable-Structure DC/DC Converter Based on an LLC Resonant Converter.” *Energies*, vol. 18, no. 14, art. 3664, 2025. doi:10.3390/en18143664. (TR899, [A Panel-Jet Ram Transform for Wide-Gain-Range Variable-Structure LLC Resonant Converters A Variable-Structure Mode-Transition Embodiment under TR197/P197]).
- [776] Ghassem Eini Guraji, Bijan Elyasi, S. Hamid Fathi, and Amir Khorsandi. “A Hybrid Design Approach for an LLC Resonant DC-DC Converter Based on Time-Frequency Domain Analysis for Electric Vehicle Application.” *IET Power Electronics*, vol. 18, no. 1, art. e70169, 2025. doi:10.1049/pel2.70169. (TR900, [A Panel-Jet Ram Transform Formulation of the LLC Resonant DC-DC Converter for Electric-Vehicle Charging A Closed-Form Switching-Waveform Operator with Block-Tridiagonal Steady-State Closure and Windowed-Exponential Ramlet Gain Analysis]).
- [777] Fan Yang, Xinxi Tang, Hongfei Wu, and Yan Xing. “LLC Resonant Converters With Reconfigurable Rectifier for Wide Voltage Range Applications.” *IET Power Electronics*, vol. 18, no. 1, art. e70172, 2025. doi:10.1049/pel2.70172. (TR902, [Multimodal Panel-Jet Ram Transforms for LLC Resonant Converters with Reconfigurable Rectifiers over a Wide Voltage Range A Continuation-in-Part Extension of the Power-Electronics Panel-Jet Exactness Framework (TR197/P197)]).
- [778] Yi Zhang, Xiangjie Liu, Jiamian Wang, Baojiang Wu, Feilong Liu, and Junfeng Xie. “PWM-PFM Hybrid Control of Three-Port LLC Resonant Converter for DC Microgrids.” *Energies*, vol. 18, no. 10, art. 2615, 2025. doi:10.3390/en18102615. (TR903, [Panel-Jet Ram Transform for the Three-Port LLC Resonant Converter under Hybrid PWM-PFM Control: Multi-Port Cross-Center Coupling and a Two-Parameter (Duty-Frequency) Jet Control Map]).
- [779] Gwang-Min Park and Kui-Jun Lee. “Small-Signal Modeling of Asymmetric PWM Control Based Series Resonant Converter.” *Electronics*, vol. 14, no. 17, art. 3394, 2025. doi:10.3390/electronics14173394. (TR904, [Panel-Jet Small-Signal Modeling of the Asymmetric-PWM Series Resonant Converter A Ram-Transform Derivation of Closed-Form Control-to-Output Transfer Functions]).
- [780] Vittorio Bertolini, Antonio Faba, Marco Dionigi, and Ermanno Cardelli. “Frequency Domain Model of a Resonant LCC-S Converter for High-Frequency Wireless Power Transfer Applications Considering Switching Losses in MOSFETs Bridge.” *Applied Sciences*, vol. 15, no. 11, art. 5878, 2025. doi:10.3390/app15115878. (TR905, [Panel-Jet Ram Transform for the Loss-Aware Frequency-Domain Model of a Resonant LCC-S Wireless Power Transfer Converter A Loss-Augmented Analytic Forward/Inverse Operator with Panel Decomposition, Ramlet Resonant Atoms, and Semi-Blind Switching-Loss Calibration]).
- [781] Yujie Ning, Yijing Chen, Dawei Zhao, Chunhua Li, Xiaojiang Guo, and Dongdong Zhou. “Construction and Comparison of Models With Different Time Scales For Offshore DC Wind Turbine Using LLC Resonant Converter.” *IET Renewable Power Generation*, vol. 19, no. 1, art. e70116, 2025. doi:10.1049/rpg2.70116. (TR907, [Multi-Time-Scale Panel-Jet Ram Transform for Offshore DC Wind-Turbine LLC Resonant Converters]).
- [782] Tran Duc Hung, Zeeshan Waheed, Manh Tuan Tran, and Woojin Choi. “A High-Efficiency Bi-Directional CLLLC Converter with Auxiliary LC Network for Fixed-Frequency Operation in V2G Systems.” *Energies*, vol. 18, no. 14, art. 3815, 2025. doi:10.3390/en18143815. (TR908, [Panel-Jet Ram Transform for Steady-State Analysis of the Bi-Directional CLLLC Resonant Converter with Auxiliary LC Network in Fixed-Frequency V2G Operation]).

- [783] Chandra Babu Guttikonda, Pinni Srinivasa Varma, Malligunta Kiran Kumar, Kambhampati Venkata Govardhan Rao, Rakesh Teerdala, and Santoshi Kanagala. “A versatile three-level CLLC resonant converter for off-board EV chargers with wide voltage adaptability contribution.” *International Journal of Power Electronics and Drive Systems (IJPEDS)*, vol. 16, no. 3, art. 1775, 2025. doi:10.11591/ijpeds.v16.i3.pp1775-1788. (TR909, [A Panel-Jet Ram Transform for the Three-Level CLLC Resonant Converter: Closed-Form Steady-State Waveforms and Wide-Voltage Gain Maps]).

