MODEL PARAMETER IDENTIFICATION AND CONTROL PARAMETER OPTIMISATION

EICASLAB offers a professional support and advanced features to address the overall model parameter identification and control parameter optimisation process.

The *Model Parameter Identification* and *Control Parameter Optimisation* advanced features are managed in EICASLAB by the professional **MPI/CPO Manager** tool available in the **MPI/CPO EICASLAB module**.

MPI/CPO PROCESS OVERVIEW

Model Parameter Identification and *Control Parameter Optimisation* are two important tasks to be addressed during the control algorithm development. EICASLAB offers support to the control designer for carrying out these two tasks, by means of the MPI/CPO module based on two advanced functionalities:

- the ***Model Parameter Identification*** **(MPI)**, specifically devoted to identify the parameters of the plant model;
- the ***Control Parameter Optimisation*** **(CPO)**, specifically devoted to optimise the control algorithm parameters in order to obtain the required performance.

The *Model Parameter Identification* allows the identification of the most appropriate values of the model parameters from experimental data acquired on field.

Let us point out that the above parameter "true" value does not exist. Indeed, the model is an approximate description of the plant and the parameter "best" value depends on the *cost function* adopted to evaluate the difference between model and plant. EICAS has developed an original identification method, which estimates the best values of the model parameters using an EICAS proprietary numerical algorithm.

MPI/CPO Highlights

- **Identification of plant model parameters**
- **Optimisation of control algorithm parameters for guaranteed performance**
- **Original and powerful numerical algorithm for minimisation**
- **Very fast computing time for large number of parameters**
- **Easy and fast configuration**

The *Control Parameter Optimisation* allows to perform the control parameter tuning in simulated environment.

The optimisation is performed numerically over a predefined simulated trial, that is for a given mission (host command sequence and disturbance acting on the plant and any other potential event related to the plant performance) and for a given *cost function* associated with the plant control performance.

Control Design

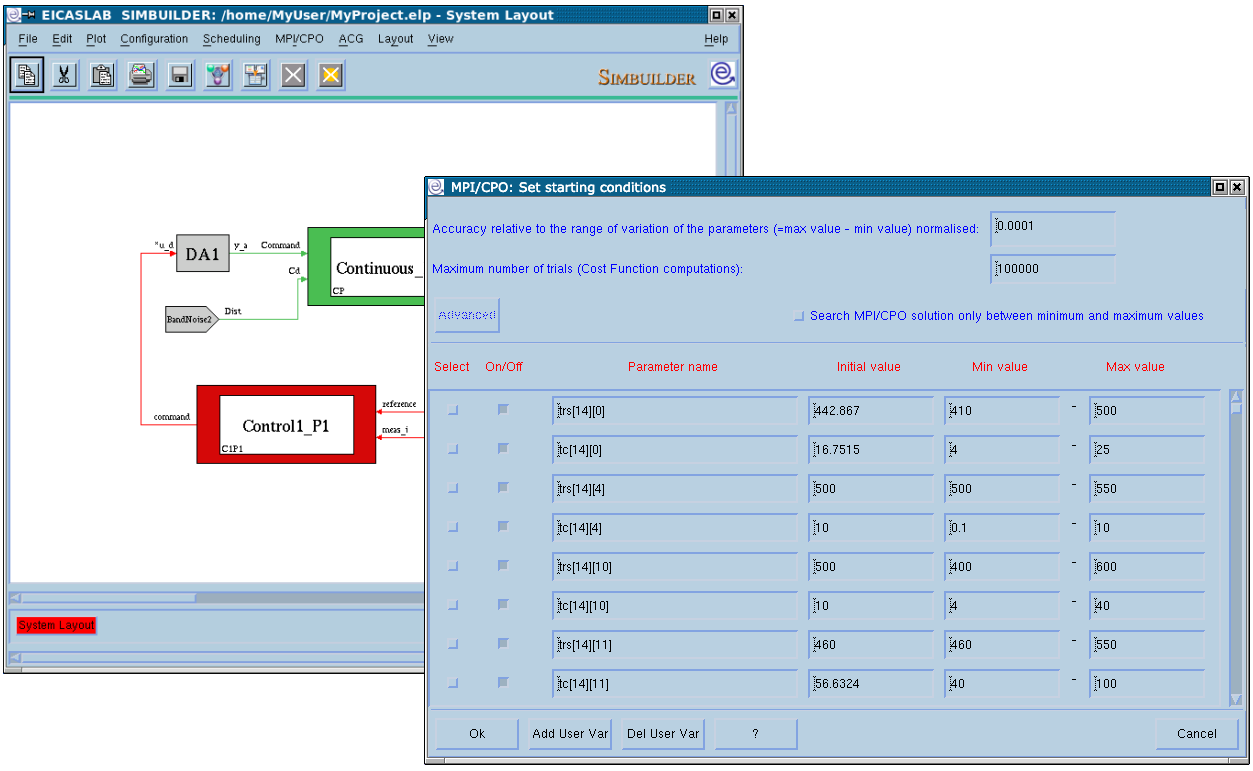
The MPI/CPO process is performed by a powerful numerical algorithm, originally developed by EICAS, which allows in a very reasonable computing time to get the optimum value of a large number of parameters (it has been already used to optimise the control system with up to about 100 parameters).

