Explicit nonlinear model predictive control: theory and applications

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Abstrak

This book considers the multi-parametric Nonlinear Programming (mp-NLP) approaches to explicit approximate NMPC of constrained nonlinear systems, developed by the authors, as well as their applications to various NMPC problem formulations and several case studies. The following types of nonlinear systems are considered, resulting in different NMPC problem formulations;

Ø Nonlinear systems described by first-principles models and nonlinear systems described by black-box models;

- Nonlinear systems with continuous control inputs and nonlinear systems with quantized control inputs;
- Nonlinear systems without uncertainty and nonlinear systems with uncertainties (polyhedral description of uncertainty and stochastic description of uncertainty);
- Nonlinear systems, consisting of interconnected nonlinear sub-systems.

The proposed mp-NLP approaches are illustrated with applications to several case studies, which are taken from diverse areas such as automotive mechatronics, compressor control, combustion plant control, reactor control, pH maintaining system control, cart and spring system control, and diving computers.