15.3 Converter Impedance Identification and Fault Diagnostics

- [784] Oscar Lahuerta, Claudio Carretero, Luis Angel Barragan, Denis Navarro, and Jesus Acero. “Hybrid-Timescale Physics-Informed Neural Network for Electrical Equivalent Impedance Identification in Induction Heating Systems.” *IEEE Open Journal of the Industrial Electronics Society*, vol. 7, pp. 382-392, 2026. doi:10.1109/ojies.2026.3663897. (TR498, [A Hybrid-Timescale Analytic-Core Ram Transform for Electrical Equivalent-Impedance Identification in Induction-Heating Systems: Variable-Coefficient Operator Inversion under an Analytic-Core-plus-Learned-Residual Umbrella]).
- [785] Xianyang Cui, Tao Jin, and Jian Song. “Time-Frequency EPFCN for Fault Warning and Diagnosis of Multi-Phase Interleaved Converters in DC Microgrids.” *Electronics*, vol. 15, no. 13, art. 2894, 2026. doi:10.3390/electronics15132894. (TR522, [A Panel-Jet Ram Transform with Analytic-Core-plus-Learned-Residual for Time-Frequency Fault Warning and Diagnosis of Multi-Phase Interleaved DC/DC Converters in DC Microgrids]).
- [786] Chintala Govinda Raju, Laxmidhar Senapati, Sunita Oram, Pragnyashree Ray, and Pradyumna Kumar Behera. “Small-Signal Modeling and Control-Oriented Design of a Cascaded Bidirectional Dual Active Bridge-Cuk Converter.” In *2026 4th Odisha International Conference on Electrical Power Engineering, Communication and Computing Technology (ODICON)*, pp. 1-6, 2026. doi:10.1109/odicon66687.2026.11470593. (TR611, [A Ram Panel-Jet Small-Signal Operator for the Cascaded Bidirectional Dual-Active-Bridge-Cuk Converter: Closed-Form Control-to-Output and Input-Admittance Transfer Functions]).
- [787] Wei Ge, Mingzhi He, Zhiqin Zhang, Tiesheng Yan, Xiaobao Yang, and Shuhan Zhou. “An Efficiency-Oriented Hybrid Modulation with Open-Circuit Fault Diagnosis for Three-Phase Dual-Active-Bridge Converters.” *IEEE Journal of Emerging and Selected Topics in Power Electronics*, pp. 1-1, 2026. doi:10.1109/jestpe.2026.3692305. (TR614, [Panel-Jet Ram Transform Operators for Three-Phase Dual-Active-Bridge Converters: Efficiency-Oriented Hybrid Modulation and Open-Circuit Fault Diagnosis via Analytic Core plus Structured Residual]).
- [788] Yun Zhang, Mingqi Xu, Qinghan Wei, Zhen Huang, and Bin Li. “Inductance Identification Method for Dual Active Bridge Converters Considering Sampling Noise Over the Full Power Range.” *IEEE Transactions on Industrial Electronics*, pp. 1-12, 2026. doi:10.1109/tie.2026.3684225. (TR617, [Noise-Robust Full-Power-Range Inductance Identification for Dual Active Bridge Converters via Ram Panel-Jet Moments with Mollified Inverse-Consistency Calibration]).
- [789] Mian Liao, Tanuj Sen, Yang Wu, and Minjie Chen. “Analysis and Design of a Cyclo-Active-Bridge Inverter for Single-Stage Three-Phase Grid Interface.” In *2025 IEEE Applied Power Electronics Conference and Exposition (APEC)*, pp. 139-146, 2025. doi:10.1109/apec48143.2025.10977301. (TR885, [Panel-Jet Ram Transform for the Cyclo-Active-Bridge Single-Stage Three-Phase Grid Interface: Closed-Form Switched-Waveform Operators with Block-Tridiagonal Steady-State Closure]).
- [790] Nie Hou, Xuesong Wu, Zhengqin Huang, and Yunwei Li. “A Topology-Reconstructed Minimum-Current-Stress Modulation for a Single-Phase Isolated DC-AC Converter.” *IEEE Transactions on Power Electronics*, vol. 40, no. 8, pp. 10391-10395, 2025. doi:10.1109/tpel.2025.3556755. (TR895, [A Panel-Jet Ram Transform for Topology-Reconstructed Minimum-Current-Stress Modulation of a Single-Phase Isolated DC-AC Converter]).
- [791] Jae-Hyuck Choi, Young-Joo Kim, So-Jeong Kong, Jin-Su Kim, Eui-Hoon Chung, and Jun-Young Lee. “40-kW isolated bidirectional DC/DC converter based on LLC/SRC and buck converters with ZVT for fast

chargers.” *Journal of Power Electronics*, vol. 25, no. 5, pp. 814–825, 2025. doi:10.1007/s43236-025-01039-9. (TR901, [A Panel-Jet Ram Transform for a 40 kW Isolated Bidirectional LLC/SRC + Buck DC/DC Converter with Zero-Voltage Transition Topology-Specific Closed-Form Switching-Waveform Operator with Certified Interval-Boundary Matching]).

- [792] Liting Li, Mei Su, Wenjing Xiong, Yu Han, and Guo Xu. “Fully Soft Switched Coupled Inductor-Based Semi Dual Active Half Bridge Converter with Voltage Match Control.” *Energies*, vol. 18, no. 4, art. 886, 2025. doi:10.3390/en18040886. (TR906, [A Panel-Jet (Ram Transform) Formulation for the Fully Soft-Switched Coupled-Inductor Semi Dual-Active Half-Bridge Converter with Voltage-Match Control A Worked Specialization of TR197/P197]).
- [793] Xinze Li, Fanfan Lin, Huai Wang, Xin Zhang, Hao Ma, Changyun Wen, and Frede Blaabjerg. “Temporal Modeling for Power Converters With Physics-in-Architecture Recurrent Neural Network.” *IEEE Transactions on Industrial Electronics*, vol. 71, no. 11, pp. 14111–14123, 2024. doi:10.1109/tie.2024.3352119. (TR976, [A Ram Transform Derivation for Temporal Modeling of Switched Power Converters]).

