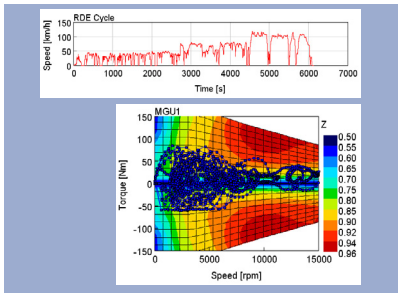
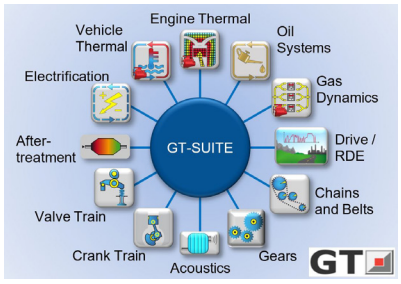
MAHLE Powertrain 03/2025

MAHLE Powertrain

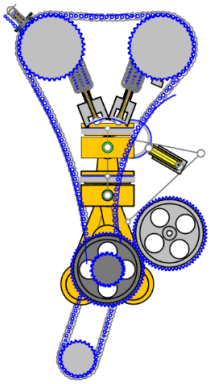
1D Analysis



Battery Development Centre (BDC)



GT-SUITE applications



Laser welding

Flexible Simulation Capability

1D simulation is the use of physics equations and empirical data to model the dynamics and integration of many parts within complex systems.

MAHLE Powertrain has vast experience of 1D simulation using GT-SUITE software. This allows for a first principals approach to any engineering problem.

Rapidly generated models can be readily populated with data from our test cells and data bases before the specialist correlation and optimisation processes can begin.

Traditional Engine & Powertrain Simulation

- Mechanical Simulation
  - › Crankshafts, chains, belts, gears, pumps, lubrication
  - › Complete hybrid powertrain vibration analysis
- GT-POWER Engine Simulation
  - › Hardware selection & optimisation
  - › Novel technologies & combustion processes

Rapid model creation and correlation
Specification and optimisation

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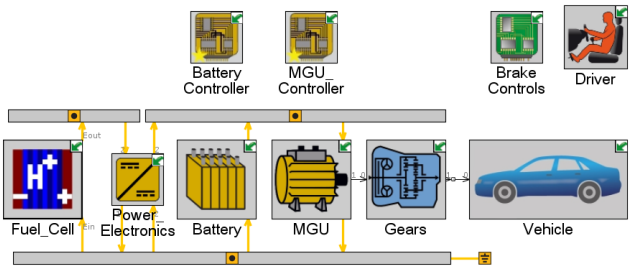
Battery Simulation

- Cell selection, pack sizing & cooling definition
- Electrical model creation from cell data
- FE-mesh to 1D cell thermal model progression
- Thermal inputs from CFD (e.g. cooling plate)
- Linked into vehicle system (powertrain for energy demand, cooling system for thermal regulation) and optimised over drive cycles

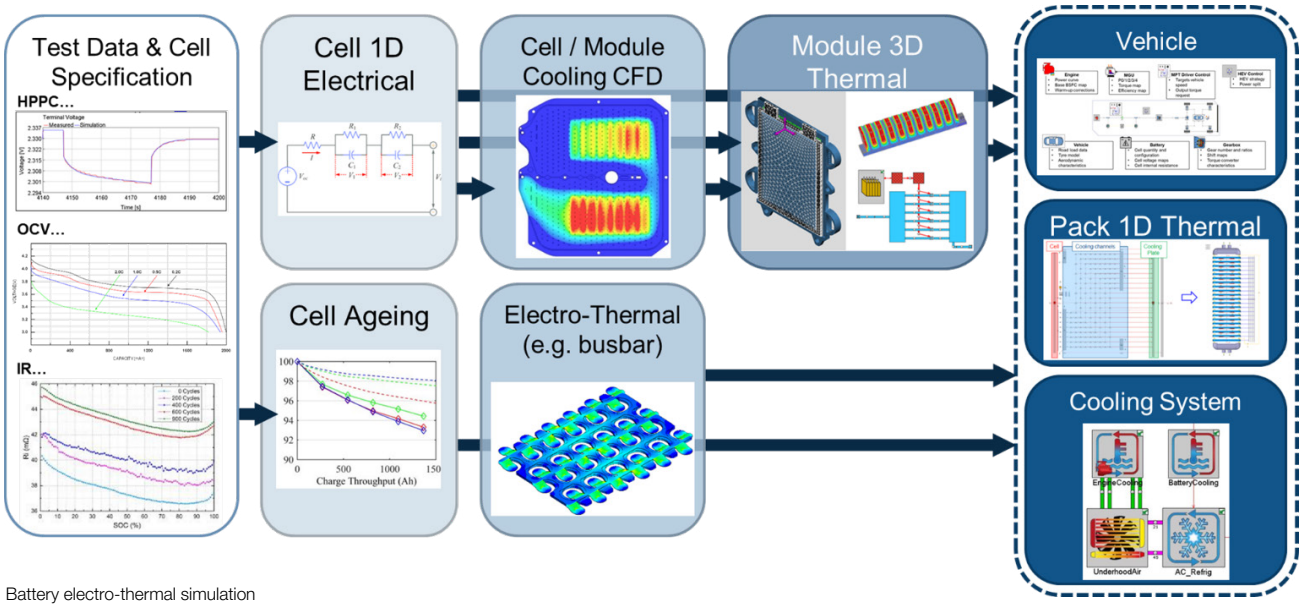
Software, Tools & Services

- Flexible vehicle co-simulation environment
- Any sub-system models can be linked in
  - › Thermal, controls, emissions models etc.
- Sub-system specification and operating strategy optimisation over drive cycles
- Virtual calibration and testing, SiL and HiL
- Tailored RDE drive cycle generation



Fuel Cell & xEV Simulation

- Optimisation of fuel cell size
- Analysis of fuel cell architecture concepts
- Hydrogen and air flow system modelling
  - › Tank filling
  - › Compression system dynamics
- Hybrid strategy development
  - › Energy development
  - › Automated optimisation techniques



Battery electro-thermal simulation

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