

DMS Formation

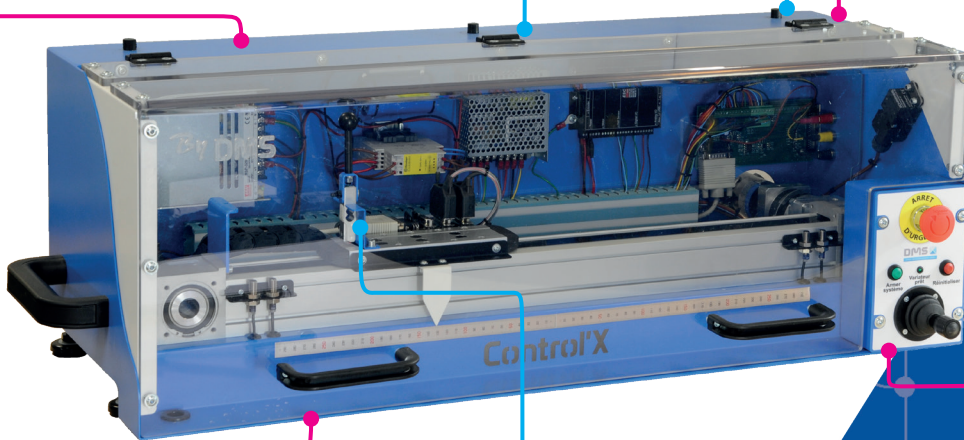
Creative engineering for quality education

real time and
high frequency
feedback control

tachogenerator

instantaneous
acquisitions

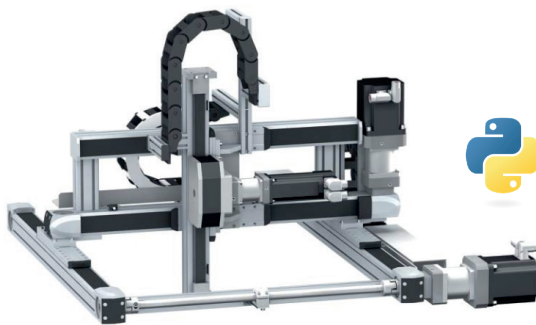
incremental
encoder



real
industrial
system

force
sensor

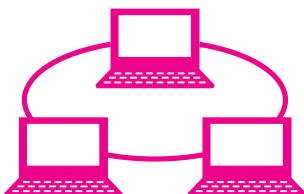
unique software
environment for
experiments and
modeling



 python™

...from an industrial
« pick and place » robot

A pedagogy to train up to 5
students at the same time



CONTROL'X

DESCRIPTION



The «Control'X» system is a didactic linear axis designed from a real industrial multi-axis «Pick & Place» robot. It allows the positioning of parts with a very high level of performance.

Control'X's exploitation allows :

- With Control'Drive, its associated software, to do experimentation but also : identification, modeling, simulation, controller synthesis and gap analysis (required, simulated, real) in a single software environment.

- With Matlab-Simulink, and his real-time kernel, allowing to run any Simulink code up to 20 kHz sampling frequency. In this simple and intuitive environment, Control'X becomes a fully open architecture system.

True «hardware in the loop» simulations can be performed in a few clicks. Desired, simulated and real behavior are observed in real time in a single scope. The gap analysis are analysed immediately and the adjustments of the physical model are very fast.

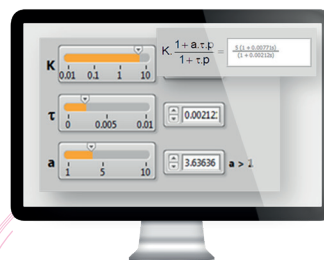
The input/output signals are all accessible and all challenges can then be offered to the students imagination: the axis offers all kinds of derived applications: inverted pendulum, parasismic tuned mass damper construction, anti-sway crane, haptic controller, collaborative robot, fuzzy logic controller, artificial intelligence ...



The Control'X's hardware part system is made of :

- an **energy chain** composed of a power supply, speed controller, a highly dynamic 110W DC motor coupled to the carriage axis via a gear and a pulley-belt system.
- an **information chain** composed of:
 - an acquisition card
 - an incremental encoder and a tachogenerator mounted on the motor shaft
 - a magnetostrictive position encoder mounted on the carriage of the axis
 - an external force sensor
 - an optical distance sensor
 - a voltage sensor at the input of the speed controller
 - a motor voltage and a current sensors

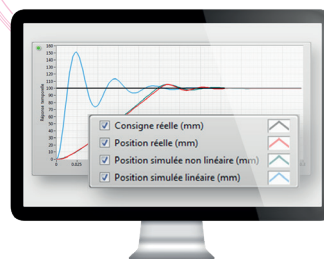
The richness of the instrumentation makes it possible to characterize all the behaviors in a way rarely observed. The key points of the curriculum such as geometrical, kinematic, static or dynamic input/output relationships are plotted in a few clicks. The energy aspect is addressed with a complete analysis of the motor behavior and the efficiency of the mechanism. A large place is given to controls and discrete event systems are not left out with a possible implementation of state charts diagrams.