16 Single-Photon and Computational Imaging

57 bibliography items.

16.1 Single-Photon LiDAR and Photon-Limited Reconstruction

- [794] Sandor Plosz, Aurora Maccarone, Stephen McLaughlin, Gerald S. Buller, and Abderrahim Halimi. “Real-Time Reconstruction of 3D Videos From Single-Photon LiDAR Data in the Presence of Obscurants.” *IEEE Transactions on Computational Imaging*, vol. 9, pp. 106–119, 2023. doi:10.1109/tci.2023.3241547. (TR212, [A Ram-Transform Analytic-Core-plus-Learned-Residual Method for Real-Time Reconstruction of 3D Single-Photon LiDAR Video in the Presence of Obscurants]).
- [795] Alice Ruget, Lewis Wilson, Jonathan Leach, Rachael Tobin, Aongus McCarthy, Gerald S. Buller, Steve McLaughlin, and Abderrahim Halimi. “Plug-and-play algorithm for 3D guided video super-resolution of single-photon LiDAR data.” *Optics Express*, vol. 33, no. 5, art. 11775, 2025. doi:10.1364/oe.550516. (TR910, [A Ram Transform Approach to Plug-and-Play 3D Guided Video Super-Resolution of Single-Photon LiDAR Data]).
- [796] Xiaoyin Li, Yuanjian Huang, Yinghui Guo, Hengshuo Guo, Mingbo Pu, Runzhe Zhang, Qi Zhang, Fei Zhang, Mingfeng Xu, Nan Chi, and Xiangang Luo. “Sub-Diffraction Limited Single-Photon LiDAR with Optimized Confocal Super-Oscillatory Illumination.” *Laser & Photonics Reviews*, vol. 19, no. 15, art. 2401837, 2025. doi:10.1002/lpor.202401837. (TR911, [Sub-Diffraction Single-Photon LiDAR via a Bilinear Ram Transform for Confocal Super-Oscillatory Illumination]).
- [797] Yanyun Pu, Chengyuan Zhu, Gongxin Yao, Chao Li, Yu Pan, Kaixiang Yang, and Qinmin Yang. “Computational imaging based on single-photon detection: a survey.” *Artificial Intelligence Review*, vol. 58, no. 8, art. 251, 2025. doi:10.1007/s10462-025-11252-4. (TR912, [Ram Transform Analysis of Single-Photon Computational Imaging]).
- [798] Ruairidh Smith, Arthur C. Cardoso, Imogen Morland, Jack W. Thomas, Krish Pandiyan, Greg Blanchard-Emmerson, Corin Gawith, Sara Carver, Andrew Weld, Xiao Ai, John G. Rarity, and Loyd J. McKnight. “Remote methane sensing using single-photon PPLN-waveguide upconversion lidar.” *Optics Express*, vol. 33, no. 13, art. 28177, 2025. doi:10.1364/oe.562989. (TR913, [A Composite Ram Transform for Single-Photon PPLN-Upconversion DIAL Lidar: Analytic-Core Range and Methane-Concentration Inversion with a Super-Geometric Sampling Bound]).
- [799] Yaoqi Bao, Yitian Zhang, Dong Li, Lichen Feng, Rui Ma, and Zhangming Zhu. “Compressive single-photon data representation with spatial correlation on the time-frequency domain.” *Applied Optics*, vol. 65, no.

