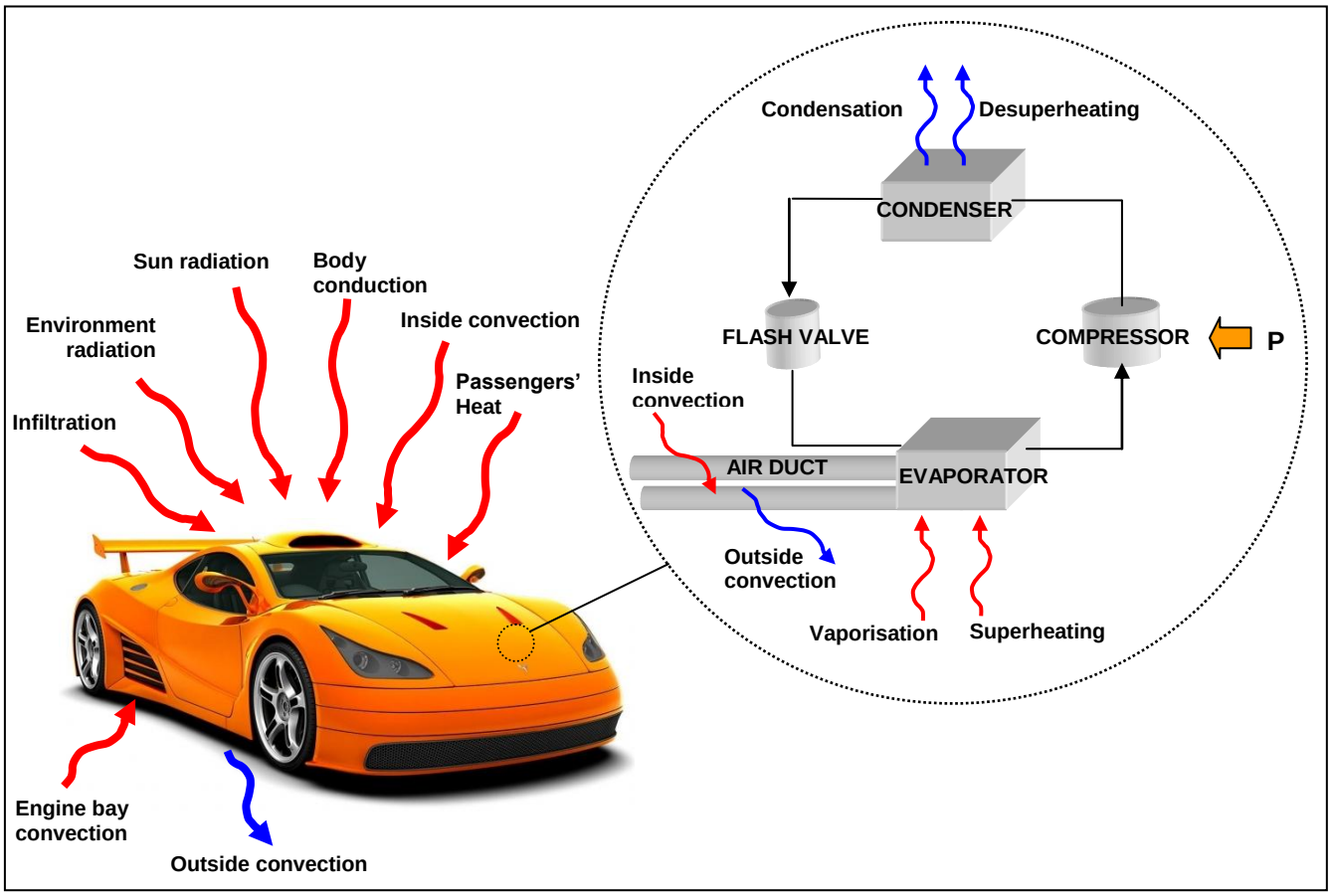
Systems & Advanced Technologies Engineering S.r.l.

MathWorks Partner

CONDIZ

A PROGRAM FOR THE SIMULATION OF AUTOMOTIVE AIR CONDITIONING SYSTEMS



OVERVIEW

CONDIZ is a software application developed with MATLAB/Simulink® for the simulation of air conditioning systems designed for motor vehicles.

In particular ***CONDIZ*** simulates the thermodynamic behaviour of the whole process made up of the refrigeration system, the inlet and delivery air ducts and the passenger compartment. The model includes a proportional-integral controller that regulates the compressor flow capacity to reach and maintain the temperature at a set value.

CONDIZ is an advanced engineering tool for the design of air conditioning systems that provides indications about the system performance and allows identifying the most effective design and temperature controller settings.

