Chair of Automatic Control

FAU

Announcement for Bachelor Thesis/Research project

Implementation of an asynchronous sensitivity-based distributed model predictive control algorithm for linear systems

Motivation

To overcome the problem of increasing computational burden in model predictive control for highly scaled systems, the individual optimal control problems can be split into several coupled subsystems, called agents. These agents can solve their optimization problems locally; only the solutions need to be communicated between the agents.

Various methods exist to solve these problems, such as the ADMM algorithm or sensitivity-based approaches. This thesis will apply the sensitivity-based algorithm from [1] to linear systems. Furthermore, recent studies have shown that asynchronous information exchange can help speed up the algorithms while maintaining convergence properties. That is why the sensitivity-based algorithm from [1] shall be extended to an asynchronous formulation and its performance evaluated.

Task description

The main goal of this thesis is to apply an existing sensitivity-based control algorithm to the distributed model-predictive control of linear systems. The sensitivity-based algorithm shall then be implemented in MATLAB in an object-oriented manner. Furthermore, the algorithm shall be extended to an asynchronous formulation which can be compared to the synchronous version. Finally, the performance of the algorithm shall be compared to the popular ADMM algorithm.

Requirements

Basic knowledge of optimal control and MPC is required, either by having attended the corresponding lecture or by familiarizing oneself with the topic at the beginning of the thesis as well as experience with MATLAB.

References

[1] Huber, H., & Graichen, K. (2021, August). A sensitivity-based distributed model predictive control algorithm for nonlinear continuous-time systems. In *2021 IEEE Conference on Control Technology and Applications (CCTA)* (pp. 195-201). IEEE.

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