- 13, p. F1, 2025. doi:10.1364/ao.576457. (TR914, [A Ram-Transform Framework for Compressive Single-Photon Data Representation with Spatial Correlation on the Time-Frequency Domain]).
- [800] Alex Vicente Sola, Matthias Aquilina, Paul Kirkland, and Ashley Lyons. “Single photon event-driven 3D imaging.” *Communications Engineering*, vol. 5, no. 1, art. 2, 2025. doi:10.1038/s44172-025-00555-7. (TR917, [Event-Driven Single-Photon 3D Imaging: Identifiable Timestamp Features and a Calibrated Local Core]).
 - [801] Kehao Chi, Xialin Liu, Ruikai Xue, and Genghua Huang. “SP-LiDAR for Fast and Robust Depth Imaging at Low SBR and Few Photons.” *Photonics*, vol. 12, no. 12, art. 1229, 2025. doi:10.3390/photonics12121229. (TR918, [Low-SBR Single-Photon LiDAR: Profiled Poisson Delay Estimation with EMG Calibration]).
 - [802] Youwen Sun, Xiaomin Hu, Pan Yu, Biheng Liu, Jian Li, Yunsheng Dong, Ke Wang, Yanrui Xu, Haobin Zhao, and Cheng Liu. “Detecting stereoscopic distribution of carbon dioxide using single photon spectroscopy.” *Fundamental Research*, vol. 5, no. 6, pp. 2678-2683, 2025. doi:10.1016/j.fmre.2025.01.016. (TR920, [Single-Photon Spectroscopic CO2 Mapping: A Conditional DIAL-Tomography Formulation]).
 - [803] Tian Rong, Yuhang Wang, Qiguang Zhu, Chenxu Wang, Yanchao Zhang, Jianfeng Li, Zhiquan Zhou, and Qinghua Luo. “Sequential Multimodal Underwater Single-Photon Lidar Adaptive Target Reconstruction Algorithm Based on Spatiotemporal Sequence Fusion.” *Remote Sensing*, vol. 17, no. 2, art. 295, 2025. doi:10.3390/rs17020295. (TR921, [Sequential Underwater Single-Photon LiDAR: Target-Backscatter Separation with Spatiotemporal Fusion]).
 - [804] Shuxiao Wu, Jianyong Hu, Changgang Yang, Yanshan Fan, Jiaqing Ge, Fangyuan Jin, Yaole Cao, Zhixing Qiao, Guosheng Feng, Xilong Liang, Jianqiang Liu, Ruiyun Chen, Chengbing Qin, Guofeng Zhang, Liantuan Xiao, and Suotang Jia. “3D Trajectory Reconstruction of High-Speed Irregularly Moving Objects via Single-Photon Spatiotemporal Correlation.” *Laser & Photonics Reviews*, vol. 19, no. 21, art. e00605, 2025. doi:10.1002/lpor.202500605. (TR927, [Panel-Jet Trajectory Estimation for Single-Photon Spatiotemporal Correlation]).
 - [805] Yiming Shan, Xinyu Pang, Huan Wang, Jitong Zhao, Shuai Yang, Yunlong Li, Guicheng Xu, Lihua Cai, Zhenyu Liu, Xiaoming Wang, and Yi Yu. “Distance Measurement and Data Analysis for Civil Aviation at 1000 Frames per Second Using Single-Photon Detection Technology.” *Sensors*, vol. 25, no. 13, art. 3918, 2025. doi:10.3390/s25133918. (TR928, [Robust Local-Polynomial Range, Velocity, and Acceleration Estimation for Kilohertz Single-Photon Civil-Aviation Measurements]).
 - [806] Wen Zhang, Kun Huang, Xu Wang, Ben Sun, Jianan Fang, Yijing Li, and Heping Zeng. “Mid-Infrared Single-Photon Computational Temporal Ghost Imaging.” *Laser & Photonics Reviews*, vol. 19, no. 11, art. 2402180, 2025. doi:10.1002/lpor.202402180. (TR944, [A Panel-Moment Ram Inverse for Mid-Infrared Single-Photon Computational Temporal Ghost Imaging]).
 - [807] Haomeng Yin, Hui Zhao, Mingyang Yang, Pengfei Wang, Yongan Liu, Lizhi Sheng, and Xuewu Fan. “Single-photon depth super-resolution 3D imaging.” In *Third Advanced Imaging and Information Processing Conference (AIIP 2025)*, p. 39, 2025. doi:10.1117/12.3086571. (TR948, [Multi-Offset Ram Reconstruction for Single-Photon Depth Super-Resolution]).
 - [808] Yu Zhang and Yiming Zheng. “Computationally efficient pixelwise deep learning architecture for accurate depth reconstruction for single-photon LiDAR.” *International Journal of Electrical and Computer Engineering (IJECE)*, vol. 15, no. 6, art. 5934, 2025. doi:10.11591/ijece.v15i6.pp5934-5941. (TR952, [Calibrated Local-Jet Likelihood Cores with Lightweight Pixelwise Learning for Single-Photon LiDAR]).

16.2 Biomedical and Quantitative Computational Imaging

- [809] LESHAN SUN, Kristina Bjegovic, Lucia Rodriguez-Gonzalez, Yifei Xu, Yuchen Yan, Gilberto Gonzalez, Lucy Whitmore, Luke Connell, Yankun Lang, Prabodh Pandey, Lei Ren, Emil Schöler, Yong Chen, and Shawn Xiang. “A Physics-Informed Neural Network for In Vivo Dosimetry Using Quantitative Radiacoustic Imaging.” *Research Square preprint*, 2026. doi:10.21203/rs.3.rs-8503498/v1. (TR260, [An Analytic Green’s-Function-Surrogate Inverse-Source Core with Learned Residual for In Vivo Radiacoustic Dosimetry A Ram Transform Derivation and]).
- [810] Hadas Ben Atya, Nicole Abramenkova, Noa Mashiah, Luise Brock, Daphna Link Sourani, Ram Weiss, and Moti Freiman. “Bootstrapped Physically-Primed Neural Networks for Robust T2 Distribution Estimation in Low-SNR Pancreatic MRI.” *arXiv preprint arXiv:2603.14084*, 2026. arXiv:2603.14084. (TR309, [A Mollified Analytic Local Ram Inverse-Laplace Core with Bootstrapped Learned Residual for Robust T₂-Distribution Estimation in Low-SNR Quantitative MRI]).
- [811] Yu-Hsin Chia, Wei-Hao Liao, Sunil Vyas, Cheng Hung Chu, Takeshi Yamaguchi, Xiaoyuan Liu, Takuo Tanaka, Yi-You Huang, Mu Ku Chen, Wen-Shiang Chen, Din Ping Tsai, and Yuan Luo. “In Vivo Intelligent Fluorescence Endo-Microscopy by Varifocal Meta-Device and Deep Learning.” *Advanced Science*, vol. 11, no. 20, art. 2307837, 2024. doi:10.1002/adv.202307837. (TR999, [Certified, Depth-Generalizing Analytic-Core Reconstruction for a Varifocal Meta-Device Fluorescence Endo-Microscope]).
- [812] Pengming Song, Ruihai Wang, Lars Loetgering, Jia Liu, Peter Vouras, Yujin Lee, Shaowei Jiang, Bin Feng, Andrew Maiden, Changhui Yang, and Guoan Zheng. “Ptycho-endoscopy on a lensless ultrathin fiber bundle tip.” *Light: Science & Applications*, vol. 13, no. 1, art. 168, 2024. doi:10.1038/s41377-024-01510-5. (TR1049, [An Analytic Local Ram-Transform Inverse for Lensless Ultrathin Fiber-Bundle Ptycho-Endoscopy: Bilinear Hopkins Jet Panelized Shift-Variant Transmission Deblur under a Core-plus-Residual Umbrella]).

