

Predictive Control of an Inverted Pendulum

Projectseminar (4 students, presence sometimes required, partly homeoffice)

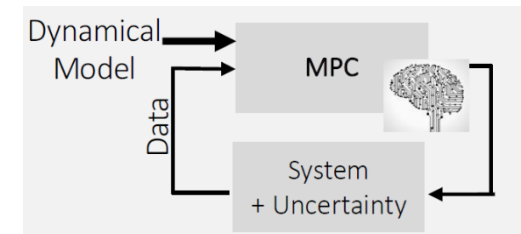
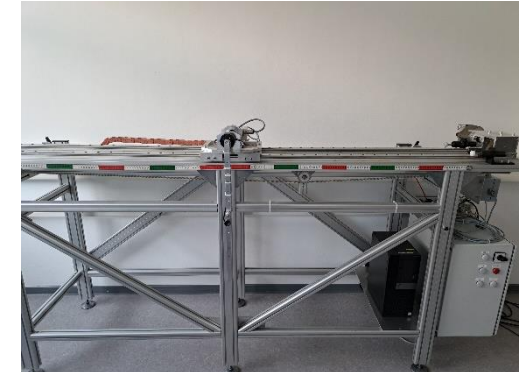
The main goal of this project is the data-driven swing-up of an inverted (double) pendulum. In the first step, the group members will accustom themselves to the experimental setup and the existing framework (ControlDesk). Currently, the swing-up of the pendulum is already implemented. Using these algorithms, closed-loop relevant data can be collected, and a data-driven model can be derived. Hence, the nonlinearity of the model can be incorporated into a predictive controller design. We plan to use the code generation functionality of the ACADO toolkit [1] to evaluate the MPC algorithm quickly. Further, you will assess the real-time feasibility of the algorithm and - if possible - deploy the algorithm on the experimental setup. Possible issues that may have to be addressed are for example state estimation or handling delays. The final report needs to be written in English.

Requirements:

- Must: Matlab, optimization, stochastics (at least multivariate gaussian distribution)
- Beneficial: MPC or Optimal Control, experience with ACADO or ACADOS, Gaussian processes

Your tasks will be:

- Identifying what problems are relevant to the experiment and dealing with them
- Deriving a data-driven model
- Address the speed of the algorithm
- Evaluate, compare and present the results



References:

[1] Ariens, D. & Houska, Boris & Ferreau, Joachim & Logist, Filip. (2010). ACADO for Matlab User's Manual. https://acado.sourceforge.net/doc/pdf/acado_manual.pdf

M. Sc. Alexander Rose, M. Sc. Roland Schurig

E-Mail: alexander.rose@iat.tu-darmstadt.de
roland.schurig@iat.tu-darmstadt.de
Web: <https://www.ccps.tu-darmstadt.de>