EICASLAB™

Automatic Control Design of the Amazing Ball with the EICASLAB suite

Webinar n.2

Modelling and Like Real-time Simulation
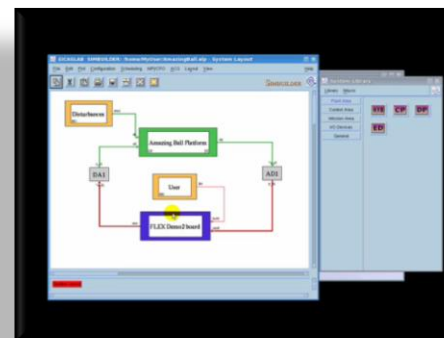
Welcome to Innovation

excellence and passion
in automatic control design

EICAS Automazione S.p.A.

Via Vincenzo Vela, 27 10128 Torino - ITALY (IT)
Tel.   +39 011 56 23 798 +39 011 56 23 088
Fax   +39 011 43 60 679

www.eicas.it

Modelling and Like Real-time Simulation

- Operative mode overview

- Outstanding characteristics

  - Pre-organized Working Areas

  - Focus on HW/SW architecture

  - The two model approach

  - Powerful algorithms and oriented libraries

  - Like Real-time simulation

  - Automatic code generation of the Application Software

Modelling and Like Real-time simulation

- A practical use case: the **EVIDENCE *Amazing Ball***

Welcome to Innovation

EICAS Automazione S.p.A.
excellence and passion in automatic control design

Via Vincenzo Vela, 27 10128 Torino - ITALY (IT)
Tel. +39 011 56 23 798 +39 011 56 23 088
Fax +39 011 43 60 679
www.eicas.it

Operative mode overview

The **Modelling and Like Real-time simulation** is the EICASLAB operative mode specifically studied for supporting the user in:

➢ **designing the overall control strategy**, and,

➢ preliminary **assessing its performance in a powerful simulated environment**, able to faithfully emulate "like real-time" the expected final software and hardware architecture.
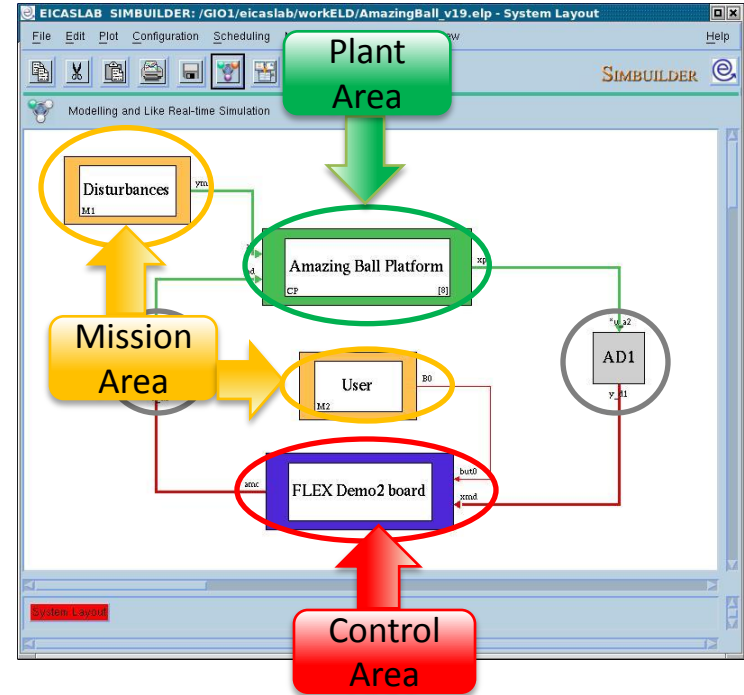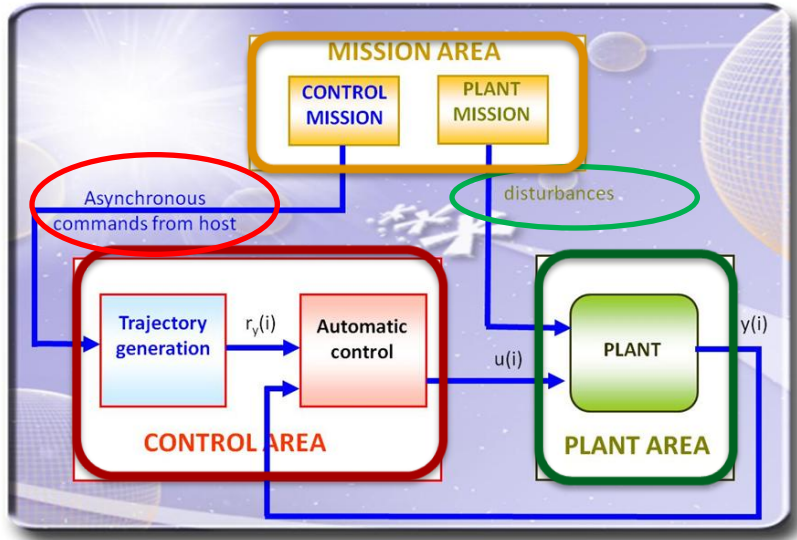
For running this operative mode a standard PC equipped with Linux or Windows O/S and with the EICASLAB suite is required.

