Chair of Automatic Control

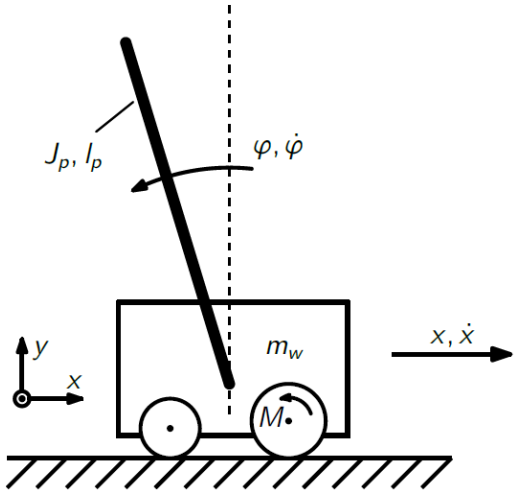
FAU

Announcement for Bachelor Thesis / Research project

Stochastic model predictive control of an inverted pendulum

Motivation

Model predictive control is a modern control method that can account for state and input constraints. It uses a model of the system to predict the system states for a certain time. However, if the system dynamics are not known exactly or if measurement noise is present, this can lead to a significant reduction of the controller performance. Stochastic model predictive control explicitly accounts for these uncertainties and ensures constraint satisfaction even in these cases.



Task description

Based on an existing framework, stochastic model predictive control is to be applied to the example of an inverted pendulum. The controller will first be simulated in Simulink and tested on an experimental system subsequently. It should be investigated how the consideration of uncertainties affects the control performance and the computation time. To this end, measurement noise can be simulated and parametric uncertainties in the system dynamics can be tested.

Requirements

Solid understanding of Matlab/Simulink and automatic control is required, e.g. from the lectures Regelungstechnik A and B. Knowledge of model predictive control, e.g. from the lecture numerical optimization and model predictive control, is advantageous. The thesis can be written in English or German.

References

[1] Englert, T., Völz, A., Mesmer, F., Rhein, S., & Graichen, K. (2019). A software framework for embedded nonlinear model predictive control using a gradient-based augmented Lagrangian approach (GRAMPC). Optimization and Engineering, 20(3), 769-809.

Contact

Daniel Landgraf, M.Sc.
Lehrstuhl für Regelungstechnik
daniel.dl.landgraf@fau.de