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Temperature Control Lab 2 (TCL 2)

Institute for Automation Engineering
Chair for Automation/Modeling

October 6, 2021

1 Objectives

The identified systems transfer function from TCL 1 will be used in this lab to determine controller parameters of a PI-controller. The PI-controller should be implemented with MATLAB/Simulink and tested via simulation and the TCL. The objectives for this lab are:

- Gaining experience with standard controllers.

- Application of simple standard methods to design controllers in the frequency domain.

- Determination and validation of controller design strategies without prior model identification.

2 Controller Design

2.1 Preparation

1. Use the transfer function obtained in TCL 1 to design the PI controller in the frequency domain:

   a) Gain adjustment with phase margin $\phi_M = 30°$ and $\phi_M = 70°$.

   b) Try to improve the results of (a) by increasing the crossover frequency while keeping the phase margin constant (Loop shaping).

2. Use the transfer function obtained in TCL 1 to design the PI controller using

   a) Ziegler tuning rules,

   b) $T_{\sum}$ rules,

   c) Opelt tuning rules.

3. Implement the PI controllers identified above in the Matlab/SIMULINK file with the transfer function from TCL 1 and test their performance.

2.2 Practical part

The following tasks refer to the same Heater-Sensor-System which was used in TCL 1:

1. Use the methods from Preparation/2a-c to design a PI controller with experimental data from the TCL.

2. Implement and test the controller for the Heater-Sensor-System by

   a) disturbing the system via the other heater,

   b) changing the set point of the heater-sensor-system.

3. Interpret the experimental results and compare the performance of the controllers to each other.

3 Deadline

Please upload your final report including answers to the questions from the preparation section and your solution of the practical part as pdf file in the e-learning platform:

https://elearning.ovgu.de/course/view.php?id=11281

Submission deadline: 16th December 2021