Real-time tuning of approximated explicit MPC of a heat exchanger

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Tunable approximated explicit model predictive control (MPC) has the significant benefit of real-time tunability without the necessity of solving the optimization problem online. The concept of tunable explicit MPC requires storing two boundary explicit MPCs having the same setup except for one of the penalty matrices. In the online phase, both controllers are used to evaluate the optimal control action. Based on both optimal control actions, the value of the tuned control action is calculated by linear interpolation according to the current tuning parameter value. This work provides a technique for scaling the tuning parameter, which depends on the current reference value. The tunable explicit MPC was implemented on a laboratory heat exchanger with nonlinear and asymmetric behavior. The setup of the tuning parameter aimed to compensate for the asymmetric behavior of the plant. The proposed tuning method was investigated by control performance evaluation. Compared to control with only one controller, the self-tunable technique decreased the maximal overshoots/undershoots, integral square error, and settling time. Future work will focus on the tuning technique designed for multiple-input multiple-output systems to increase the application range of the control strategy.