

# Basic Control Lab - syllabus

**The lab is where practice and theory meet.**

This laboratory course will be offered in the period July 21 – Sept. 10, 2013, in the control lab of the Faculty of Engineering, Tel Aviv University. The course starts with the preliminary reading of material about PID controllers, including answering several questions and doing some basic Matlab computations concerning the behaviour of a second order system with a PID controller, conducted individually. This is followed by six lab experiments conducted by students in pairs. Each lab experiment requires about 4 hours presence in the lab.

The experiments are:

1. **DC Servo motor control - Analog:** Estimate the static and dynamic parameters of a DC servo motor from measurements, design and implement analog velocity and position control loops, measure and analyze the results.
2. **Understanding Matlab and Simulink:** This is a basic introduction to this software, with simulation experiments of various control systems carried out on the lab computers.
3. **Temperature control:** Understand heat propagation, design a PID control loop, simulate thermal reaction and stability (using Simulink), tune the controller parameters, implement the design, measure and analyze the results.
4. **Analog Simulator:** A unique experiment that demonstrate the use of analog electronic blocks, such as integrators and filters, to simulate the behavior of linear control systems and linear differential equations.
5. **DC Servo motor control - Digital:** Estimate the static and dynamic parameters of a DC servo motor, design and implement nested digital PID velocity and position control loops, understand the function of the encoder, simulate the system, measure and analyze the results. Repeat certain experiments to experience the effects of different controller parameters.
6. **Balancing a ball on a moving beam:** Understanding the Lagrangian modeling and the effect of different plant parameters on the performance of the system. Design and implement digital dual position control loops, simulate the system, measure and analyze the results.

All the instruction and the written material will be in English. Besides a working knowledge of English, students are expected to have taken a basic course in control theory.

The students will receive detailed written English instructions for each experiment. Before starting an experiment, they have to read the instructions and to provide a written report and answers to a few questions. The students are required to provide a full report on each experiment within a week.