Table of Contents

Abstract **xi**

Deutsche Kurzfassung **xiii**

1 Introduction **1**
- 1.1 Motivation . . . 1
- 1.2 Related work . . . 3
- 1.3 Contributions and outline of the thesis . . . 7

2 Background **13**
- 2.1 Discrete-time LTI systems . . . 13
- 2.2 Willems' Fundamental Lemma . . . 17
- 2.3 Model predictive control . . . 19
- 2.4 Summary . . . 21

3 Data-driven MPC for linear systems with noise-free data **23**
- 3.1 Stability via terminal equality constraints . . . 24
- 3.2 Stability via general terminal ingredients . . . 30
- 3.3 Tracking MPC for affine systems . . . 38
- 3.4 Application: linearized four-tank system . . . 47
- 3.5 Summary and discussion . . . 53

4 Data-driven MPC for linear systems with noisy data **57**
- 4.1 Stability via terminal equality constraints . . . 57
- 4.2 Robust constraint satisfaction . . . 80
- 4.3 Tracking MPC for affine systems . . . 93
- 4.4 Application: numerical examples . . . 104
- 4.5 Summary and discussion . . . 111

5 Linear tracking MPC for nonlinear systems **115**
5.1 The model-based case . . . 115
5.2 The data-driven case . . . 136
5.3 Application: simulation and experiment . . . 154
5.4 Summary and discussion . . . 169

6 Conclusions **173**
6.1 Summary . . . 173
6.2 Discussion . . . 176
6.3 Outlook . . . 178

A Technical proofs **181**
A.1 Proof of Theorem 3.4 . . . 181
A.2 Proof of Theorem 4.3 . . . 189
A.3 Proof of Proposition 5.2 . . . 199
A.4 Proof of Proposition 5.4 . . . 213
A.5 Proof of Theorem 5.2 . . . 219

Bibliography **229**