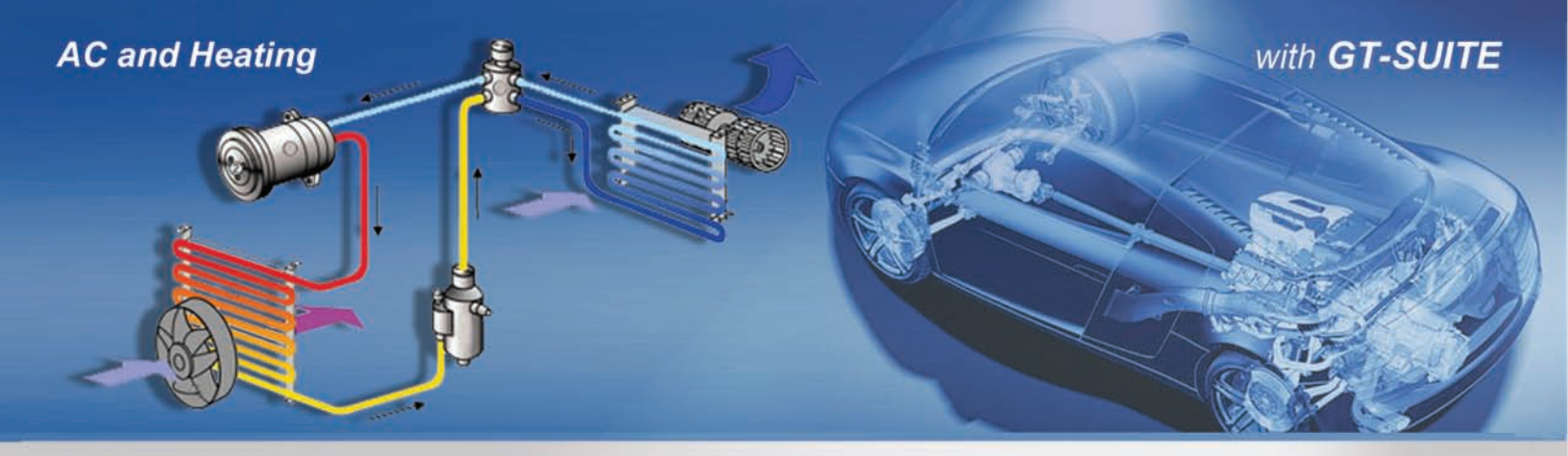


Highlights:

Model all A/C system components individually or as a complete system

Detailed spatially resolved condenser and evaporator models

REFPROP properties of refrigerants and mixtures

Robust solver based on Navier-Stokes equations

Sub- and super-critical two-phase systems

Smooth start from any initial condition

Stable even with zero flow and thus "standing water" presents no difficulty

Fast execution (faster than real-time)

