Jack K. Hale Luis T. Magalhães Waldyr M. Oliva

Dynamics in Infinite Dimensions

Second Edition

Appendix by Krzysztof P. Rybakowski

With 15 Figures



Contents

Pr	eface		V
1	Intr	oduction	1
2	Inva	ariant Sets and Attractors	7
3	Fun	ctional Differential Equations on Manifolds	19
	3.1	RFDE on manifolds	19
	3.2	Examples of RFDE on manifolds	29
	3.3	NFDE on manifolds	44
	3.4	NFDE on \mathbb{R}^n	45
		3.4.1 General properties	46
		3.4.2 Equivalence of point and compact dissipative	50
	3.5	An example of NFDE on S^1	51
	3.6	A canonical ODE in the Fréchet category	54
4	The	e Dimension of the Attractor	57
5	Sta	bility and Bifurcation	65
6	Sta	bility of Morse-Smale Maps and Semiflows	81
	6.1	Morse–Smale maps	81
	6.2	Morse–Smale semiflows	98
	6.3	An example	104
7	One	e-to-Oneness, Persistence, and Hyperbolicity	109
	7.1	The semiflow of an RFDE on a compact manifold $M cdots$	110
	7.2	Hyperbolic invariant sets	
	7.3	Hyperbolic sets as hyperbolic fixed points	111
	7.4	Persistence of hyperbolicity and perturbations	
		with one-to-oneness	
	7.5	Nonuniform hyperbolicity and invariant manifolds	
		7.5.1 Nonuniform hyperbolicity	
		7.5.2 Regular points	
		7.5.3 Hyperbolic measures and nonuniform hyperbolicity	
		7.5.4 The infinite dimensional case	127

8	Rea	alization of Vector Fields and Normal Forms	29
	8.1	Realization of vector fields on center manifolds	29
	8.2	Normal forms for RFDE in finite dimensional spaces	40
	8.3	Applications to Hopf bifurcation	4 9
		8.3.1 Hopf Bifurcation for Scalar RFDE: The General Case . 1-	49
		8.3.2 Hopf bifurcation for a delayed predator-prey system 1	56
	8.4	Applications to Bogdanov-Takens bifurcation	61
		8.4.1 Bogdanov–Takens bifurcation for scalar RFDE:	
		The general case 1	61
		8.4.2 Square and pulse waves 19	64
	8.5	Singularity with a pure imaginary pair	
		and a zero as simple eigenvalues	67
	8.6	Normal forms for RFDE in infinite dimensional spaces 1	7 0
	8.7	Periodic RFDE on \mathbb{R}^n and autonomous RFDE	
		on Banach spaces	86
	8.8	A Viscoelastic model	89
_		0 0 0136 2011	۰.
9	Att	ractor Sets as C^1 -Manifolds	95
10	Mo	notonicity 2	09
		Usual cones	
		Cones of rank k	
		Monotonicity in finite dimensions	
		J	
	10.4	Monotonicity in infinite dimensions	
	10.4	Monotonicity in infinite dimensions	16
	10.4	10.4.1 The Chafee–Infante problem	16 17
		· ·	16 17 19
11	10.5	10.4.1 The Chafee–Infante problem	16 17 19 21
11	10.5	10.4.1 The Chafee–Infante problem	16 17 19 21
11 A	10.5 The	10.4.1 The Chafee–Infante problem	16 17 19 21 29
A	10.5 The	10.4.1 The Chafee–Infante problem	16 17 19 21 29
A	10.5 The	10.4.1 The Chafee–Infante problem	16 17 19 21 29