



R Suite

Railway Energy Efficiency Simulation Platform

A Malaysian Innovation for Sustainable Metro Operations

SIMULATION | OPTIMIZATION | MALAYSIAN RAILWAY



<https://www.raftsb.com/>

R Suite

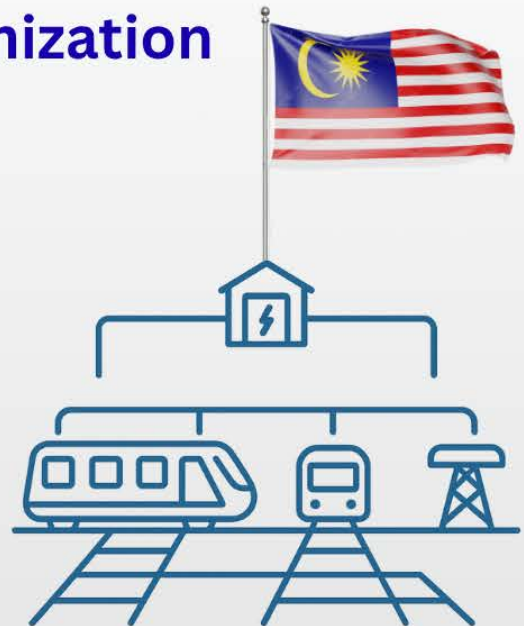
Integrated Simulation + Optimization

for Sustainable Metro Operations

Platform Overview

R Suite is Malaysia's first locally development attempt for multi-train energy simulation and optimization.

It models the interaction between trains, substation and power network to identify operational strategies that minimize traction energy use.



Potential Energy Savings

Via Dynamic Programming Driving Style and Train Pairing



Integrated Algorithm

Recursive Motion and Electrical Interaction Modelling



Local Capability

100% Local Malaysian development effort



Sustainability Impact

Supports ESG and SDG Goals

Base Module Calculation Validation

Validation Framework

1. **Cross-Validation Using Commercial Benchmark Software** (e.g. Siemens or Open PowerTrack/PowerNet)
2. **Real World Case Studies (e.g. MRT2)**
3. **IEEE1653.3 Alignment**
4. **EN50641 Benchmarking**



R Suite

Calculation Framework

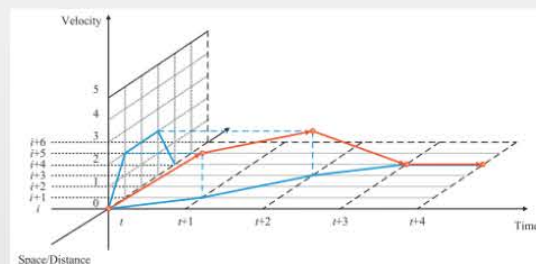
Modular, Validated and Built for Railway



Module 1 - Multi-Train Simulation Engine (Base Module)

Foundation of R-Suite - Mechanical & Electrical co-simulation of railway operations

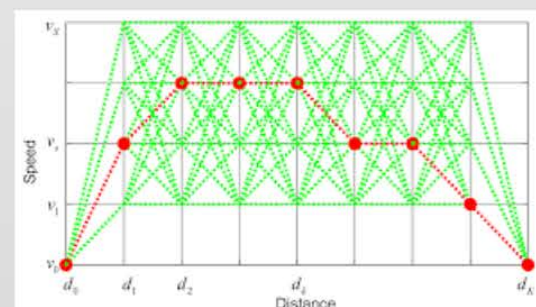
- Simulate Multi-Train motion across full network
- Integrate mechanical motion and electrical calculation recursively



Module 2 - Dynamic Programming (Driving Optimization)

Optimization of single-train driving strategies (eco-driving)

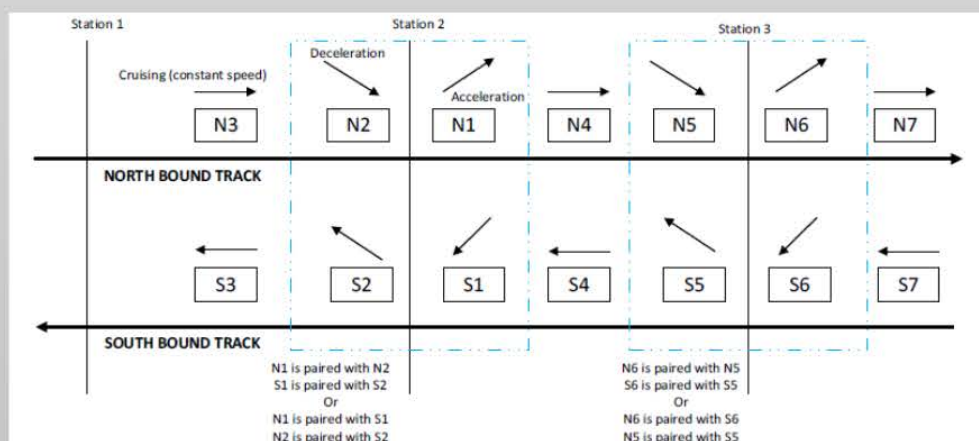
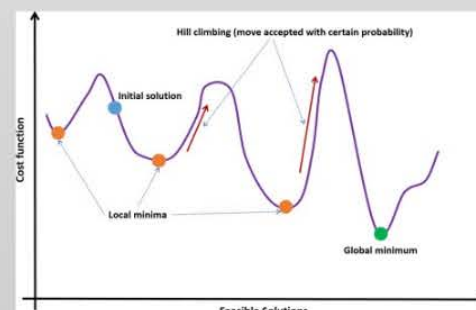
- Minimize total energy consumption while meeting trip time constraint
- Integrate voltage consideration along mechanical motion
- Generates optimized speed profiles for energy-efficient operation.