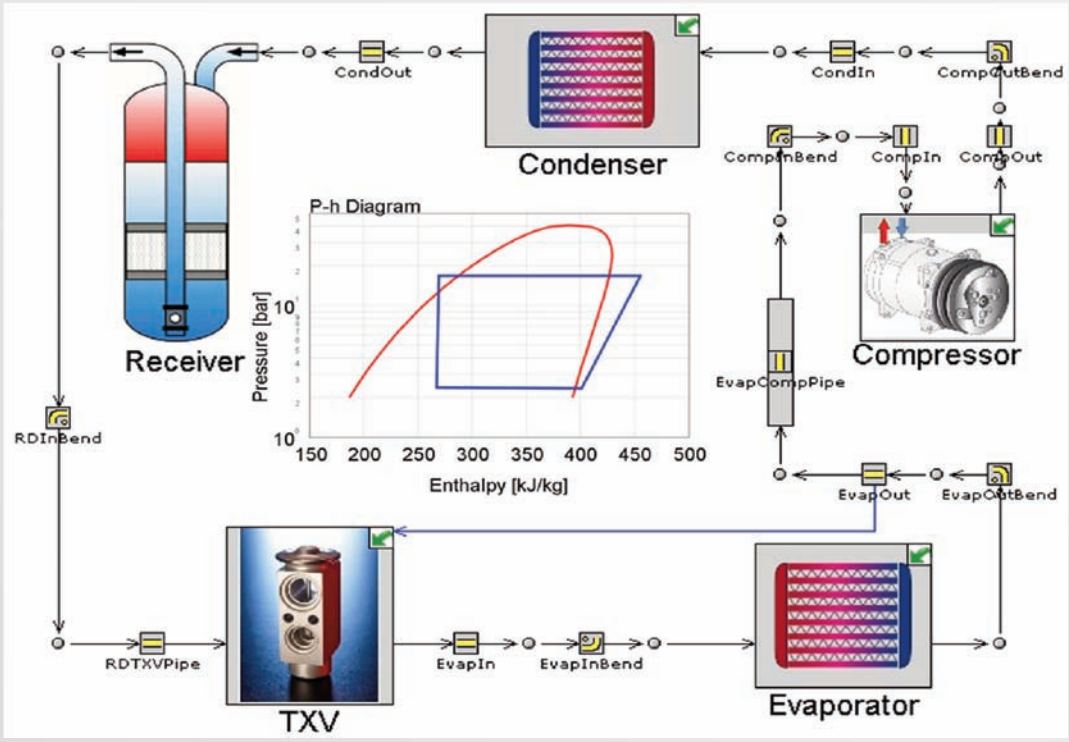
Multiple level of models of compressors, pumps, turbines and expanders, all the way to prediction of mechanical losses

Air Conditioning and Heating

Fast and Robust Simulation of Two-Phase Flows

GT-SUITE has a **highly advanced capability for solving two-phase flows**. It is based on the same proven flow solver used for a wide range of fluid simulations in GT-SUITE, such as engine performance, fuel injection and hydraulics. It handles two-phase fluids based NIST REFPROP thermodynamic properties, complemented by a variety of two-phase flow heat transfer and pressure drop correlations. The model is **completely transient**, to allow a broad range of investigations. Because of its strong fundamental flow solution methodology, it is **very robust** and allows the simulation to start from an arbitrary starting point. The code execution is **faster than real-time**.

GT-SUITE models all types of air conditioning systems, including both fixed orifice tube and accumulator systems, and thermal expansion valve (TXV) and receiver/dryer systems. It also handles **transcritical** systems (e.g. CO2 and HFO-1234yf). As with all GT-SUITE models, these models are object oriented, which allows for optimum flexibility and creation of various configurations such as branched multi-evaporator systems, as well as open-circuit modeling for component calibration.



GT Gamma Technologies

Contact us at: www.gtisoft.com

Advanced Features and Applications:

Contains models of:

- **vehicle**
- **engine**
- **condenser**
- **evaporator**
- **fixed orifice tube and accumulator**
- **thermal expansion valve (TXV) and receiver/dryer**
- **cabin**
- **compressor**
- **blower**
- **fluid machinery**
- **electrical components**
- **controls**

Refrigerant pressure drop and heat transfer correlations, including predictive heat transfer based on HX geometry

Includes humidity effects

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

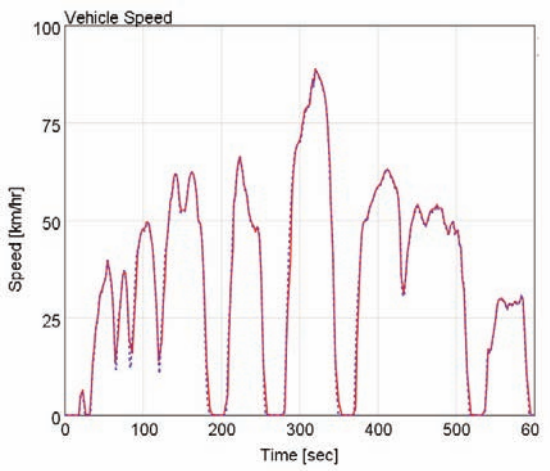
Suitable for SCO3 driving cycle energy analysis

