

# Table of Contents

|   |            |
|---|------------|
| <b>Abstract</b>   | <b>ix</b>  |
| <b>Deutsche Kurzfassung</b>                               | <b>xi</b>  |
| <b>1 Introduction</b>                                     | <b>1</b>   |
| 1.1 Motivation . . . . .                                  | 1          |
| 1.2 Contributions and outline of the thesis . . . . .     | 4          |
| <b>2 Background</b>                                       | <b>9</b>   |
| 2.1 Moving horizon estimation . . . . .                   | 9          |
| 2.2 Proximal methods . . . . .                            | 18         |
| 2.3 Summary . . . . .                                     | 25         |
| <b>3 Proximity-based MHE schemes</b>                      | <b>27</b>  |
| 3.1 Problem setup and proximity MHE . . . . .             | 27         |
| 3.2 Proximity MHE for linear systems . . . . .            | 33         |
| 3.3 Proximity MHE for nonlinear systems . . . . .         | 60         |
| 3.4 Numerical examples . . . . .                          | 79         |
| 3.5 Summary . . . . .                                     | 91         |
| <b>4 Anytime proximity-based MHE algorithms</b>           | <b>93</b>  |
| 4.1 Problem setup . . . . .                               | 94         |
| 4.2 The proximity MHE iteration scheme . . . . .          | 95         |
| 4.3 Anytime proximity MHE for linear systems . . . . .    | 100        |
| 4.4 Anytime proximity MHE for nonlinear systems . . . . . | 120        |
| 4.5 Numerical examples . . . . .                          | 133        |
| 4.6 Summary . . . . .                                     | 143        |
| <b>5 Conclusions</b>                                      | <b>145</b> |
| 5.1 Summary . . . . .                                     | 145        |
| 5.2 Outlook . . . . .                                     | 146        |
| <b>A Stability properties of discrete-time systems</b>    | <b>149</b> |
| <b>Notation</b>   | <b>153</b> |
| <b>Bibliography</b>                                       | <b>155</b> |