



# Table of Contents

<b>Introduction</b> .....	1
<b>Quantum Chaos and Ergodic Theory</b>	
B.Y. Chirikov .....	9
1. Introduction .....	9
2. Definition of Quantum Chaos .....	11
3. The Time Scales of Quantum Dynamics .....	12
4. The Quantum Steady State .....	13
5. Concluding Remarks .....	14
References .....	15
<b>On the Complete Characterization of Chaotic Attractors</b>	
R. Stoop .....	17
1. Introduction .....	17
2. Scaling Behavior .....	18
2.1 Scale Invariance .....	18
2.2 Non-unified Approach .....	20
3. Unified Approach .....	22
3.1 The Generalized Entropy Function .....	22
3.2 Hyperbolic Models with Complete Grammars .....	25
4. Extensions .....	31
4.1 The Need for Extensions .....	31
4.2 Convergence Properties .....	31
4.3 Nonhyperbolicity and Phase-Transitions .....	34
5. Conclusions .....	44
References .....	44

## VIII Table of Contents

### New Numerical Methods for High Dimensional Hopf Bifurcation Problems

J. Wu and K. Zhou .....	47
1. Introduction .....	47
2. Static Bifurcation and Pseudo-Arclength Method .....	49
3. The Numerical Methods for Hopf Bifurcation .....	52
4. Examples .....	65
References .....	68

### Catastrophe Theory and the Vibro-Impact Dynamics of Autonomous Oscillators

G.S. Whiston .....	71
1. Introduction .....	71
2. Generalities on Vibro-Impact Dynamics .....	73
3. The Geometry of Singularity Subspaces .....	79
4. Continuity of the Poincaré Map of the S/U Oscillator .....	93
References .....	95

### Codimension Two Bifurcation and Its Computational Algorithm

H. Kawakami and T. Yoshinaga .....	97
1. Introduction .....	97
2. Bifurcations of Fixed Point .....	99
2.1 The Poincaré Map and Property of Fixed Points .....	99
2.2 Codimension One Bifurcations .....	100
2.3 Codimension Two Bifurcations .....	102
3. Computational Algorithms .....	111
3.1 Derivatives of the Poincaré Map .....	112
3.2 Numerical Method of Analysis .....	113
4. Numerical Examples .....	115
4.1 Circuit Model for Chemical Oscillation at a Water-Oil Interface .....	116
4.2 Coupled Oscillator with a Sinusoidal Current Source .....	123
5. Concluding Remarks .....	129
References .....	131

### Chaos and Its Associated Oscillations in Josephson Circuits

M. Morisue, A. Kanaguri .....	133
1. Introduction .....	133
2. Model of Josephson Junction .....	134
3. Chaos in a Forced Oscillation Circuit .....	137

4. Autonomous Josephson Circuit .....	141
4.1 Introduction .....	141
4.2 Results of Calculation .....	145
5. Distributed Parameter Circuit .....	147
6. Conclusion .....	152
References .....	152

**Chaos in Systems with Magnetic Force**

J. Tani .....	153
1. Introduction .....	153
2. System of Two Conducting Wires .....	154
2.1 Formulation of Dynamical Equations .....	154
2.2 Analytical Procedure .....	157
2.3 Numerical Simulation of Chaos .....	158
3. Multi-Equilibrium Magnetoelastic Systems .....	163
3.1 Theoretical Models .....	164
3.2 Numerical Simulation .....	169
3.3 Experiment .....	173
4. Magnetic Levitation Systems .....	178
4.1 Formulation of Dynamic Equations .....	178
4.2 Linearization in Terms of Manifolds .....	183
4.3 Numerical Simulation .....	184
4.4 Conclusion .....	189
References .....	190

**Bifurcation and Chaos in the Helmholtz-Duffing Oscillator**

G. Rega .....	191
1. Mechanical System and Mathematical Model .....	191
2. Behaviour Chart and Characterization of Chaotic Response .....	194
3. Prediction of Local Bifurcations of Regular Solutions .....	198
4. Geometrical Description of System Response Using Attractor-Basin Portraits and Invariant Manifolds .....	207
5. Conclusions .....	213
References .....	214

**Bifurcations and Chaotic Motions  
in Resonantly Excited Structures**

S.I. Chang, A.K. Bajaj and P. Davies .....	217
1. Introduction .....	217
2. Nonlinear Structural Members .....	219
2.1 Strings .....	219

X      Table of Contents

2.2	Beams .....	220
2.3	Cylindrical Shells and Rings .....	221
2.4	Plates .....	222
3.	Resonant Motions of Rectangular Plates with Internal and External Resonances .....	223
3.1	Equations of Motion .....	224
3.2	Averaged Equations .....	226
3.3	Steady-State Constant Solutions .....	229
3.4	Stability Analysis of Constant Solutions .....	233
3.5	Periodic and Chaotic Solutions of Averaged Equations .....	238
4.	Summary and Conclusions .....	247
	References .....	247
	Appendix .....	250

**Non-Linear Behavior of a Rectangular Plate  
Exposed to Airflow**

J. Awrejcewicz, J. Mrozowski and M. Potier-Ferry .....	253	
1.	Introduction .....	253
2.	Mathematical Model .....	254
3.	Threshold Determination of Periodic Oscillations .....	262
4.	Dynamics Past the Hopf Bifurcation Point .....	264
5.	Summary and Concluding Remarks .....	270
	References .....	271

