



GAMMA
TECHNOLOGIES

GT-SUITE

The standard in Multi-Physics System Simulation

ELECTRIFIED VEHICLE DESIGN AND ANALYSIS WITH **GT-SUITE**



Maximize electric
range and fuel
economy



Optimize thermal
management and
climate control



Address
driveability and
NVH challenges

Challenges and GT Solutions

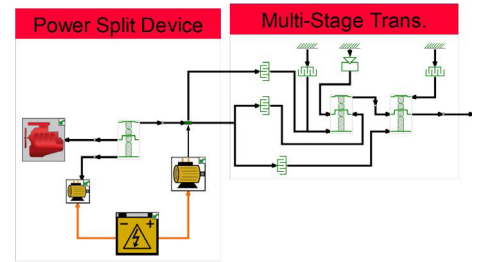
Flexible platform modeling tool for all stages of development process

Vehicle Development Process

Concept & Architecture Design

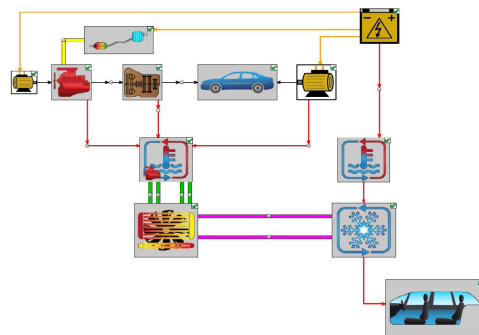
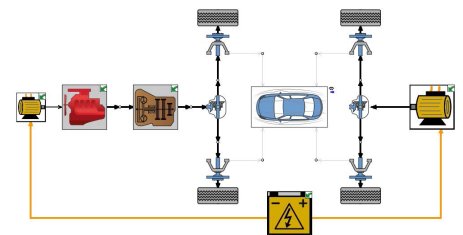
The Challenge

- Selection of hybrid powertrain architecture (series, parallel, power-split, etc.) and components
- Selection of electrification level (48 volt mild-HEV, PHEV, BEV, etc.)



GT-SUITE Solution

- Utilize GT-SUITE's powerful model and data management tools to build libraries of components to quickly set up and test many vehicle architectures, combinations of components, and battery sizes
- Use GT-SUITE's full transmission library and object-oriented interface to build and test any electrified vehicle architecture, even exotic architectures like a power-split hybrid with a multi-stage



The Challenge

- Temperature control of HEV components like batteries, engines, transmissions, motors, and power electronics
- Ensure pleasant cabin comfort while preserving fuel economy and electric range

GT-SUITE Solution

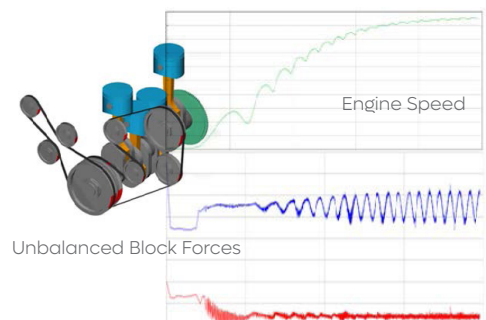
- Integrate thermal management and after-treatment systems with electrified vehicles to optimize vehicle thermal and energy management strategies

The Challenge

- Frequent starts and stops of the engine require more refined engine start-stop dynamics
- Certain electrified powertrains increase usage of clutches, causing vibrations during engagement

GT-SUITE Solution

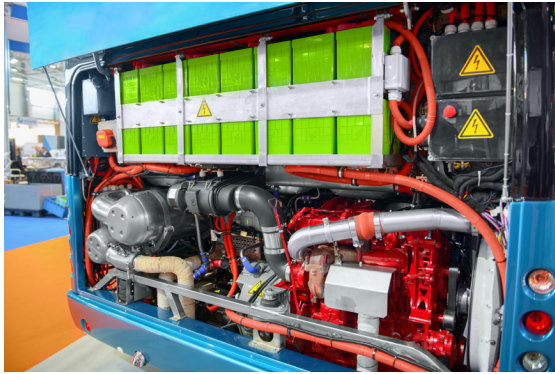
- Integrate GT-POWER engine models, 2D engine mechanics models, and accurate drivetrain models together to mitigate drivability-related challenges



