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ELEC-C1310 Automaatio ja systeemitekniikan laboratoriotyöt
Modeling and Control of a DC Motor

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1 Materials used in the Lab

1. Rotary Servo Base Unit - Workbook (Student).pdf
2. Rotary Servo Base Unit - User Manual.pdf

These files are provided in the Materials folder on the MyCourses page for this lab. In this lab, we will be covering chapters 1-3 (Modeling, Position Control, and Speed Control). It is expected that you go through these materials and submit the solutions to the questions to be solved before the pre-hearing session. Only one copy per group has to be submitted.

2 Pre-Hearing Questions

1. **Modeling:** Read **Section 1.1** and answer all questions in **Section 1.2** of the workbook.
2. **Position Control:** Read **Section 2.1** and answer all questions in **Section 2.2** of the workbook.
3. **Speed Control:** Read **Section 3.1** and answer all questions in **Section 3.2** of the workbook.

The questions have to be solved and submitted before your pre-hearing slot. Upon your progress in answering the pre-hearing questions (those given in the workbook as well as the questions asked by the instructor), you will be allowed to book the slots for the In-Lab Tasks.

3 In-Lab Tasks

1. The first task of this lab is to estimate the steady-state gain K and the time constant τ of the system and validate them against the values calculated in the pre-hearing questions.
2. The second task of this lab is the design of a position controller for the DC motor. We shall achieve this in these three subtasks:
   (a) Using the model parameters obtained before, design a PD controller in the frequency domain.
   (b) Simulate the system in the time domain and tune the PD gains if the time-domain specifications aren't met. You may be required to iterate between time and frequency domain analysis.
   (c) With the PD gains at hand, use the PD controller to control the motor position and compare the experimental results with the simulation results.
3. The third task of this lab is the design of a speed controller for the DC motor. Do note that we will be doing PI controller and not the LEAD compensator design. This shall be achieved in these two subtasks:
   (a) Using the model parameters, evaluate the PI gains and simulate the controller to fine-tune the gains if necessary.
   (b) Implement this controller in the experimental setup and compare the simulation results with the experimental ones.

Should you have any questions, please ask the instructor!