16.3 Wave, Scattering, and Tomographic Inversion

- [813] Qiao-Ping Chen, Hongyu Liu, Zejun Sun, Li-Li Wang, and Guang-Hui Zheng. “Inverse Random Source Problem for the Helmholtz Equation from Statistical Phaseless Data.” *Journal of Scientific Computing*, vol. 107, no. 1, art. 18, 2026. doi:10.1007/s10915-026-03233-8. (TR289, [A Ram-Transform Framework for the Inverse Random Source Problem of the Helmholtz Equation from Statistical Phaseless Data]).
- [814] Lefu Cai, Hongjie Li, and Xianchao Wang. “A Non-Decoupled Time-Domain Direct Sampling Method for Inverse Elastic Medium Scattering.” *arXiv preprint arXiv:2607.08067*, 2026. doi:10.48550/arxiv.2607.08067. (TR414, [A Coupled-Elastic Block-Jet Ram Transform for Non-Decoupled Time-Domain Inverse Elastic Medium Scattering: An Analytically Invertible P/S Block-Jet Core plus Learned Residual Panelized over the Space-Time Propagation Kernel]).
- [815] Amit K. Singh, Mateo Gomez, Kevin Y. Cho, Aaron W. Skiba, and Samuel J. Grauer. “Ultra-high-speed chemiluminescence tomography of spinning-mode detonation waves.” *arXiv preprint arXiv:2607.07971*, 2026. doi:10.48550/arxiv.2607.07971. (TR415, [Coordinate-Mapped Panel Ram Transform for Ultra-High-Speed Chemiluminescence Tomography of Spinning-Mode Detonation Waves A Shift-Variant Limited-View Reconstruction Operator with an Analytic Core and a Learned Residual]).
- [816] Bangyan Huang, Zipai Wang, Xinjie Zeng, Amir H. Goldan, and Jinyi Qi. “Fast high-resolution lifetime image reconstruction for positron lifetime tomography.” *Communications Physics*, vol. 8, no. 1, art. 181, 2025. doi:10.1038/s42005-025-02100-6. (TR943, [A Statistical Panel-Jet Formulation for SIMPLE Positron Lifetime Tomography]).
- [817] Sheng Gao, Hang Chen, Yichen Wang, Zhengyang Duan, Haiou Zhang, Zhi Sun, Yuan Shen, and Xing Lin. “Super-resolution diffractive neural network for all-optical direction of arrival estimation beyond diffraction limits.” *Light: Science & Applications*, vol. 13, no. 1, art. 161, 2024. doi:10.1038/s41377-024-01511-4. (TR1044, [A Ram Transform Derivation for All-Optical Direction-of-Arrival Super-Resolution Beyond

the Diffraction Limit Analytic Steering-Manifold Inverse Core with Learned Diffractive Residual and a Conditional Local Remainder Bound]).

- [818] Liu Li, Shuai Wang, Feng Zhao, Yixin Zhang, Shun Wen, Huichao Chai, Yunhui Gao, Wenhui Wang, Liangcai Cao, and Yuanmu Yang. “Single-shot deterministic complex amplitude imaging with a single-layer met-alens.” *Science Advances*, vol. 10, no. 1, art. eadl0501, 2024. doi:10.1126/sciadv.adl0501. (TR1046, [Ram Transform Panel-Localized Hopkins-Bilinear Ram Inverse for Single-Shot Complex-Amplitude Imaging with a Single-Layer Metalens]).

