

# Design of new didactic devices for teaching of control engineering

## Supervising team

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## Context

Many of the pilot processes used in the SAAS department to teach control theory were developed through master's theses. This is the case for the rotary inverted pendulum, the ring positioner, the ball in the tube process, ...

The aim of this master thesis is to develop new pilot processes that are modular, evolving, and open-source to provide a better and more practical learning experience to the students.

Here are a few examples of processes that SAAS would like to develop (non-exhaustive list):

- Ball in hoop or Flying ball in hoop
  - o <https://www.youtube.com/watch?v=8FaNk6C2ckM>
  - o <https://www.youtube.com/watch?v=484GN4KBQnc>
  - o <https://github.com/aa4cc/flying-ball-in-hoop>
  - o <https://aa4cc.github.io/flying-ball-in-hoop/>
- Cubli - robot that can jump up and balance on its corner
  - o <https://www.wevolver.com/specs/cubli>
- ...

### Key objectives:

- o selection of the sensors/actuators
- o design of the signal conditioning / acquisition stages
- o design of the experimental setup (SolidWorks, 3D printer ...)
- o design of the power supply & cable management
- o modeling of the process
- o implementation of a control strategy (Arduino/C programming or Matlab/data-acquisition board or Raspberry PI)
- o setup of some didactic experiments & their related teaching materials

### Requested skills:

- o quick & autonomous learner in a dynamic environment
- o team player, creativity
- o basic knowledge in control theory, digital signal processing, electronics

### Reference

Xavier Jordens, Robin Wilmart, Emanuele Garone, Michel Kinnaert, Laurent Catoire. A Project-Based Learning Approach for Building an Affordable Control Teaching Lab: The Centrifugal Ring Positioner, IEEE Access, vol 10, pp 4907 – 4918, 2022.