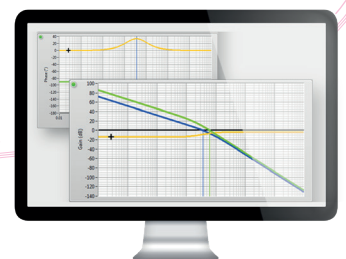
Wide range of **controllers**:
parallel or academic PID, lead-lag,
linear of any kind



Very rich instrumentation associated
with **high quality signal** conditioning



Linear or non-linear simulation.
Control'X: **models that fit !**



Controller synthesis in the
time domain, frequency domain or
pole-zero map
Model-Based design approach



A pedagogy to train up to **5 students** at the same time



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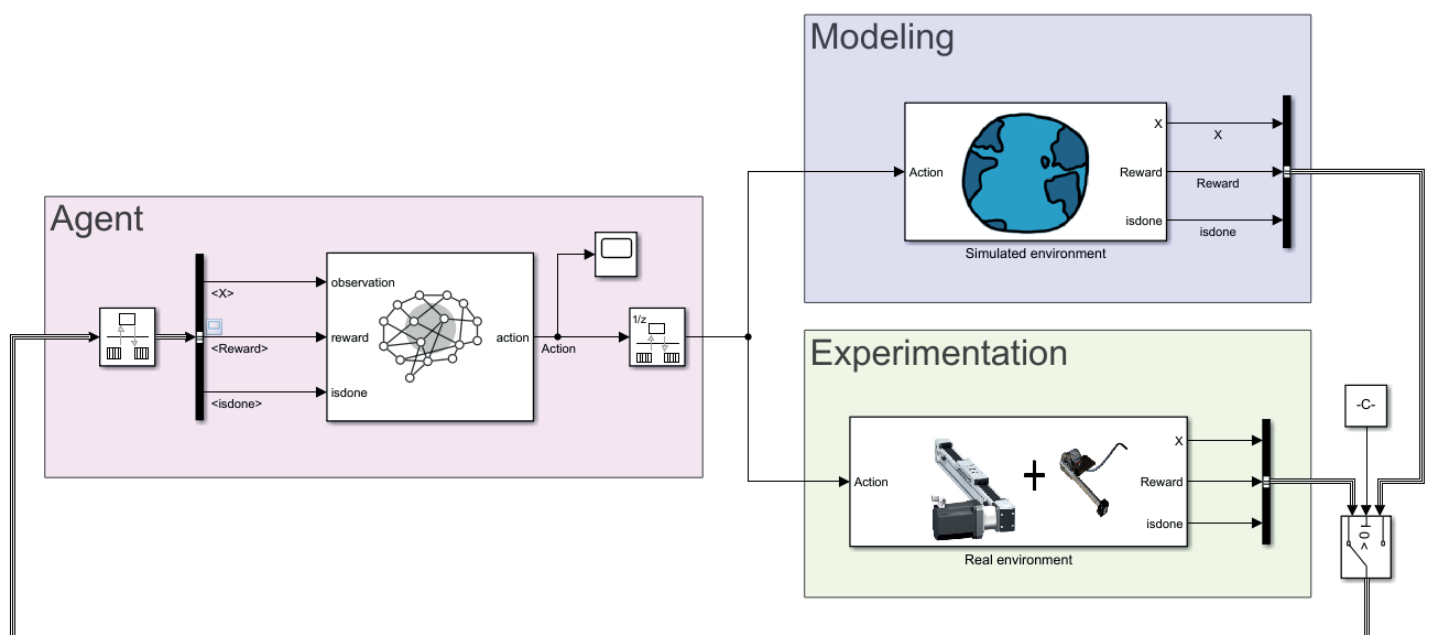
tutorials



Control'X can address addresses the full range of skills in control theory :

Laboratory experiment	Goal
Lab 1 2 x 2 hours	The interest of a feedback system. Open loop, closed loop control
Lab 2 2 x 2 hours	How to optimize the positioning performance of a system
Lab 3 2 x 2 hours	What transformations of movements and efforts in the power transmission chain?
Lab 4 2 x 2 hours	Which servo setpoint law to optimize positioning performance
Lab 5 2 x 2 hours	Is the gearmotor correctly sized?
Lab 6 2 x 2 hours	Which behavior, which model for each component of the system?
Lab 7 2 x 2 hours	How to justify the interest of a speed controller based on a PWM signal? How to choose the PWM frequency?
Lab 8 2 x 2 hours	Controller synthesis