16.4 Spectral Reconstruction and Deconvolution

- [819] Vasily Kozhevnikov, Andrey Kozyrev, Dmitry Sorokin, Victor Tarasenko, Dmitry Beloplotov, Eugene Baksht, and Mikhail Lomaev. “Deep Learning-Based Reconstruction of Particle Beam Energy Spectra from Attenuation Curve Data.” *Plasma*, vol. 9, no. 2, p. 18, 2026. doi:10.3390/plasma9020018. (TR302, [Coordinate-Mapped Mollified Ram Inversion with a Learned Residual for Particle-Beam Energy-Spectrum Unfolding from Attenuation Curves A First-Kind Fredholm Inverse Problem under the Analytic-Core-plus-Learned-Residual Umbrella (TR165)]).
- [820] Zhuofan Zhang, Mingxuan Wei, Kyle Fleck, Jun Liu, Xinjian Tan, Gianluca Sarri, and Wenchao Yan. “Neural network-based deconvolution for GeV-scale gamma-ray spectroscopy.” *High Power Laser Science and Engineering*, vol. 14, art. e50, 2026. doi:10.1017/hpl.2026.10142. (TR305, [An Analytic-Core-Plus-Learned-Residual Ram Transform for GeV-Scale Gamma-Ray Spectroscopic Deconvolution]).
- [821] Katia Omani, Mourad Lahdir, Nadia Zikiou, and David Helbert. “Hyperspectral image super-resolution based on spectral graph wavelet transform.” *Earth Science Informatics*, vol. 19, no. 2, art. 19, 2026. doi:10.1007/s12145-025-02072-9. (TR579, [Hyperspectral Image Super-Resolution as a Graph-Global Ram Transform: GGRT-Restriction Spectral Analysis with Panel-Deblur Spatial Synthesis and Learned Residual]).
- [822] Jiajun Shen, Yan Shi, Yi Zhang, Rui Xu, Tianqi Zhao, Chunliu Zhao, and Chunlian Zhan. “Analysis and compensation of 3D reconstruction errors in LiDAR with a time-gated SPAD array camera.” *Applied Optics*, vol. 64, no. 12, art. 3193, 2025. doi:10.1364/ao.553230. (TR915, [A Shift-Variant Ram Transform for Analytic Compensation of 3D Reconstruction Errors in Time-Gated SPAD-Array LiDAR]).
- [823] Sadra Tafaghodi Jami, Sobhan Dabidian, Zahra Kavehvasht, Ali Fotowat-Ahmady, and Jie Yuan. “Noise and Interference Co-Suppression Technique in SPAD-Based Direct Time-of-Flight (d-ToF) Pulsed LiDAR Sensors.” In *2025 IEEE SENSORS*, pp. 1-4, 2025. doi:10.1109/sensors59705.2025.11331064. (TR916, [A Ram-Transform Approach to Noise and Interference Co-Suppression in SPAD-Based Direct Time-of-Flight (d-ToF) Pulsed LiDAR Sensors]).
- [824] Houzhi Cai, Zeng Ye, Fangding Yao, Chao Lv, Xiaohan Cheng, and Lijuan Xiang. “Streak Tube-Based LiDAR for 3D Imaging.” *Sensors*, vol. 25, no. 17, art. 5348, 2025. doi:10.3390/s25175348. (TR919, [Streak-Tube LiDAR 3D Imaging: Calibrated Sweep Rectification and Rank-Tested Local Depth Fitting]).
- [825] Shuxiao Wu, Jianyong Hu, Jiaqing Ge, Yanshan Fan, Zhexin Li, Liu Yang, Kai Song, Jiazhao Tian, Zhixing Qiao, Guosheng Feng, Xilong Liang, Changgang Yang, Ruiyun Chen, Chengbing Qin, Guofeng Zhang, Liantuan Xiao, and Suotang Jia. “10-km passive drone detection using broadband quantum compressed sensing imaging.” *Light: Science & Applications*, vol. 14, no. 1, art. 244, 2025. doi:10.1038/s41377-025-01878-y. (TR922, [Passive Long-Range Drone Detection: Event-Time Sparse Spectral Recovery with Timing-Warp Calibration]).
- [826] Wei Zhong, Yingyu Liu, Qin Yin, Ruocan Zhao, Chong Wang, Wei Ren, Xiankang Dou, and Xianghui Xue. “Broadband photon-counting dual-comb spectroscopy with attowatt sensitivity over turbulent optical paths.” *Light: Science & Applications*, vol. 14, no. 1, art. 293, 2025. doi:10.1038/s41377-025-01934-7. (TR923, [Photon-Counting Dual-Comb Spectroscopy: Residual Timing-Warp Estimation after Common-Mode Triggering]).