Outstanding characterists: **Support to system design**
Pre-organized Working Areas

Three pre-organised Working Areas are available:

- the **Plant Area**,
- the **Control Area**,
- the **Mission Area**,

specifically devoted and customized to program the different parts of the project.

Welcome to Innovation

Via Vincenzo Vela, 27 10128 Torino - ITALY (IT)
Tel. +39 011 56 23 798 +39 011 56 23 088
Fax +39 011 43 60 679

EICAS Automazione S.p.A.

www.eicas.it

Outstanding characterists: Support to system design
Focus on HW/SW architecture

Since the beginning, special focus is given on hardware and software architecture.
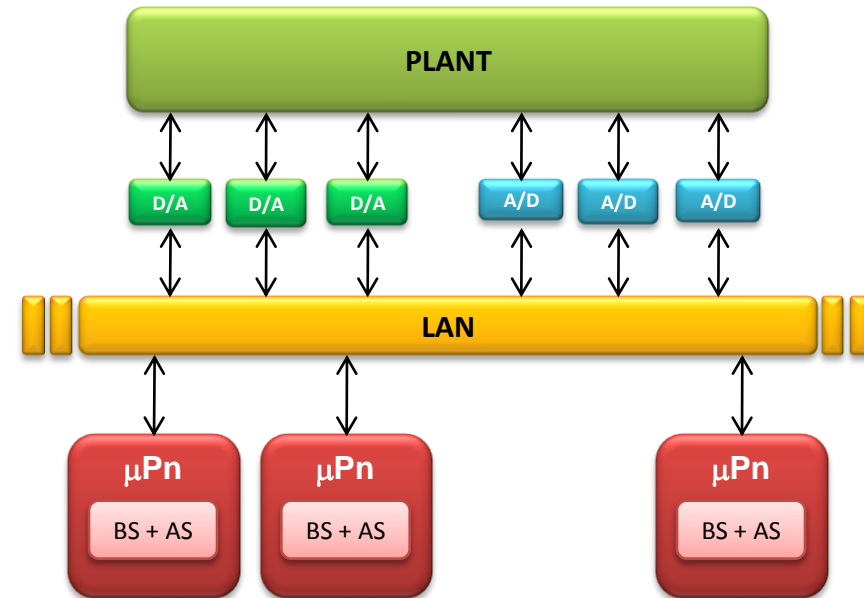
Multi-processors and multi-level hierarchical controls can be easily designed and implemented.

The control software is subdivided into control functions allocated by the designer to the different processors.

Each control function has to be scheduled in term of period, duration and phase.

HW Components	
S1	Sensors
A1	Actuators
LAN	Local Area Network
uP	Microprocessor

SW Components	
BS	Basic Software
AS	Application Software

PLANT

D/A   D/A   D/A   A/D   A/D   A/D

LAN

μPn BS + AS   μPn BS + AS   μPn BS + AS

Welcome to Innovation

EICAS Automazione S.p.A.

Via Vincenzo Vela, 27 10128 Torino - ITALY (IT)
Tel. +39 011 56 23 798 +39 011 56 23 088
Fax +39 011 43 60 679
www.eicas.it

Outstanding characterists: Support to system design
The two model approach

In EICASLAB you can implement your control algorithms by following your own control design methodology.

In particular, you can follow a Model-Based approach and you can distinguish between:

- the model used for designing your control – here called **Simplified Model**, and,
- the model used to simulate the plant to be controlled - here called **Fine Model**.

The Simplified Model is typically linear and time invariant.

The Fine Model is typically non-linear and time variant and includes all the aspects neglected in the simplified model, but that may affect your control (like hysteresis, backslash…).

This approach – called the **two model approach** - allows you to test and tune your control algorithm, by assessing the limits of validity of the simplified model.

Outstanding characteristics
Powerful algorithms and oriented libraries
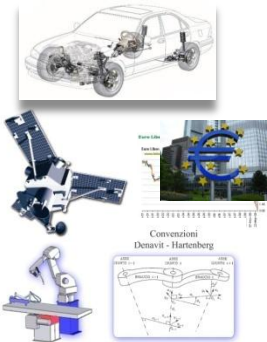
Each Working Area is equipped with **libraries oriented to specific application sectors**, easily customizable by the user.

