

Table of Contents

1	Introduction: Dynamics, Perturbation and Discretization .	1
1.1	Starting Point	2
1.2	Different Approaches	4
1.3	Basic Idea	6
1.4	Outline of the Results	7
1.5	Open Questions and Future Research	10
2	Setup and Preliminaries	13
2.1	Continuous Time Systems	13
2.2	Discrete Time Systems	19
2.3	Sets, Distances and Limits	22
3	Strongly Attracting Sets	27
3.1	Strong Attraction	27
3.2	Robustness Concepts	29
3.3	Geometric Characterizations	34
3.4	Relation between Robustness Concepts	38
3.5	Lyapunov Function Characterization	43
3.6	Stability of Robustness Concepts	52
3.7	Inflated Systems	56
3.8	Discrete and Continuous Time Systems	64
4	Weakly Attracting Sets	69
4.1	Weak Attraction	69
4.2	Robustness Concepts	75
4.3	Geometric Characterizations	78

4.4	Relation between Robustness Concepts	82
4.5	Lyapunov Function Characterization	87
4.6	Stability of Robustness Concepts	96
4.7	Inflated Systems	100
4.8	Discrete and Continuous Time Systems	107
5	Relation between Discretization and Perturbation	113
5.1	Time Discretization: Theoretical Framework	113
5.2	Time Discretization: Numerical Schemes	117
5.3	Space Discretization	129
6	Discretizations of Attracting Sets	137
6.1	Strongly Attracting Sets	137
6.2	Strong Attractors	142
6.3	Subdivision Algorithm	148
6.4	Weakly Attracting Sets	151
7	Domains of Attraction	157
7.1	Definitions and Basic Properties	157
7.2	Zubov's Method	159
7.3	Robustness for Domains of Attraction	169
7.4	Domains of Attraction under One-Step Discretizations	173
7.5	Subdivision Algorithm	178
7.6	Numerical Approximation of Zubov's Method	185
7.7	Reachable Sets	189
Appendices		
A	Viscosity Solutions	195
A.1	Definition	195
A.2	Optimality Principles	196
B	Comparison Functions	201
B.1	Definition	201
B.2	Approximation by Smooth Functions	203

C Numerical Examples	207
C.1 Subdivision Algorithm: Test Examples	207
C.2 Subdivision Algorithm: Further Examples	212
C.3 Zubov's Method	215
Notation	219
References	221
Index	229

Asymptotic Behavior of Dynamical and Control Systems
under Perturbation and Discretization

Grüne, L.

2002, X, 238 p., Softcover

ISBN: 978-3-540-43391-0