Both the functionalities are based on a *cost function*, defined by the user: the MPI/CPO Manager tool simulates the project in an iterative way, by modifying the value of the parameters to be identified or optimised, in order to minimise the value of the *cost function*.

HOW TO CONFIGURE THE MPI/CPO PROCESS

The MPI/CPO process can be easily configured in SIMBUILDER where the user may:

- define the list of parameters subject to identification/optimisation;
- provide the process configuration (in particular the range of variation of the parameters to be identified/optimised and the accuracy with which the algorithm must obtain the parameter values);
- define the related *cost function*;
- configure the plotting areas for monitoring the MPI/CPO process during its execution.



MPI/CPO configuration from SIMBUILDER

HOW THE MPI/CPO PROCESS WORKS

When enabled, the MPI/CPO Manager tool, created through an *Assisted Compiling Process*, **is integrated inside the SIM tool** with the goal to manage the overall MPI/CPO process.

Specifically, the MPI/CPO process distinguishes the following three main steps:

1. preliminary simulation trial, or *initial Base Trial*;

2. *iterative process*;

3. *final Base Trial* execution.

In the first phase, a preliminary simulation - called *initial Base Trial* - is performed starting from the initial parameter values provided by the user and a preliminary evaluation of the *cost function* is made. During the *initial Base Trial* the trends of the variables selected by the user may be displayed in the classical SIM plotting window.

At the end of the execution of the *initial Base Trial*, the second step, named *iterative process*, starts. It is the iterative part of the MPI/CPO process and in such a phase the parameter values are changed in order to reduce the *cost function* value, updated at any iteration, until the minimum has been reached, with the requested accuracy. During the *iterative process* the MPI/CPO Manager GUI gets opened on the screen allowing the user to control the overall *iterative process*.

The MPI/CPO Manager GUI includes:

- a *control panel* for a full control of the MPI/CPO process allowing to *start*, *continue* or *stop* the MPI/CPO process, as well as to restart it;

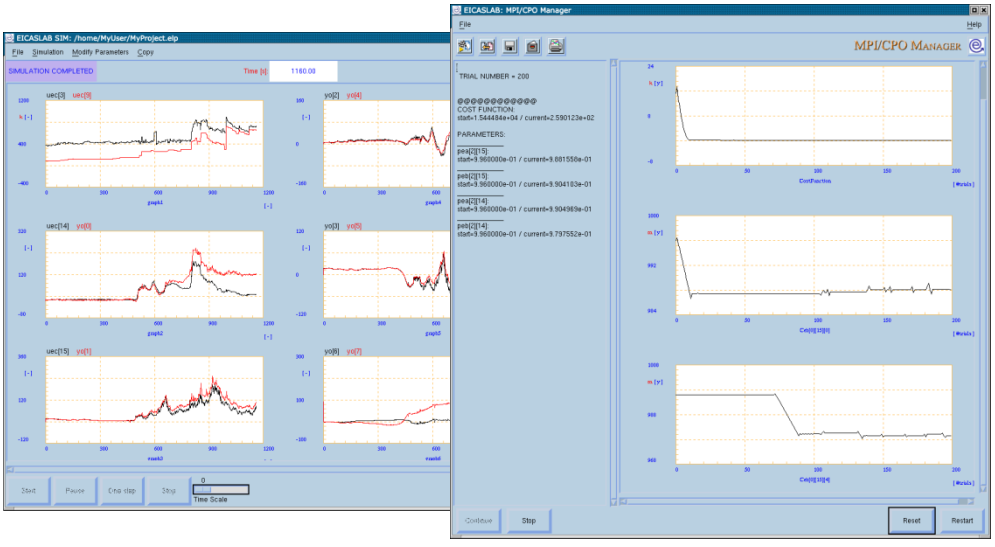
- a set of *plotting areas* for displaying in graphs the parameters and *cost function* values;

- a *text area* for showing the results of the MPI/CPO process, including the numerical values both of the parameters and of the *cost function* as they are changed during the MPI/CPO process with respect to the initial values used in the *initial Base Tri*al;

- a *menu toolbar* for customising the algorithm and for configuring the parameter values.

When the *iterative process* is completed the third phase, named *final Base Trial,* starts. Once achieved the minimum value of the *cost function*, the *final Base Trial* is executed with the related parameter values obtained from the previous *iterative process*. The results are graphically displayed again in the SIM GUI for showing a comparison with respect to the ones obtained in the *initial Base Trial*.