To perform *Model Parameter Identification*, an **original identification method** is available in EICASLAB, oriented to estimate the best values of the plant simplified model parameters from the point of view of the control design.

To integrate the system of differential equations used to represent the Plant to be controlled, a **fully original proprietary integration procedure is available** specifically developed for overcoming the frequent difficulties met as a consequence of the numerical errors.

CP

$$\begin{cases} \dot{x} = f(x, u, t) \\ y = g(x, u, t) \end{cases}$$

To perform *Control Parameter Optimisation*, a **powerful numerical optimisation algorithm** is available, which allows in very reasonable computing time to get the optimum value of a large number of parameters.

Welcome to Innovation

EICAS Automazione S.p.A.

excellence and passion
in automatic control design

Via Vincenzo Vela, 27 10128 Torino - ITALY (IT)
Tel. +39 011 56 23 798 +39 011 56 23 088
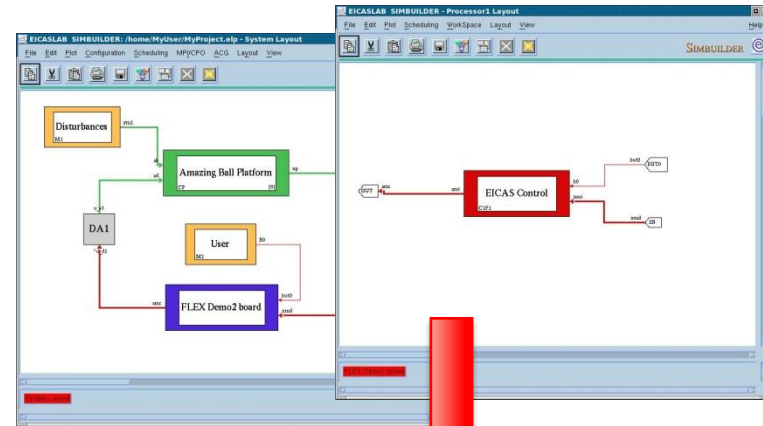Fax +39 011 43 60 679

www.eicas.it

Outstanding characterists: Support to simulation
Like Real-time simulation

A "like real-time" technique is applied in simulation, capable to faithfully emulate the execution of the control architecture running on the final target.

All the activities assigned to the Plant, Mission and Control Areas, together with data transmissions among blocks, are executed by strictly following the scheduling constraints set out by the user, in order to reproduce the order in which these activities will be really executed in the final target.
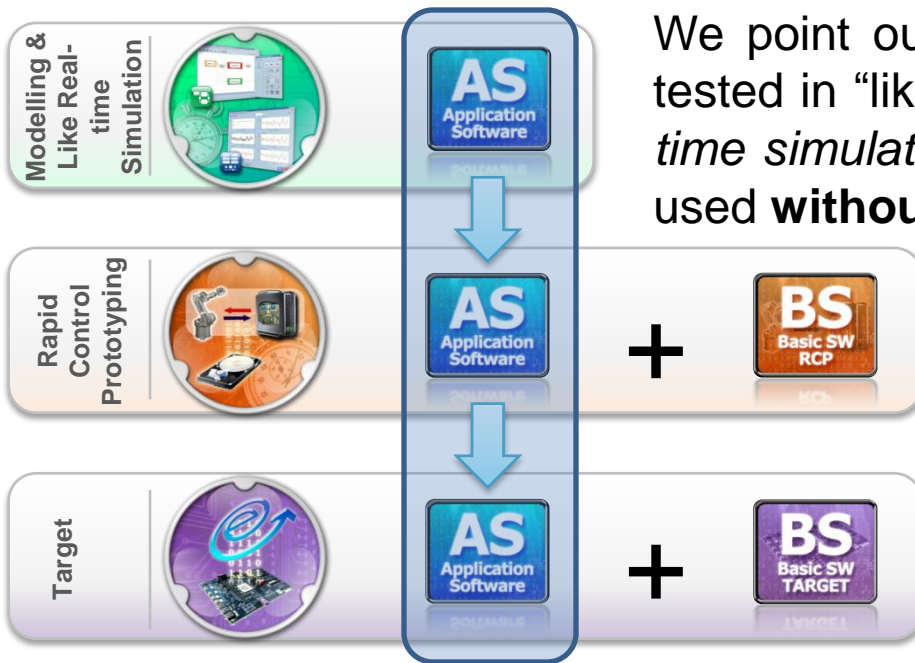
Welcome to Innovation

Via Vincenzo Vela, 27 10128 Torino - ITALY (IT)
Tel.   +39 011 56 23 798 +39 011 56 23 088
Fax   +39 011 43 60 679

EICAS Automazione S.p.A.

excellence and passion in automatic control design

www.eicas.it

Outstanding characterists:
Automatic code generation of the Application Software

Starting from the *Modelling and Like Real-time simulation* operative mode, the **Application Software** (AS) - that represents the "*target independent*" part of the final code to be transferred in the final target - can be automatically generated thanks to the EICASLAB ACG module.