- [827] Zhihao Zhao, Zhaohua Yang, Jie Liu, Ling'an Wu, and Yuanjin Yu. "Hyperspectral-depth imaging based on single-pixel detectors." *Chinese Optics Letters*, vol. 23, no. 5, art. 051103, 2025. doi:10.3788/col202523.051103. (TR924, [Single-Pixel Hyperspectral-Depth Imaging: Coupled Calibration, Local Subspaces, and Identifiability]).
- [828] Jincui Hu, Qichang An, Wenjie Wang, Tong Li, Lin Ma, Shufei Yi, and Liang Wang. "Research Progress and Applications of Single-Pixel Imaging Technology." *Photonics*, vol. 12, no. 2, art. 164, 2025. doi:10.3390/photonics12020164. (TR925, [Single-Pixel Imaging Across Architectures: A Conditioning-Aware Local-Subspace Framework]).
- [829] Carsten Pitsch, Alessia Suprano, Benjamin Guery, Francesco Poggiali, Chiara Michelini, Henri Haka, Davide Moschella, Dominik Walter, Ugo Zanforlin, Massimiliano Proietti, Massimiliano Dispenza, Alberto Tosi, and Federica Villa. "Toward video-rate quantum ghost imaging." *APL Photonics*, vol. 10, no. 10, art. 100801, 2025. doi:10.1063/5.0284755. (TR926, [Asynchronous Quantum Ghost Imaging: Coincidence Calibration and Streaming Reconstruction at Video Rate]).
- [830] Bowen Wang, Wenwu Chen, Jiaming Qian, Shijie Feng, Qian Chen, and Chao Zuo. "Single-shot super-resolved fringe projection profilometry (SSSR-FPP): 100,000 frames-per-second 3D imaging with deep learning." *Light: Science & Applications*, vol. 14, no. 1, art. 70, 2025. doi:10.1038/s41377-024-01721-w. (TR929, [Coordinate-Mapped Analytic-Core Reconstruction for Single-Shot Super-Resolved Fringe Projection Profilometry]).
- [831] Tao Liu, Jiahao Liu, Dong Li, and Shan Tan. "Bayesian deep-learning structured illumination microscopy enables reliable super-resolution imaging with uncertainty quantification." *Nature Communications*, vol. 16, no. 1, art. 5027, 2025. doi:10.1038/s41467-025-60093-w. (TR930, [Analytic Covariance and Residual Diagnostics for Bayesian Deep-Learning Structured Illumination Microscopy]).
- [832] Yiming Liu, Spozmai Panezai, Yutong Wang, and Sjoerd Stallinga. "Noise amplification and ill-convergence of Richardson-Lucy deconvolution." *Nature Communications*, vol. 16, no. 1, art. 911, 2025. doi:10.1038/s41467-025-56241-x. (TR931, [Noise-Gain-Limited Panel Inversion in Light of the Richardson-Lucy CRLB Divergence]).
- [833] Min Guo, Yicong Wu, Chad M. Hobson, Yijun Su, Shuhao Qian, Eric Krueger, Ryan Christensen, Grant Kroeschell, Johnny Bui, Matthew Chaw, Lixia Zhang, Jiamin Liu, Xuekai Hou, Xiaofei Han, Zhiye Lu, Xuefei Ma, Alexander Zhovmer, Christian Combs, Mark Moyle, Eviatar Yemini, Huaifeng Liu, Zhiyi Liu, Alexandre Benedetto, Patrick La Riviere, Daniel Colón-Ramos, and Hari Shroff. "Deep learning-based aberration compensation improves contrast and resolution in fluorescence microscopy." *Nature Communications*, vol. 16, no. 1, art. 313, 2025. doi:10.1038/s41467-024-55267-x. (TR932, [Calibrated Panel Inversion and Learned Residuals for Fluorescence-Microscopy Aberration Compensation]).
- [834] Baolei Liu and Fan Wang. "Multi-resolution analysis for high-fidelity deconvolution microscopy." *Light: Science & Applications*, vol. 14, no. 1, art. 1, 2025. doi:10.1038/s41377-024-01654-4. (TR933, [Ram Panel Preconditioning for Fidelity-Constrained Multi-Resolution Deconvolution Microscopy]).
- [835] James P. Fleming, Lucy A. Downes, John M. Girkin, and Kevin J. Weatherill. "Virtually structured illumination for terahertz super-resolution imaging." *Optics Express*, vol. 33, no. 12, art. 26509, 2025. doi:10.1364/oe.563675. (TR934, [Regularized Local-Operator Completion of Virtually Structured Detection for Terahertz Super-Resolution]).
- [836] Xuehua Wang, Hechong Zhang, Hao Yang, Xiangcong Xu, Hanyang Lin, Dingan Han, and Junle Qu. "High-fidelity super-resolution optical fluctuation imaging via frequency separation correlation." *Optics Express*, vol. 33, no. 25, art. 53144, 2025. doi:10.1364/oe.583829. (TR935, [Regularized Effective-PSF Inversion after Frequency-Separation Correlation SOFI]).
- [837] Amit Kohli, Anastasios N. Angelopoulos, David McAllister, Esther Whang, Sixian You, Kyrollos Yanny, Federico M. Gasparoli, Bo-Jui Chang, Reto Fiolka, and Laura Waller. "Ring deconvolution microscopy: exploiting symmetry for efficient spatially varying aberration correction." *Nature Methods*, vol. 22, no. 6, pp. 1311-1320, 2025. doi:10.1038/s41592-025-02684-5. (TR936, [Symmetry-Preserving Radial Panel Operators for Ring Deconvolution Microscopy]).

