SATE
Systems & Advanced Technologies Engineering S.r.l.

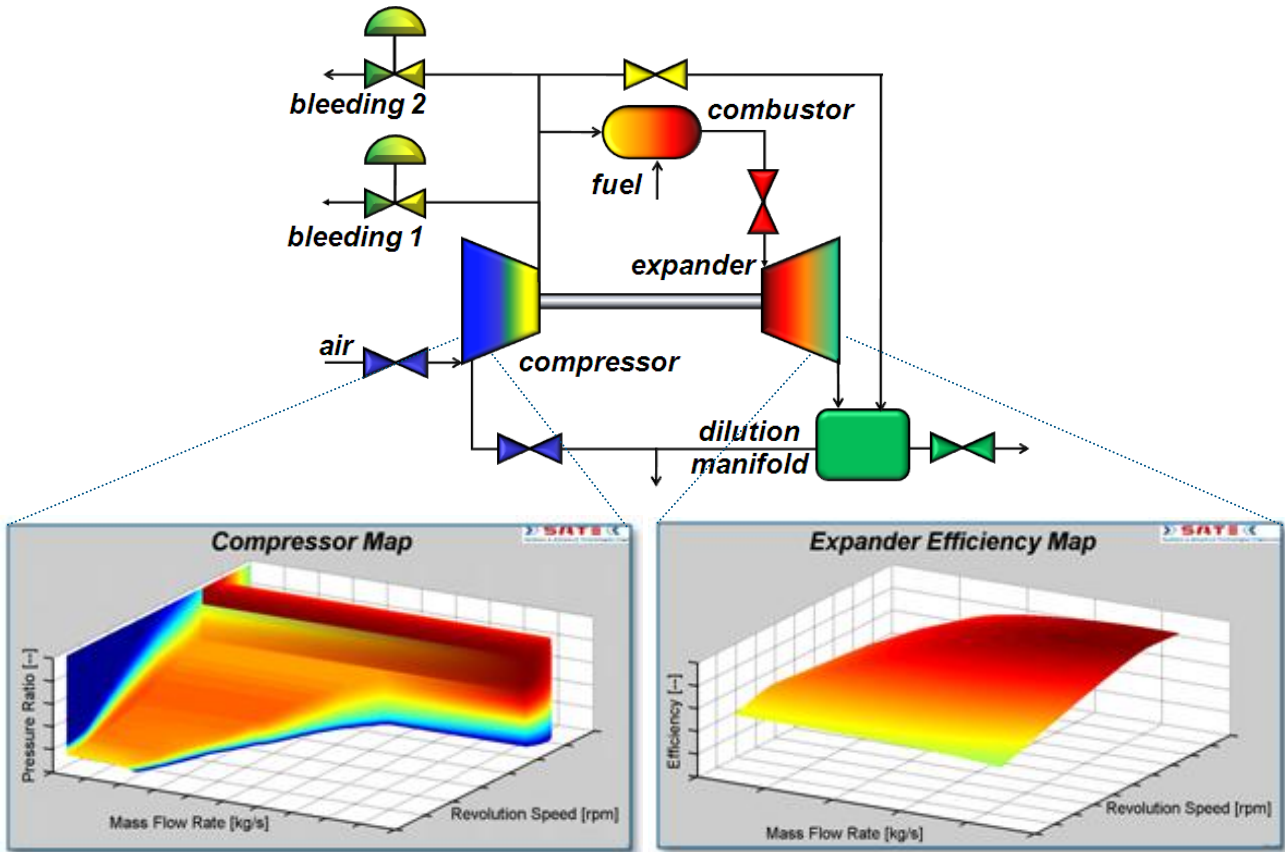**MathWorks**
Partner

TGSIM
A PROGRAM FOR THE SIMULATION OF GAS TURBINE POWER GENERATORS

Plant equivalent scheme and 3D plots of compressor and expander maps.

OVERVIEW

TGSIM is a software application developed with MATLAB®/Simulink® for the dynamic simulation of a gas turbine power generation system.

The model has been implemented as a stand alone application, but its main purpose is to be included in a more complex model that integrates the gas turbine load, the accessories and the control system for Software in the Loop or Hardware in the Loop simulations.

In particular **TGSIM** simulates the thermodynamic behaviour of the whole process, made up of compressor, combustor, expander, dilution manifold and exhaust nozzle. Moreover, the model includes also the staging controller of the gas turbine and the variation of the compressor map with inlet guide vanes angle and bleeding.

