

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 1 |
| 1.1 | Fault Diagnosis Methodologies | 2 |
| 1.2 | Robust Observer-Based Fault Diagnosis: An Overview | 4 |
| 1.3 | Outline of the Book | 6 |
| | References | 7 |
| 2 | Detection and Isolation of Actuator Faults | 11 |
| 2.1 | Introduction | 11 |
| 2.2 | Problem Formulation | 12 |
| 2.3 | Actuator FD Scheme | 14 |
| 2.4 | Actuator FI Scheme | 20 |
| 2.5 | Simulation Results | 24 |
| 2.6 | Conclusions | 31 |
| | References | 32 |
| 3 | Detection and Isolation of Sensor Faults | 35 |
| 3.1 | Introduction | 35 |
| 3.2 | Problem Formulation | 36 |
| 3.3 | Sensor FD Scheme | 39 |
| 3.4 | Sensor FI Scheme | 43 |
| 3.5 | Simulation Results | 46 |
| 3.6 | Conclusions | 56 |
| | References | 56 |
| 4 | Robust Estimation of Actuator Faults | 57 |
| 4.1 | Introduction | 57 |
| 4.2 | Problem Formulation | 58 |
| 4.3 | Actuator FE Scheme | 60 |
| 4.3.1 | Observer Design | 60 |
| 4.3.2 | Estimation of Actuator Faults | 67 |

| | | |
|----------|---|------------|
| 4.4 | A Generalization to Sensor FE | 68 |
| 4.4.1 | Observer Design | 70 |
| 4.4.2 | Estimation of Sensor Faults | 73 |
| 4.5 | Simulation Results | 73 |
| 4.5.1 | Actuator Fault Estimation | 74 |
| 4.5.2 | Sensor Fault Estimation | 79 |
| 4.6 | Conclusions | 84 |
| | References | 85 |
| 5 | Robust Estimation of Sensor Faults | 87 |
| 5.1 | Introduction | 87 |
| 5.2 | Problem Formulation | 88 |
| 5.3 | SMO-Based Sensor FE | 91 |
| 5.4 | AO-Based Sensor FE | 96 |
| 5.5 | Simulation Results | 100 |
| 5.6 | Conclusions | 113 |
| | References | 113 |
| 6 | Simultaneous Estimation of Actuator and Sensor Faults Using SMO and AO | 115 |
| 6.1 | Introduction | 115 |
| 6.2 | Problem Formulation | 116 |
| 6.3 | SMOs-Based FE Scheme | 118 |
| 6.3.1 | Design of Observers | 119 |
| 6.3.2 | Estimation of Faults | 126 |
| 6.4 | SMO- and AO-Based FE Scheme | 128 |
| 6.4.1 | Design of Observers | 128 |
| 6.4.2 | Estimation of Faults | 131 |
| 6.5 | Simulation Results | 132 |
| 6.6 | Conclusions | 143 |
| | References | 144 |
| 7 | Simultaneous Estimation of Actuator and Sensor Faults Using SMO and UIO | 145 |
| 7.1 | Introduction | 145 |
| 7.2 | Problem Formulation | 146 |
| 7.3 | Design of Observers | 148 |
| 7.4 | Estimation of Faults | 155 |
| 7.5 | Simulation Results | 157 |
| 7.6 | Conclusions | 163 |
| | References | 163 |
| 8 | Simultaneous Estimation of Actuator and Sensor Faults for Descriptor Systems | 165 |
| 8.1 | Introduction | 165 |
| 8.2 | Problem Formulation | 167 |

| | | |
|----------|--|------------|
| 8.3 | Design of Observer | 168 |
| 8.4 | Simulation Results | 177 |
| 8.4.1 | Example of FE for Descriptor Systems | 177 |
| 8.4.2 | Example of FE for Normal Systems | 187 |
| 8.5 | Conclusion | 194 |
| | References | 196 |
| 9 | Conclusions and Future Work | 199 |
| 9.1 | Conclusions | 199 |
| 9.2 | Future Work | 200 |
| | References | 201 |
| | Appendix A: Solving Linear Matrix Inequality (LMI) Problems | 203 |
| | Appendix B: YALMIP Toolbox: A Short Tutorial | 213 |
| | Index | 223 |

Robust Observer-Based Fault Diagnosis for Nonlinear
Systems Using MATLAB®

Zhang, J.; Swain, A.; Nguang, S.K.

2016, XIII, 224 p. 44 illus., 42 illus. in color. With online
files/update., Hardcover

ISBN: 978-3-319-32323-7