Distributed Model Predictive Control Design for a Laboratory Device

Pavlovičová, E., Oravec, J.

Slovak University of Technology in Bratislava

This work focuses on a model predictive control design using a numerical distributed optimization method called the Augmented Lagrangian based Alternating Direction Inexact Newton method (ALADIN). The ALADIN algorithm is divided into distributed and coordination levels. In addition, an explicit MPC is utilized at the distributed level to achieve a faster evaluation of control input. The ALADIN algorithm is evaluated in two distinct stages. An explicit MPC is constructed during the first stage, offline. The second part of the process occurs online and consists of solving a point location problem. The output of this phase is then used to obtain a solution that approximates the optimal one. This control input is subsequently implemented for closed-loop device control. The aim is to implement the ALADIN algorithm to provide offset-free reference tracking control of the device with fast dynamics. Flexy 2.0 was chosen as the controlled system for the controller design purpose. Subsequently, the control performance and the computational effort of the designed MPC controller are analyzed. The benefits of the presented algorithm are discussed within the final parts of the work, e.g., possible parallelization of computation and implementation on the low-level hardware.