We point out that the AS, generated and preliminary tested in "like real-time" in the *Modelling and Like Real-time simulation* operative mode, will be transferred and used **without modifications** in the other two operatives mode, will be transferred and used **without modifications** in the other two operatives modes, and especially it will be **exactly the same one that will be transferred in the final target.**

Welcome to Innovation

EICAS Automazione S.p.A.
excellence and passion in automatic control design
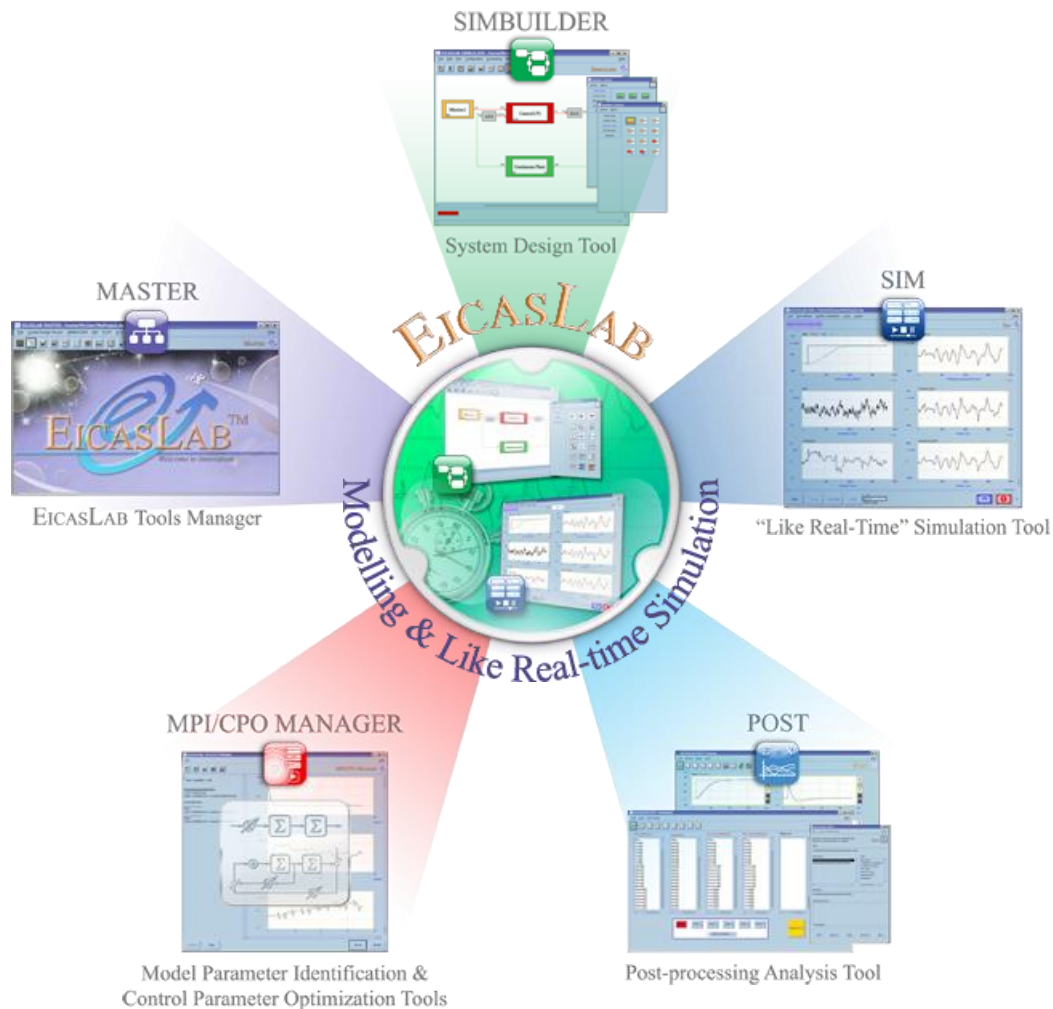
EicasLab™

The Professional Software Suite
for Automatic Control Design
and Forecasting

To be continued!

www.eicaslab.com

for Linux & for Windows

Welcome to Innovation