Module 3 - Simulated Annealing (SA)

System Wide timetable optimization for multi-train regenerative energy

- Minimize net traction energy
- Maximizes energy transfer between accelerating and braking trains

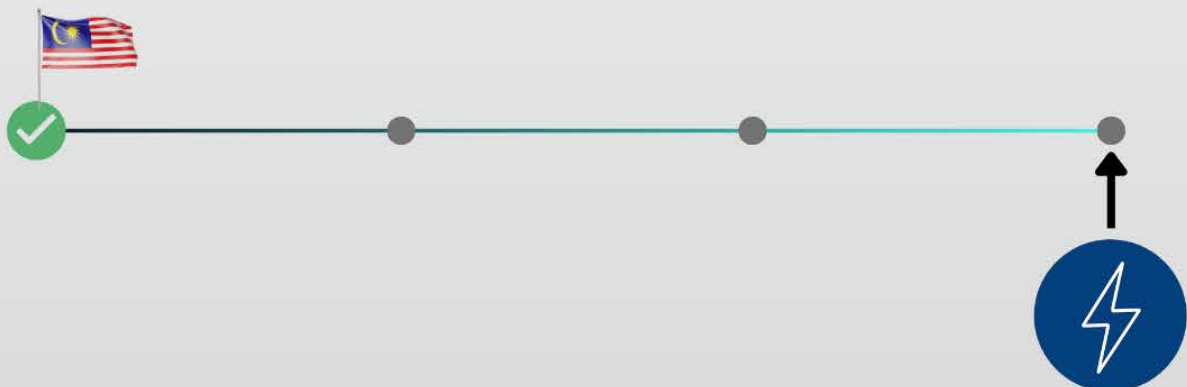


R Suite

Development Milestones & Progress

From Simulation Core to Real-World Energy Optimization, In Partnership with Industry Leaders.

Current Progress: Base Module Completed - Entering Validation Phase



Base Simulation Module

Completed ✓

R Suite's multi-train simulation engine is fully developed and currently undergoing validation.

This milestone begins a collaborative validation phase, strengthened by our partner's technical insights and operational data sharing.

The results from this validation will form the cornerstone for upcoming optimization modules.

Targeted Energy Savings:
20-25% reduction in traction energy.



With sincere appreciation to MRT Corp for their support in data validation

Rafflesia
Technology
Innovation Blooms Here



R Suite

Our development Journey

From Conceptual Modelling to Industrial compliant simulation

R Suite integrates mechanical-electrical coupling, voltage-dependent traction logic, and adaptive control algorithms, forming the foundation for energy optimization and real-world validation.

Here goes our journey....

Adaptive Speed Limit Profiling

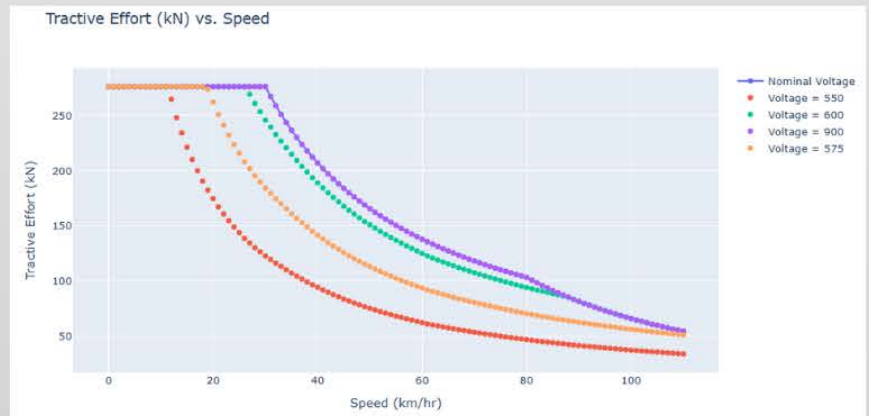


- Real-time smoothing of discrete speed steps
- Incorporates acceleration limits and braking dynamics
- Foundation for predictive driving control logic, prevents train over-travel and pre-stop motion

Traction Effort with Voltage Dependency

Developed a model where tractive effort dynamically responds to DC voltage levels, ensuring alignment with EN50388 and EN50163 electrical behavior.

- Full tractive effort vs speed profile under multiple voltage levels
- Captures traction power degradation due to voltage drop



Power Limit Modelling



Introduced voltage-dependent power clamping logic that restricts electrical power output based on available supply voltage.

- This ensures simulation conformance to EN50388 Annex A for power limitation and protection.
- Foundation for full EN50163 voltage envelope integration



