
Contents

Preface	vii
1 Dissipative Dynamical Systems	1
1.1 Limit Sets and Global Attractors	2
1.2 Chain Transitivity and Attractivity	4
1.2.1 Chain Transitive Sets	5
1.2.2 Attractivity and Morse Decompositions	11
1.3 Strong Repellers and Uniform Persistence	15
1.3.1 Strong Repellers	15
1.3.2 Uniform Persistence	18
1.3.3 Coexistence States.....	20
1.3.4 Order Persistence	24
1.4 Persistence Under Perturbations.....	26
1.4.1 Perturbation of a Globally Stable Steady State.....	27
1.4.2 Persistence Uniform in Parameters	28
1.4.3 Robust Permanence	29
1.5 Notes	33
2 Monotone Dynamics	37
2.1 Attracting Order Intervals and Connecting Orbits	38
2.2 Global Attractivity and Convergence.....	42
2.3 Subhomogeneous Maps and Skew-Product Semiflows.....	46
2.4 Competitive Systems on Ordered Banach Spaces	52
2.5 Exponential Ordering Induced Monotonicity	55
2.6 Notes	60
3 Nonautonomous Semiflows	63
3.1 Periodic Semiflows.....	64
3.1.1 Reduction to Poincaré Maps	64
3.1.2 Monotone Periodic Systems.....	66
3.2 Asymptotically Periodic Semiflows.....	74

3.2.1	Reduction to Asymptotically Autonomous Processes ...	74
3.2.2	Asymptotically Periodic Systems	76
3.3	Monotone and Subhomogeneous Almost Periodic Systems	84
3.4	Continuous Processes	93
3.5	Notes	98
4	A Discrete-Time Chemostat Model	101
4.1	The Model	102
4.2	The Limiting System	104
4.3	Global Dynamics	107
4.4	Notes	110
5	<i>N</i>-Species Competition in a Periodic Chemostat	111
5.1	Weak Periodic Repellers	112
5.2	Single Population Growth	115
5.3	<i>N</i> -Species Competition	122
5.4	3-Species Competition	126
5.5	Notes	132
6	Almost Periodic Competitive Systems	133
6.1	Almost Periodic Attractors in Scalar Equations	134
6.2	Competitive Coexistence	143
6.3	An Almost Periodic Chemostat Model	147
6.4	Nonautonomous 2-Species Competitive Systems	152
6.5	Notes	158
7	Competitor–Competitor–Mutualist Systems	159
7.1	Weak Periodic Repellers	161
7.2	Competitive Coexistence	163
7.3	Competitive Exclusion	171
7.4	Bifurcations of Periodic Solutions: A Case Study	175
7.5	Notes	188
8	A Periodically Pulsed Bioreactor Model	189
8.1	The Model	190
8.2	Unperturbed Model	193
8.2.1	Conservation Principle	194
8.2.2	Single Species Growth	195
8.2.3	Two Species Competition	200
8.3	Perturbed Model	204
8.3.1	Periodic Systems with Parameters	205
8.3.2	Single Species Growth	208
8.3.3	Two Species Competition	212
8.4	Notes	215

9 A Nonlocal and Delayed Predator–Prey Model 217

9.1 The Model 218

9.2 Global Coexistence 223

9.3 Global Extinction 226

9.4 Global Attractivity: A Fluctuation Method 228

9.5 Threshold Dynamics: A Single Species Model 231

9.6 Notes 238

10 Traveling Waves in Bistable Nonlinearities 241

10.1 Existence of Periodic Traveling Waves 242

10.2 Attractivity and Uniqueness of Traveling Waves 248

10.3 Exponential Stability of Traveling Waves 253

10.4 Autonomous Case: A Spruce Budworm Model 256

10.5 Notes 259

References 261

Index 275