## **Contents**

## Preface — v

Zhanyuan Hou	
Permanence, global attraction and stability —	1

1	Introduction — 1
2	Existence of a compact uniform attractor — 3
3	Proof of Theorems 2.1, 2.2 and 2.3 — 8
4	Partial permanence and permanence — 15
5	Necessary conditions for permanence of Lotka-Volterra systems — 26
6	Sufficient condition for permanence of Lotka-Volterra systems — 31
7	Further notes — 39
8	Global attraction and stability of Lotka-Volterra systems — 39
9	Global stability by Lyapunov functions — 40
10	Global stability by split Lyapunov functions — 42
10.1	Checking the conditions (10.2) and (10.8) — 46
10.2	Examples — 47
11	Global stability of competitive Lotka-Volterra systems — 48
12	Global attraction of competitive Lotka-Volterra systems — 55
13	Some notes — 60
	Bibliography — 60
Bened	letta Lisena
Comp	etitive Lotka–Volterra systems with periodic coefficients 63
1	Introduction — 63
2	The autonomous model. The logistic equation — 64

One species extinction in three-dimensional models — 82
 The impulsive logistic equation — 91

Competitive exclusion --- 76

Two species periodic models — 68

- 7 Two species systems with impulsive effects. A look at the N-dimensional case 95
- The influence of impulsive perturbations on extinction in three-species models 109
  Bibliography 121

3

4

## Marina Pireddu and Fabio Zanolin

Fixed points, periodic points and chaotic dynamics for continuous maps with applications to population dynamics —— 123

1	Introduction — 123
2	Notation — 125
3	Search of fixed points for maps expansive along one direction — 127
4	The planar case —— 128
4.1	Stretching along the paths and variants — 128
4.2	The Crossing Lemma —— 143
5	The $N$ -dimensional setting: Intersection Lemma —— 152
5.1	Zero-sets of maps depending on parameters — 157
5.2	Stretching along the paths in the $N$ -dimensional case — 163
6	Chaotic dynamics for continuous maps — 168
7	Definitions and main results — 172
8	Symbolic dynamics — 181
9	On various notions of chaos —— 190
10	Linked twist maps — 198
11	Examples from the ODEs — 206
12	Predator-prey model — 207
12.1	The effects of a periodic harvesting — 207
12.2	Technical details and proofs — 215
	Bibliography — 225

Index — 235