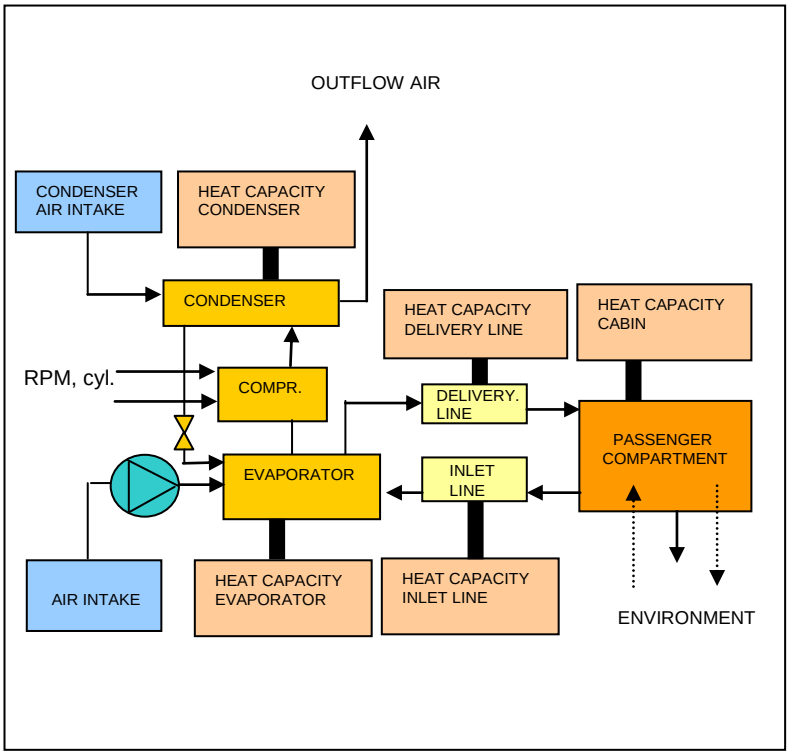
PROGRAM DESCRIPTION

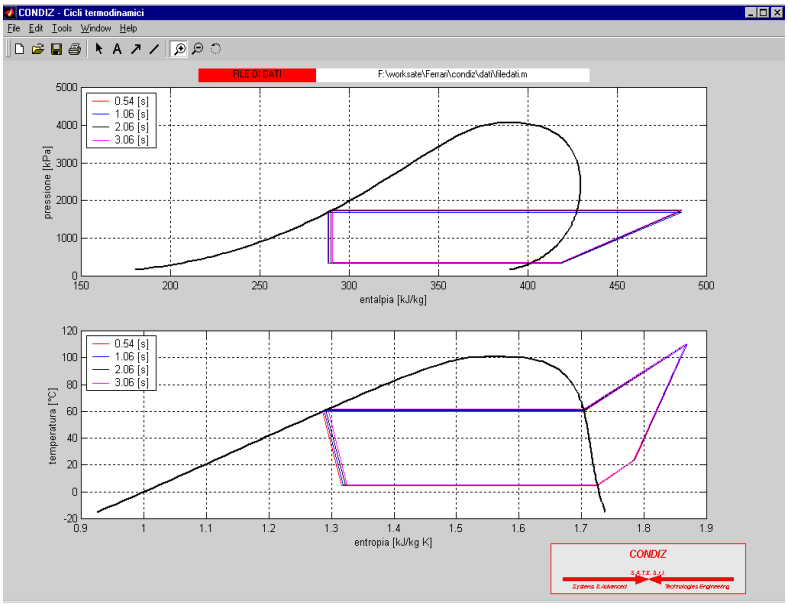
CONDIZ runs under The Mathworks' MATLAB/Simulink® environment: a very powerful, qualified mathematical solver and systems simulation tool. The program includes with a user-friendly graphic interface based on buttons and menu driven commands, which only require knowledge of basic pc use.

CONDIZ performs dynamic simulation of an automotive air conditioning system, featuring:

- Thermal dynamics of the passenger compartment (considered as a single air mass zone) considering convective, conductive and radiating heat exchange with environment
- Thermal dynamics of the piping system and heat exchangers considering dynamically varying heat flow coefficients
- Quasi-steady refrigeration cycle thermodynamics using BWR equations to calculate the thermodynamic functions and cycle at each time step
- Variable compressor flow rate
- Circulating air flow rate as a function of the vehicle speed

The mathematic model of the air conditioning system is based on a hybrid dynamic and quasi-steady approach. This implies that, at each time step, the refrigerant cycle is balanced: each section of the refrigerant loop is crossed by the same flow rate and, therefore, there is no mass





accumulation. Instead, several differential equations describe the mass and energy balances of the other components, i.e. air loop and cabin environment. The time histories of all state variables and of the main operational functions are supplied.

PROCEDURES OUTLINE

The user defines the parameters of the simulation in easily editable texts as MS Excel® files that are pre-formatted and organised in a comprehensible manner. Data, which includes relevant dimensions, compressor efficiency, heat transfer coefficients and initial and final values of the external conditions, can be stored on files to create a library of configurations that can be recalled for further simulations.
Results of the simulation can be displayed in a variety of output plots that can be printed or exported to other environments. Numerical results can also be written in files compatible and already formatted for easy handling by spreadsheets. The user can view the time histories of the calculated variables in single, multiple or superposed plots; it is possible to view the thermodynamic cycle of the refrigerant at user selected time steps.

APPLICATIONS

Although ***CONDIZ*** has been developed for the simulation of air conditioning for motor vehicles, it may easily be applied to the conditioning of any single volume space involved in heat exchange with the environment, i.e. laboratories, trucks, helicopter cabins, etc.
S.A.T.E. is developing a fully dynamic model including refrigerant cycle dynamics.

S.A.T.E. Systems and Advanced Technologies Engineering S.r.l.

Santa Croce 664/a, 30135 VENICE (ITALY)

Tel.: +39 041 – 2757634 fax: +39 041 – 2757633

Email: info@sate-italy.com

www.sate-italy.com