TGSIM is an advanced engineering tool useful for the design of gas turbine power generation systems; it provides indications about the system's performance and allows identifying the most effective design and control settings to optimize transients and steady state operations.

PROGRAM DESCRIPTION

TGSIM runs under The Mathworks™ MATLAB®/Simulink® environment, a very powerful, qualified mathematical solver and systems simulation tool. The program includes a user-friendly graphic interface based on buttons and menu driven commands, which only require knowledge of basic pc use.
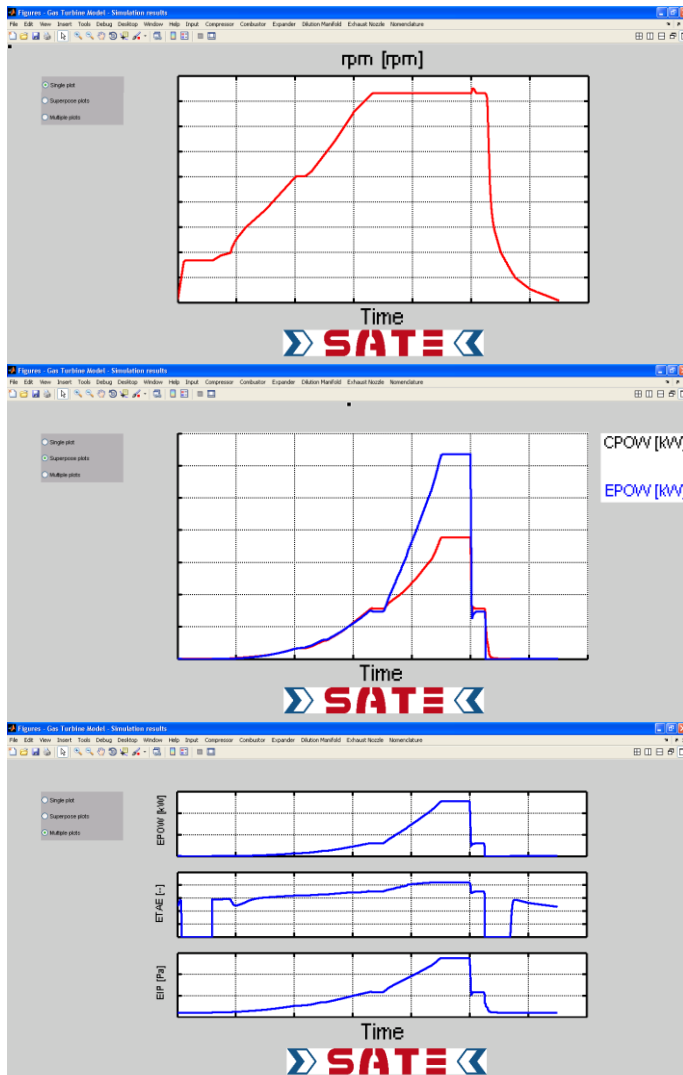
Examples of model output plots

TGSIM implements the following relevant aspects:

- Thermodynamics of the compressor, featuring filter pressure drop, interpolation of compressor maps, computation of the operating point and of extracted mass flow rates (including bleeding).
- Thermodynamics of the combustor, with the implementation of two different schemes of combustion chamber (single stage and two stages)
- Thermodynamics of the expander, including interpolation of turbine maps, computation of the operating point and active torque calculation
- Thermodynamics of the dilution of exhaust gas, implemented with two different schemes (mixer without capacity and dilution manifold with variable mass and energy content).
- Thermodynamics of the exhaust nozzle, different according to the scheme adopted for the dilution manifold.

The time histories of all state variables and of the main operational functions are supplied as output.

PROCEDURES OUTLINE

The user defines the input data of the simulation in easily editable texts as MS Excel® files and Matlab scripts. Results of the simulation can be displayed in a variety of output plots that can be printed or exported to other environments. The user can view the time histories of the calculated variables in single, multiple or superposed plots.

APPLICATIONS

TGSIM has been developed as a stand-alone program for the simulation of gas turbine power generation systems; however, it may easily be connected with other SATE simulation software tools, to simulate e.g. a gas turbine driven compression train or a combined power generation system.
The model can be used both in offline mode or, after compilation by Real Time Workshop, in real time applications for software and hardware in the loop simulations and to be used on embedded systems.

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