

Model Predictive Control for Fast Dynamical Systems

Bastian Schürmann

Technische Universität München

July 1, 2016

Control of Dynamical Systems

- Dynamical systems can be modeled using differential equations with states (position, velocity, etc.) and inputs (steering, acceleration, breaking, etc.)
- Restrictions through input constraints: maximum acceleration/breaking, maximum torques

Model Predictive Control

- **Open-loop, optimal control**

- + Able to take input and state constraints into account
- + Minimizing given cost function, e.g., energy, time, etc.
- Not robust against disturbances or model mismatch

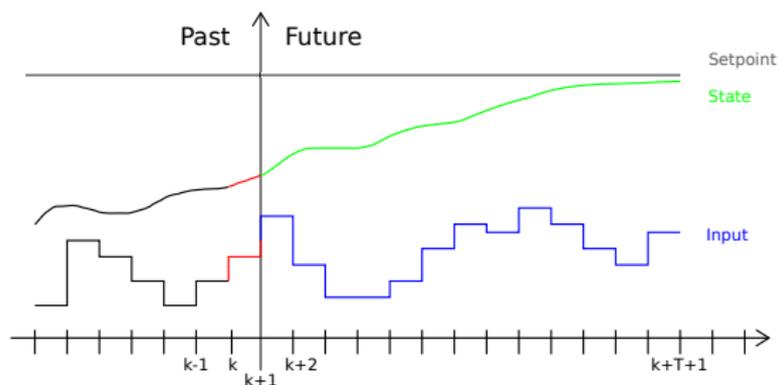
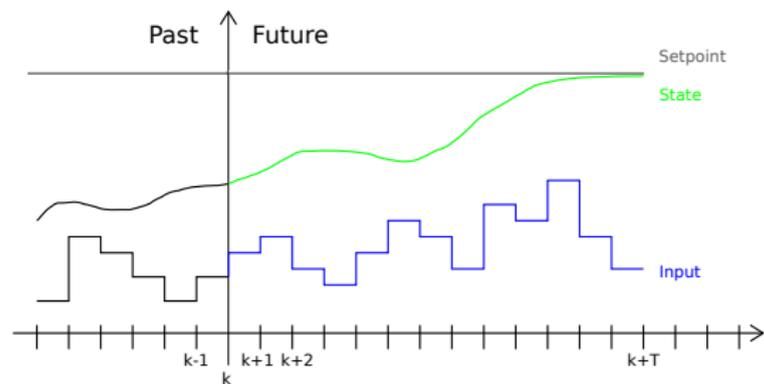
- **Closed-loop control**

- + Robust against disturbances
- Hard to consider constraints

- **Model predictive control (MPC)**

- Combines advantages of both methods by repeatedly optimizing over limited time horizon
- By applying only the input of the first input and repeating for new horizon, closed-loop control is achieved

Model Predictive Control



Topic: Model Predictive Control for Fast Dynamical Systems

- **Tasks:**
 - Review literature/read papers about different model-predictive control approaches which are suitable for systems with fast dynamics
 - Implement one or more for an example system
 - Compare the approaches
- **Required:** Background in control theory

Questions?

Contact:

Bastian Schürmann

MI 03.07.039

bastian.schuermann@in.tum.de