

Highlights:

The most complete VTM system analysis tool

Built-in GT-POWER engine model assures the highest accuracy in representation of engines

Two-way interactions between cooling and CAC and EGR cooler

Handles rapidly and with ease large scale models with even 10,000 or more components

Contains models of:

- vehicle
- engine
- coolant circuit
- lubrication circuit
- transmission oil circuit
- HVAC with 2-phase flow
- 3-D underhood module
- electrical components
- controls

All above models are highly capable, and establish a new level of state-of-the-art

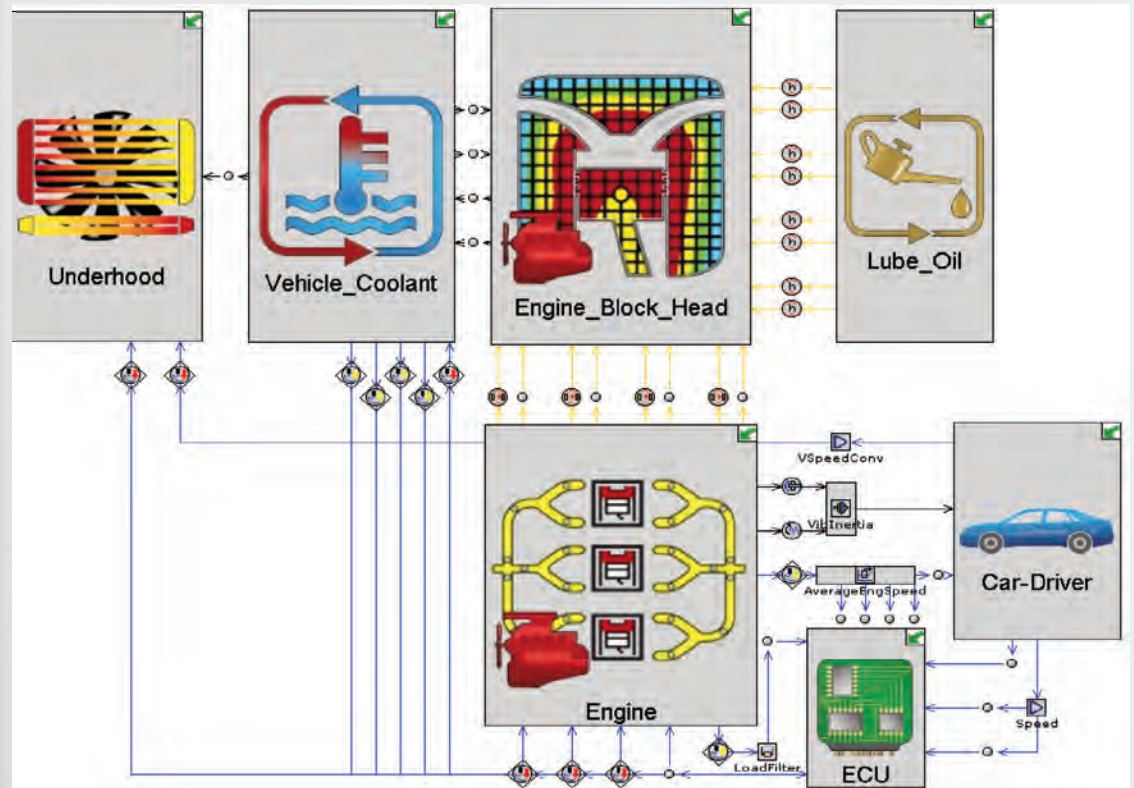
Vehicle Thermal and Energy Management

Complete Solution of the Entire System

GT-SUITE has a very strong capability for design and optimization of vehicle thermal management systems. It has been specifically designed for use by vehicle manufacturers and heat management component suppliers.

Thermal management is a broad area whose tasks are distributed over a number of vehicle sub-systems and organizational departments. Traditionally, each sub-system was designed and optimized with independent analytical tools, which may have varied from department to department (engine, vehicle, engine cooling, underhood, lubrication). However, **to study vehicle thermal management as a system requires that the models of the various vehicle subsystems are allowed to fully interact.** This is not easily achievable when a number of separate CAE tools are used, and this has become a roadblock to progress, and inhibits sharing of relevant data across the various disciplines involved in heat management.

