

Igor Chueshov

Monotone Random Systems Theory and Applications



Springer

Contents

Introduction	1
1. General Facts about Random Dynamical Systems	9
1.1 Metric Dynamical Systems	9
1.2 Concept of RDS	13
1.3 Random Sets	18
1.4 Dissipative, Compact and Asymptotically Compact RDS	24
1.5 Trajectories	32
1.6 Omega-limit Sets	34
1.7 Equilibria	38
1.8 Random Attractors	41
1.9 Dissipative Linear and Affine RDS	45
1.10 Connection Between Attractors and Invariant Measures	49
2. Generation of Random Dynamical Systems	55
2.1 RDS Generated by Random Differential Equations	55
2.2 Deterministic Invariant Sets	61
2.3 The Itô and Stratonovich Stochastic Integrals	65
2.4 RDS Generated by Stochastic Differential Equations	70
2.5 Relations Between RDE and SDE	76
3. Order-Preserving Random Dynamical Systems	83
3.1 Partially Ordered Banach Spaces	83
3.2 Random Sets in Partially Ordered Spaces	88
3.3 Definition of Order-Preserving RDS	93
3.4 Sub-Equilibria and Super-Equilibria	95
3.5 Equilibria	100
3.6 Properties of Invariant Sets of Order-Preserving RDS	105
3.7 Comparison Principle	109
4. Sublinear Random Dynamical Systems	113
4.1 Sublinear and Concave RDS	113
4.2 Equilibria and Semi-Equilibria for Sublinear RDS	116
4.3 Almost Equilibria	122

4.4	Limit Set Trichotomy for Sublinear RDS	125
4.5	Random Mappings	132
4.6	Positive Affine RDS.....	138
5.	Cooperative Random Differential Equations	143
5.1	Basic Assumptions and the Existence Theorem.....	143
5.2	Generation of RDS	145
5.3	Random Comparison Principle	150
5.4	Equilibria, Semi-Equilibria and Attractors	156
5.5	Random Equations with Concavity Properties.....	160
5.6	One-Dimensional Explicitly Solvable Random Equations.....	166
5.7	Applications	171
5.7.1	Random Biochemical Control Circuit	171
5.7.2	Random Gonorrhea Model.....	175
5.7.3	Random Model of Symbiotic Interaction.....	176
5.7.4	Random Gross-Substitute System	178
5.8	Order-Preserving RDE with Non-Standard Cone	180
6.	Cooperative Stochastic Differential Equations	185
6.1	Main Assumptions.....	185
6.2	Generation of Order-Preserving RDS	186
6.3	Conjugacy with Random Differential Equations	188
6.4	Stochastic Comparison Principle	192
6.5	Equilibria and Attractors	194
6.6	One-Dimensional Stochastic Equations	199
6.6.1	Stochastic Equations on $\mathbb{R}_+$	199
6.6.2	Stochastic Equations on a Bounded Interval	206
6.7	Stochastic Equations with Concavity Properties	214
6.8	Applications	219
6.8.1	Stochastic Biochemical Control Circuit.....	219
6.8.2	Stochastic Gonorrhea Model	221
6.8.3	Stochastic Model of Symbiotic Interaction	222
6.8.4	Lattice Models of Statistical Mechanics	223
	References	227
	Index	233