Integration & Detailed Analysis

Supporting Technologies

Battery Systems



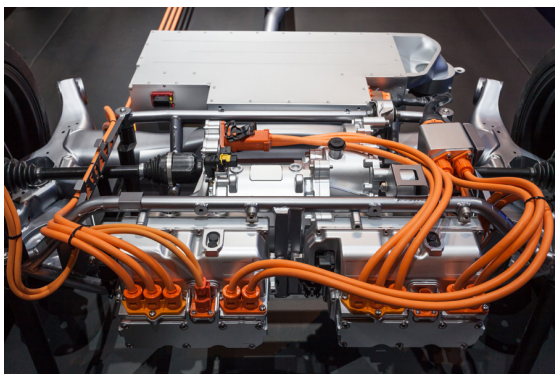
- Easily iterate cell selection and number of cells for fast battery size optimization
- Quickly explore designs for battery cooling architecture (air, coolant, or refrigerant-cooled) and their effects on warm-up and temperature control
- Integrate advanced thermal management systems with electrical solution for module-to-module, cell-to-cell, or intracellular temperature and current distribution
- Electrically discretize to account for losses in battery wiring or cell-balancing circuits

Engine Systems



- Predict fuel economy and emissions with simple, map-based, fast-running engines
- Utilize industry standard GT-POWER engine models for transient effects of engine flow paths and turbocharger lag
- Integrate aftertreatment reaction kinetics to test electrically heated catalyst strategies
- Use 2D and 3D multi-body dynamic models of engine mechanics and belts for accurate engine start-stop dynamics

Transmission and Driveline



- Build any hybrid architecture with GT-SUITE's complete and flexible transmission library
- Integrate hydraulics, pneumatics, and multi-body dynamics for shift quality assessment
- Model electrical, mechanical, and thermal dynamics of entire e-axle systems
- Connect to thermal management systems for transient warm-up studies

Thermal Management Systems



- Accurately model thermal warm-up of powertrain components like batteries, engines, and transmissions
- Optimize heat exchanger layout with fast-running, quasi-3D Navier Stokes approach for underhood modeling
- Ensure cabin comfort with transient-capable models of cabin components
- Maximize performance of air conditioning and waste heat recovery systems with 2-phase flow modeling

About Gamma Technologies

Founded in 1994 and headquartered in Westmont, Illinois, Gamma Technologies, LLC develops and licenses GT-SUITE, a leading multi-physics CAE system simulation software. GT-SUITE includes a complete library of physics based modeling templates covering fluid flow, thermal, mechanical, electrical, magnetic, chemical, and controls domains. We at GT are dedicated to building the most advanced system simulation tools, complemented with carefully designed software solutions that provide major productivity improvements for our customers.

Why use GT-SUITE?

- GT-SUITE is the industry leading system simulation tool
- Proven fidelity, ease of use, and speed
- Link to PLM tools for data storage and retrieval
- Ability to integrate subsystems and physical disciplines in xLINK, the tool-neutral co-simulation platform
- Multi-Physics foundation allows for tightly coupled simulation that accounts for interdependencies of physical domains
- Powerful fusion of 1D and 3D
- Guide product development from initial specifications to final implementation
- Integrated DOE and Optimization at no extra cost

Testimonials

- "Gamma has set the standard for CAE software. Other applications are being compared to GT-SUITE as the benchmark."
- "GT is continuously improving their product and they give world-class support"
- "When people asked if something can be modeled in GT-SUITE, I have always been able to say 'Yes'.
- "Enables battery modeling and hybrid control strategy development."
- "GT-SUITE has become the 'Bread&Butter' for us. No wonder why it is called the 'Industry Standard'."
- "It's great to see that GT-SUITE capabilities stay ahead of our requirements. The vision & effort to keep ahead of customer requirements will keep Gamma a leader in this field."
- "Fantastic platform for multi-disciplinary collaboration."

Customer Service

GT is committed to providing the best possible training and customer support to all users of GT-SUITE. We strongly believe that high quality customer support is essential to ensure that users get the most accurate and meaningful results. In parallel, through our daily support interactions with customers, we receive valuable feedback and requests for new cutting-edge features, which benefits the further development of GT-SUITE.

In addition to the day-to-day support, GT also offers classes, seminars, webinars and organizes annual user conferences.