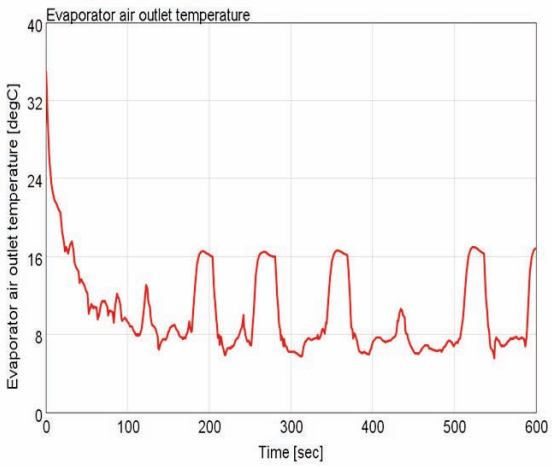
Seamless integration of vehicle and engine models

No extra cost, included in every GT-SUITE license

Transient Operation and Driving Cycles

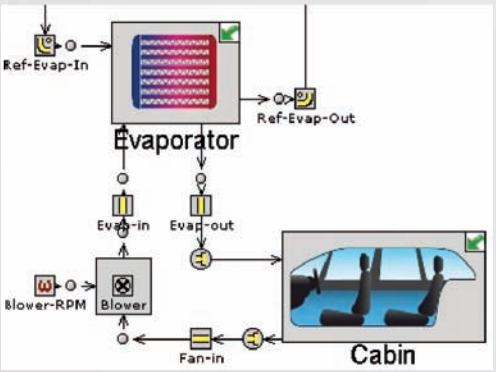
Because of its fully transient capability, coupled with vehicle, engine and thermal management capabilities, GT-SUITE can simulate operation under the new **SC03 driving cycle**, providing information about the effects of AC operation on vehicle energy consumption. The two figures below show results from such a simulation, with the prescribed vehicle speed on the left, and the predicted evaporator air outlet temperature on the right.

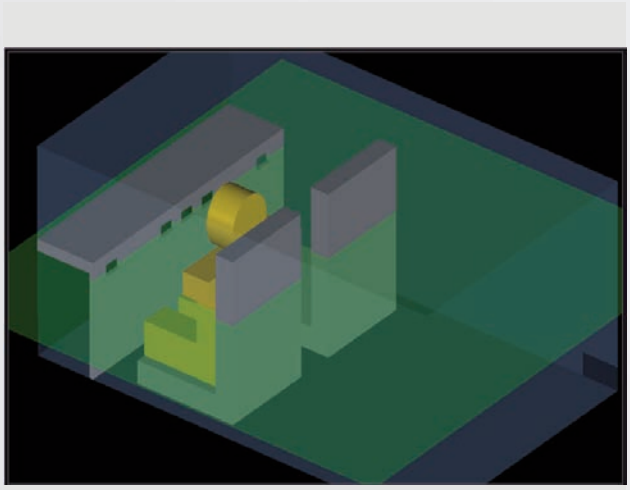




Cabin Cooling

Modeling of air conditioning includes also the modeling of the passenger cabin. There are two models available in GT-SUITE. One is a lumped analysis, using a **modular cabin object** (shown below on the left), that handles cooling air flow, recirculation, solar radiation, and heat transfer through the frame This object can be used to build-up a multi-volume representation of the cabin to various degrees of detail, from a single volume to several volumes assembled together.





To obtain a more detailed prediction of 3-D air flow and temperatures within the cabin one may use the CAD based preprocessor COOL3D to build a **3-D model of the cabin** (see above on the right), discretized into hundreds of sub-volumes to resolve the flow around the passengers. It offers a rapid 3-D coarse CFD calculation, well suited for example for the prediction of temperature at the passenger face during cabin cooldown.