To overcome this problem GT-SUITE offers all of the relevant capabilities needed to carry out an analysis of vehicle thermal management in a single integrated model.



Advanced Features and Applications:

Couples with GT-POWER engine models

Four levels of engine models are available: map-based, mean-value and two levels of crankangle based models

Applications typically include vehicle modeling

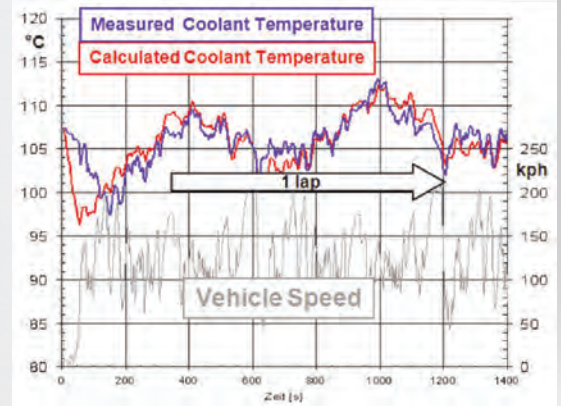
Executes any desired driving cycle

User-defined driving events can be structured using the provided "Event Manager"

Widely used for component selection, typically evaluated over a driving cycle

These capabilities are included in every GT-SUITE license

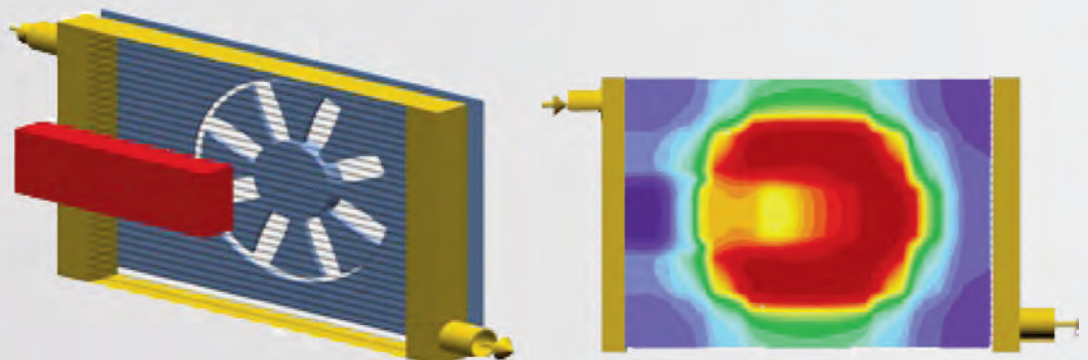
GT-SUITE uses **advanced flow solution methodology** based on compressible 1-D CFD flow that solves for mass, momentum, energy and species (unlike other hydraulics simulation tools which use approximations such as an electrical analogy). As a result, it obtains more accurate predictions, especially under transient or unsteady flow conditions. It is very robust and stable, and **handles "standing water" in the piping without difficulty**.



Prediction of coolant temperature in a vehicle at high speeds

To create a complete vehicle thermal management system model, many **parallel fluid circuits** can be modeled simultaneously, each containing a different fluid (coolant, oil, transmission fluid, air, combustion products, A/C refrigerant, etc.). More detail on the individual sub-systems may be found in the sheets dealing with "**Engine Cooling**", "**Lubrication**", and "**Air Conditioning and Heating**". These circuits interact through heat exchangers or thermal masses, transferring heat from one circuit to another, which allows the calculation of the overall heat balance in the system.

All of the fluid circuits meet in the **underhood cooling module (UHM)**, containing multiple heat exchangers and the fan. The CAD-based preprocessor COOL3D automatically meshes the UHM to produce a 3-D flow model solved by GT-SUITE (see sheet dealing with "**Underhood Cooling Module**"). This provides a powerful predictive capability which is **unique in the industry**.



Prediction of 3-D features of the air flow through a radiator and a fan

GT-SUITE contains all of the specialized models required for vehicle system analysis, including engine and vehicle models for simulation of any desired driving cycle or schedule. An included library of **electric components** is used to model **hybrids and all other electric systems** (see sheet dealing with "Hybrids and Electrics").