

Table of Contents

Notations	vii
Acronyms	ix
Introduction	xi
Chapter 1. Uncertainty Representation Based on Set Theory	1
1.1. Basic set definitions: advantages and weaknesses	3
1.1.1. Interval set	5
1.1.2. Ellipsoidal set	7
1.1.3. Polyhedral set	9
1.1.4. Zonotopic set	12
1.2. Main properties of zonotopes	17
Chapter 2. Several Approaches on Zonotopic Guaranteed Set-Membership Estimation	27
2.1. Context	27
2.2. Problem formulation	32
2.2.1. Singular Value Decomposition-based method	35
2.2.2. Optimization-based methods	40

Chapter 3. Zonotopic Guaranteed State Estimation Based on P-Radius Minimization . . .	49
3.1. Single-Output systems approach	49
3.2. Multi-Output systems approaches	63
3.2.1. General formulation	64
3.2.2. Extensions of the Single-Output systems methodology	67
3.2.3. Dedicated approach for Multi-Output systems	85
Chapter 4. Tube Model Predictive Control Based on Zonotopic Set-Membership Estimation	95
4.1. Context	95
4.2. Problem formulation	100
4.3. Tube-based output feedback Model Predictive Control design	100
4.4. Application on the magnetic levitation system	112
4.4.1. System description	113
4.4.2. Control problem	116
Conclusion and Perspectives	125
Appendix. Basic Matrix Operation Definitions	129
Bibliography	133
Index	149