Both in the *initial* and *final Base Trials* SIM plots the dynamic behaviour of the variables selected for SIM plotting in order to immediately show the benefits obtained with the MPI/CPO algorithm.



MPI/CPO Manager GUI and the SIM GUI

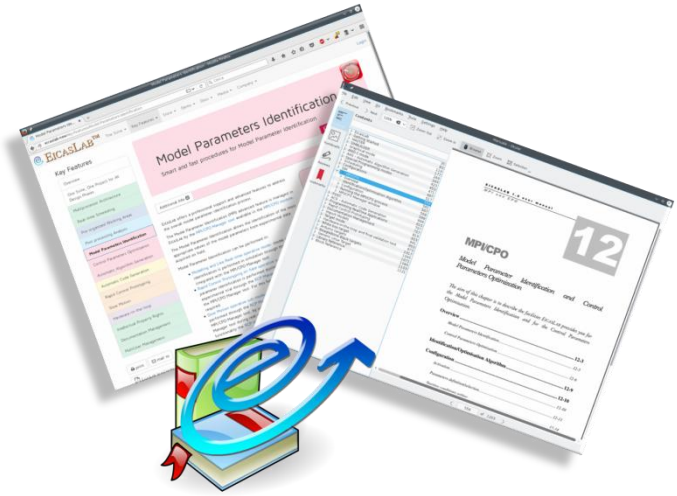
MANUAL & DOCUMENTATION

The MPI/CPO Manager provides the user with all the necessary support during the MPI/CPO process:

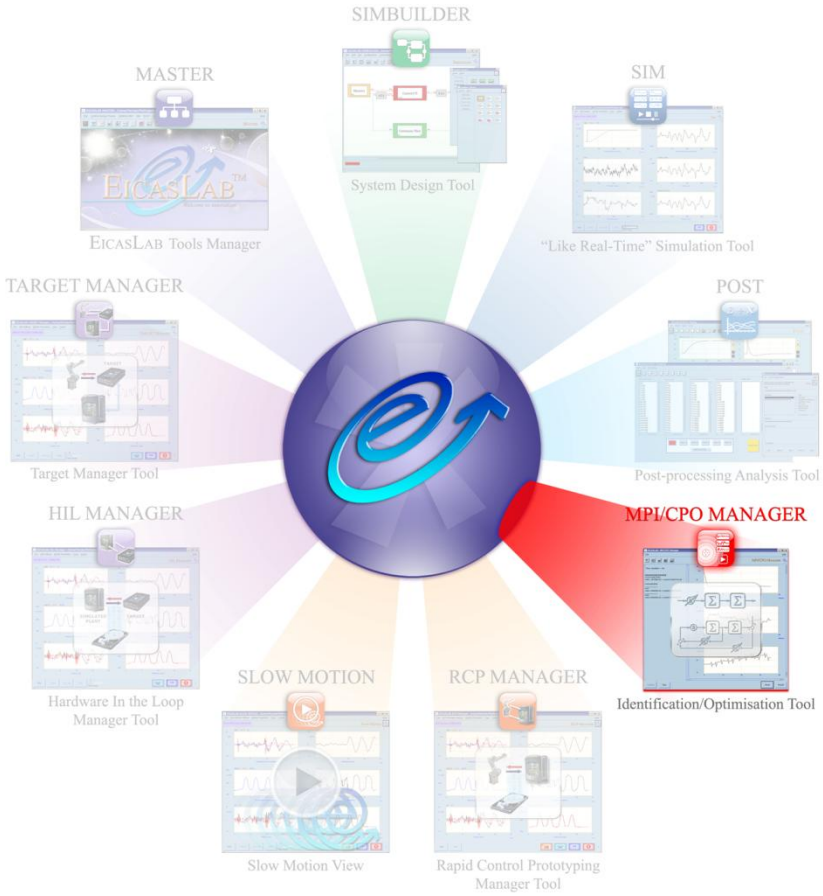
- a specific chapter of the EICASLAB User Manual is devoted to illustrate the overall MPI/CPO capabilities and help the user making profit in using the EICASLAB software for plant model identification and control algorithm parameters optimisation;

- the EICASLAB website can be directly accessed to get information, to contact us, to ask additional support to perform the overall MPI/CPO process, or enjoy the advantages of the EICASLAB Consultancy services.

Our service support is always at disposal of our Customers with the aim to guarantee the best assistance.



Welcome to EICASLAB Suite.
Welcome to Innovation!



excellence and passion in automatic control design
EICAS Automazione S.p.A.
Via Vincenzo Vela, 27 10128 Torino (Italy)
Tel +39 011 5623798 / +39 011 5623088
Fax +39 011 4360679
E-mail: info@eicas.it web: www.eicas.it