Stabilization of the pendulum by reinforcement learning

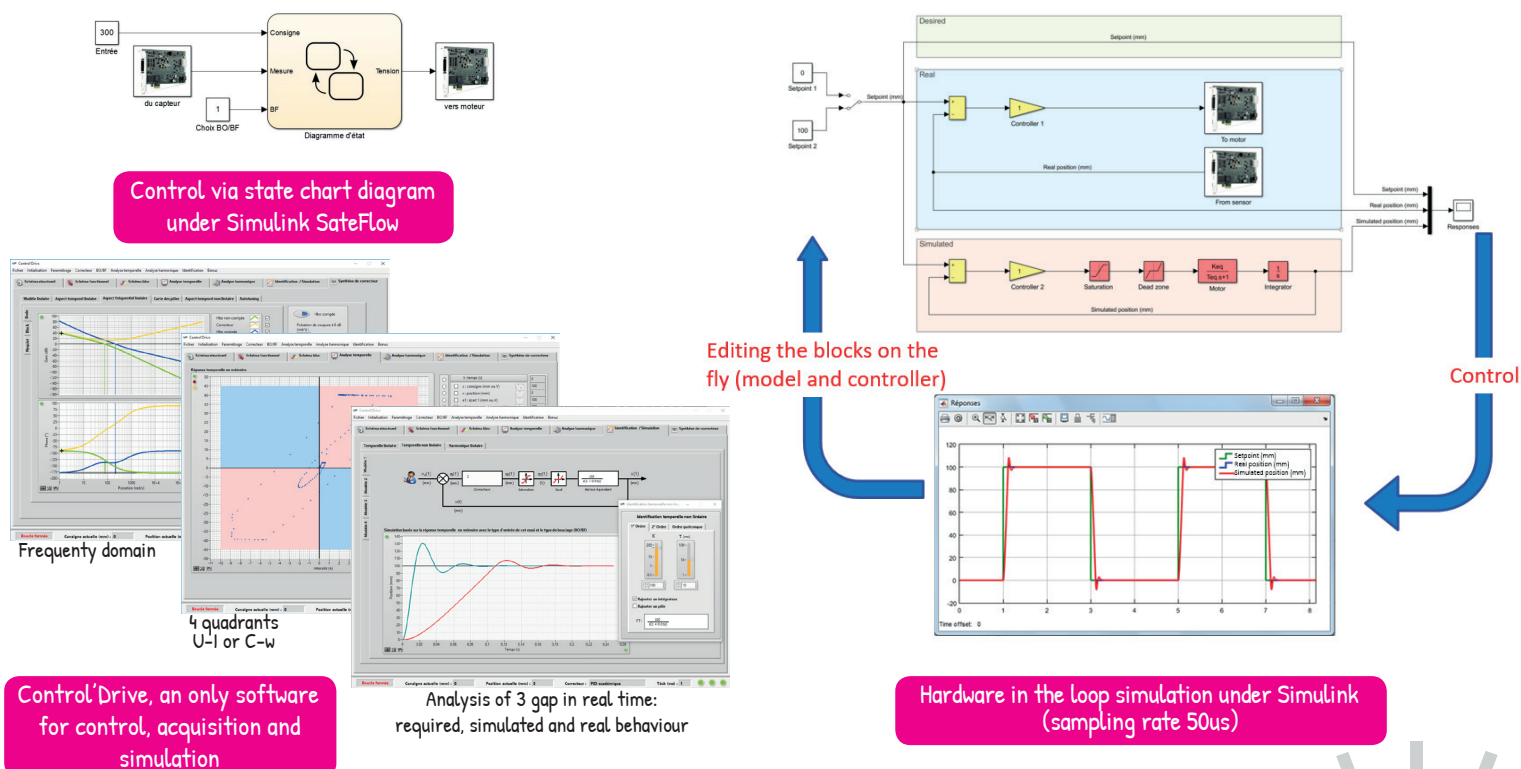


The Control'X system allows you to meet all the challenges of your imagination

ACCOMPANYING DOCUMENTATION

The system «control'x» is provided with accompanying documents in digital format (**nearly 1000 pages of documents**):

- An **exceptional software**, Control'Drive, allowing in a single software environment to implement all the curriculum of control theory.
- A **technical documentation** with the presentation of the original industrial system, its functional and structural description and specifications. The technical characteristics of all the components are shown in a very comprehensive way. One leaflet declines a variety of models: **all components of Control'X are analyzed and modeled**. Assumptions are clearly formulated and justified. The numerical values required to develop the models are all specified. The models can thus be validated in a fast and spectacular way. **3D SolidWorks and multiphysics models are also available**. A Lab0 intended specifically for teachers allows immediate handling of the system.
- A **comprehensive educational pack**, with an innovative pedagogical organization. All Lab are fully written and corrected.
- A **resource folder** containing educational and technological resources, with additional information that may enrich the students' scientific and technological culture.



TO ORDER

The system «Control'X» is proposed in two references :

- The reference **CPGE3500** includes the Control'X system, its accessories as well as the accompanying documents for the CPGE lessons.
- The reference **CPGE3560** includes to the Complete Computer Station for the system Control'X. The item is delivered installed, configured and calibrated.

