Data-Driven Model Predictive Control of a Three-Tank System

TECHNISCHE UNIVERSITÄT DARMSTADT

Bachelor‘s Thesis

Model predictive control (MPC) is a popular and successful control technique, where an optimal control problem is solved at every sampling instance. In the setup of the optimal control problem, it is assumed that a system model has been identified and is available for predicting the system’s future behavior.
In recent years, MPC formulations have been proposed that entirely rely on a system description based on measured input-output trajectories, without a prior identification step [1].
The main goal of this thesis is the implementation of a data-driven MPC scheme on the three-tank system that is available at the institute.
First, you should familiarize yourself with the (physical) system and a control goal must be formulated.
Then, an input-output trajectory that sufficiently excites the system has to be recorded.
The measured data can be used to design the controller and to run it in simulations. You will receive assistance and code for solving the associated optimization problem.
Finally, the obtained controller is to be implemented, tested, and evaluated on the real system.

The thesis thus contains the following steps:

- Familiarization with the system, including both the hardware and software aspects
- Literature review on data-driven MPC
- Creation of a simulation environment to assess the data-driven controller
- Implementation of the controller on the real system
- Evaluation of the results

Basic knowledge of control theory and Matlab/Simulink is required. Please don’t hesitate to contact me if you have any further questions!

[1] J. Berberich, J. Köhler, M. A. Müller and F. Allgöwer, "Data-Driven Model Predictive Control With Stability and Robustness Guarantees," in *IEEE Transactions on Automatic Control*, vol. 66, no. 4, pp. 1702-1717, 2021

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