

Contents

- 1. Introduction** 1
 - 1.1. Challenges in Sensor Data Fusion 1
 - 1.2. Scenarios and Methodologies 2
 - 1.3. Structure of this Thesis 4
- 2. Principles of Bayesian Tracking** 7
 - 2.1. Bayesian Tracking 7
 - 2.2. Fundamental Equations of Linear Estimation 9
 - 2.3. Kalman Filter 11
 - 2.4. Multi-Hypotheses-Tracker 13
 - 2.5. Interacting Multiple Model Filter 15
- I. Refinement of the Tracking Methodology** 19
- 3. Measurement Fusion in Distributed Sensor Applications** 21
 - 3.1. Related Work 22
 - 3.2. ASD Posterior 22
 - 3.3. Recursive Measurement Fusion using ASDs 29
 - 3.4. Information Filter Form of the ASD 32
 - 3.5. ASDs for MHT Filtering 38
 - 3.6. Combined MHT/IMM Filtering using ASDs 40
 - 3.7. Single State Version of the ASD Filter and Computational Costs 42
 - 3.8. Generalized Smoothing and OoS Processing 43
 - 3.9. Conclusion 47
- 4. Track-to-Track Fusion at Arbitrary Communication Rates** 49
 - 4.1. Related Work 50
 - 4.2. Optimal T2TF for Full Communication Rates 51
 - 4.3. Arbitrary Communication Rate Fusion 53
 - 4.4. Globalized Likelihood Function for Distributed Kalman Processing 62
 - 4.5. Discussion of Results 65
 - 4.6. Conclusion 67
- 5. Track before Detect on Low-Observable Targets** 69
 - 5.1. Related Work 70

5.2. DPA Algorithm	71
5.3. OoS Data Processing with DPA	73
5.4. Conclusion	75
II. Implementation, Evaluation, Experimentation	77
6. Evaluation and Implementation of the ASD Filter	79
6.1. Numerical Comparison to Different OoS Processing Schemes	79
6.2. ASD Filter Implementation Setup for Real Data Set	84
6.3. Evaluation of the Generalized-Rauch-Tung-Striebel Equations	90
6.4. Conclusion	91
7. Evaluation of the Distributed Kalman Filter Scheme	93
7.1. Two-Sensor Scenario	93
7.2. Ten-Sensor Scenario	96
7.3. Conclusion	96
8. Application of the OoS TBD Algorithm	99
8.1. Computational Costs of the OoS-DPA	100
8.2. Numerical Tests	100
8.3. Accuracy of the OoS-DPA	102
8.4. Conclusion	104
9. Conclusions and Future Work	105
9.1. Conclusions	105
9.2. Future Work	108
Appendix	111
Bibliography	113
Own Publications	123
List of Figures	127
List of Tables	131
Index	132