- [838] Lanxin Zhu, Jiahao Sun, Chengqiang Yi, Meng Zhang, Yihang Huang, Sicen Wu, Mian He, Liting Chen, Yicheng Zhang, Chunhong Zheng, Hao Chen, Jiang Tang, Yu-Hui Zhang, Dongyu Li, and Peng Fei. “Adaptive-learning physics-assisted light-field microscopy enables day-long and millisecond-scale super-resolution imaging of 3D subcellular dynamics.” *Nature Communications*, vol. 16, no. 1, art. 7132, 2025. doi:10.1038/s41467-025-62471-w. (TR937, [A Rank-Qualified Panel-Jet Analytic Core for Adaptive Physics-Assisted Light-Field Microscopy]).
- [839] Xu Zhang, Bowen Wang, Sheng Li, Kunyao Liang, Haitao Guan, Qian Chen, and Chao Zuo. “Lensless imaging with a programmable Fresnel zone aperture.” *Science Advances*, vol. 11, no. 12, art. eadt3909, 2025. doi:10.1126/sciadv.adt3909. (TR938, [A Rank-Qualified Panel-Jet Correction for Programmable Fresnel-Zone-Aperture Lensless Imaging]).
- [840] Yibin Liu, Shengbin Luo Wang, Guoqing Wu, Ke Liu, Zezhou Wu, Ping Wang, and Yongzhen Li. “Polarization Modulation Spectral Approach for Multichannel Radar Forward-Looking Superresolution Imaging.” *IEEE Transactions on Aerospace and Electronic Systems*, vol. 61, no. 5, pp. 14764-14781, 2025. doi:10.1109/taes.2025.3586826. (TR939, [A Polarization-Stacked Panel-Jet Inverse for Single-Snapshot Forward-Looking Radar Super-Resolution]).
- [841] Zhi Lu, Manchang Jin, Shuai Chen, Xiaoge Wang, Feihao Sun, Qi Zhang, Zhifeng Zhao, Jiamin Wu, Jingyu Yang, and Qionghai Dai. “Physics-driven self-supervised learning for fast high-resolution robust 3D reconstruction of light-field microscopy.” *Nature Methods*, vol. 22, no. 7, pp. 1545-1555, 2025. doi:10.1038/s41592-025-02698-z. (TR940, [A Physics-Consistent Panel-Jet Analytic Core for Self-Supervised Light-Field Reconstruction]).
- [842] Yashil Sukurdeep, Tamás Budavári, Andrew J. Connolly, and Fausto Navarro. “ImageMM: Joint multi-frame image restoration and super-resolution.” *arXiv preprint arXiv:2501.03002*, 2025. doi:10.48550/arxiv.2501.03002. (TR941, [A Flux-Preserving Panel-Jet Preconditioner for ImageMM Multi-Frame Astronomical Restoration]).
- [843] Yasmine El Mobariki and Amine Laghrib. “Optimization constraints and Practical Implementations of a Stochastic Primal-Dual Fixed-Point Algorithm for Blind Image Deconvolution.” *Journal of Industrial and Management Optimization*, vol. 21, no. 7, pp. 4944-4984, 2025. doi:10.3934/jimo.2025081. (TR942, [A Calibrated Panel-Jet Preconditioner for Stochastic Primal-Dual Blind Deconvolution]).
- [844] Rebecca Re, Lorenzo Spinelli, Fabrizio Martelli, Laura Di Sieno, Ilaria Bargigia, Caterina Amendola, Giulia Maffei, and Alessandro Torricelli. “A review on time domain diffuse optics: principles and applications on human biological tissues.” *La Rivista del Nuovo Cimento*, vol. 48, no. 3, pp. 157-239, 2025. doi:10.1007/s40766-025-00067-2. (TR945, [A Boundary- and IRF-Aware Panel-Jet Framework for Time-Domain Diffuse Optics]).
- [845] Di Liu, Jianfeng Sun, Wei Lu, Sining Li, and Xin Zhou. “Reconstruction for Scanning LiDAR with Array GM-APD on Mobile Platform.” *Remote Sensing*, vol. 17, no. 4, art. 622, 2025. doi:10.3390/rs17040622. (TR946, [Pose-Registered and Rank-Aware Panel Reconstruction for Mobile Array GM-APD LiDAR]).
- [846] Frederic Lange, Uzair Hakim, Jack Highton, Olayinka Kowobari, Niccole Ranaei-Zamani, Sarah Johnson, Olivia Newth, Subhabrata Mitra, Ilias Tachtsidis, Dimitrios Siassakos, Sara Hillman, and Anna David. “A multispectral Time-Domain NIRS system for non-invasive placental monitoring.” *Optica Publishing Group*, 2026. doi:10.1364/opticaopen.29941637. (TR947, [Ram-Assisted Multispectral TD-NIRS Inversion]).
- [847] Michael A. Steindorfer, Peiyuan Wang, Franz Koidl, and Georg Kirchner. “Space debris and satellite laser ranging combined using a megahertz system.” *Nature Communications*, vol. 16, no. 1, art. 575, 2025. doi:10.1038/s41467-024-55777-8. (TR949, [Ephemeris-Deskewed Processing for Megahertz Laser Ranging]).
- [848] Xiongfei Su, Tianyi Zhu, Lina Liu, Zheng Chen, Yulun Zhang, Siyuan Li, Juntian Ye, Feihu Xu, and Xin Yuan. “Dual-branch Graph Feature Learning for NLOS Imaging.” *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 39, no. 7, pp. 7051-7059, 2025. doi:10.1609/aaai.v39i7.32757. (TR950, [Panelized Local-Moment Preconditioning and Dual-Branch Graph Reconstruction for Confocal Non-Line-of-Sight Imaging]).

- [849] Maxime Toussaint, Francis Loignon-Houle, Jean-Pierre Dussault, and Roger Lecomte. “Time-of-Flight Requirements to Mitigate Blurring Induced by Annihilation Photon Acollinearity.” *IEEE Transactions on Radiation and Plasma Medical Sciences*, vol. 10, no. 2, pp. 210-217, 2026. doi:10.1109/trpms.2025.3579209. (TR951, [A Panel-Moment Fisher Preconditioner for TOF-PET with Explicit Annihilation-Photon Acollinearity Modeling]).
- [850] Kaiyang Ding, Ming Wang, Mengyuan Chen, Xiaohao Wang, Kai Ni, Qian Zhou, and Benfeng Bai. “Snapshot spectral imaging: from spatial-spectral mapping to metasurface-based imaging.” *Nanophotonics*, vol. 13, no. 8, pp. 1303-1330, 2024. doi:10.1515/nanoph-2023-0867. (TR1047, [Ram Transform Derivation for Metasurface-Coded Snapshot Spectral Imaging: A Panel-Jet Shift-Variant Inverse with Analytic-Core-plus-Learned-Residual Reconstruction]).

17 Other Areas

1 bibliography item.

17.1 Helioseismology and Solar-Wave Inverse Problems

- [851] Tram Thi Ngoc Nguyen, Damien Fournier, Laurent Gizon, and Thorsten Hohage. “Linear Toroidal-Inertial Waves on A Differentially Rotating Sphere with Application to Helioseismology: Modeling, Forward and Inverse Problems.” *Mathematical Methods in the Applied Sciences*, art. mma.70775, 2026. doi:10.1002/mma.70775. (TR307, [Panelized Variable-Coefficient Ram Transform Inversion of the Toroidal-Inertial Wave Operator on a Differentially Rotating Sphere with Application to Helioseismic Rotation-Profile Recovery]).