



# Contents

Introduction .....	1
 <u>Part I <i>General Concepts</i></u>	
Towards a Revival of Natural Philosophy. By R. Thom .....	5
Catastrophe Theory. By E.C. Zeeman (With 7 Figures) .....	12
Catastrophe Geometry in Physics: A Perspective. By W. Güttinger .....	23
Synergetics and a New Approach to Bifurcation Theory. By H. Haken .....	31
 <u>Part II <i>Topological Aspects of Wave Motion</i></u>	
Catastrophe and Fractal Regimes in Random Waves. By M.V. Berry (With 2 Figures) .....	43
Distribution of Modes in Fractal Resonators. By M.V. Berry .....	51
Optical Caustics and Diffraction Catastrophes. By J.F. Nye (With 7 Figures) .....	54
 <u>Part III <i>Catastrophes in Infinite Dimensions</i></u>	
Infinite Dimensions and the Fold Catastrophe. By R. Magnus and T. Poston (With 14 Figures) .....	63
Catastrophes and Bifurcations in Variational Problems. By G. Dangelmayr (With 4 Figures) .....	84
Semiclassical Path Integrals in Terms of Catastrophes By G. Dangelmayr, W. Güttinger, and W. Veit (With 6 Figures) .....	104
Catastrophe and Stochasticity in Semiclassical Quantum Mechanics By M.V. Berry (With 1 Figure) .....	122
 <u>Part IV <i>Defects and Dislocations</i></u>	
Stable Defects in Ordered Media. By R. Thom (With 1 Figure) .....	129
Structural Stability in Evolving Flow Fields. By J.F. Nye (With 3 Figures) ..	134
Wavefront Dislocations and Their Analysis Using Catastrophe Theory By F.J. Wright (With 10 Figures) .....	141

Part V *Statistical Mechanics and Phase Transitions*

Structural Stability in Statistical Mechanics. By M. Rasetti .....	159
The 180° Rule at Triple Points: A Consideration Based on a Modified Butterfly Model. By G. Dušek (With 5 Figures) .....	176
Phase Diagrams and Catastrophes. By K. Keller, G. Dangelmayr, and H. Eikemeier (With 9 Figures) .....	186
Information Measures and Thermodynamic Criteria of Motion. By F. Schlögl ....	199
Phase Transitions as Catastrophes: A Perspective. By W.T. Grandy (With 2 Figures) .....	210

Part VI *Solitons*

Solitons in Physics: Basic Concepts. By R.K. Bullough and R.K. Dodd (With 1 Figure) .....	219
Solitons in Mathematics. By R.K. Bullough and R.K. Dodd .....	233
Spin Wave Breathers in <sup>3</sup> He B. By P.W. Kitchenside, R.K. Bullough, and P.J. Caudrey (With 10 Figures) .....	254

Part VII *Dynamical Systems*

Catastrophic Effects in Pattern Recognition. By R. Brause and M. DaI Cin (With 5 Figures) .....	269
Cusp Bifurcation in Pituitary Thyrotropin Secretion. By F.J. Seif (With 4 Figures) .....	275
Chaos. By O.E. Rössler (With 17 Figures) .....	290
<i>Index of Contributors</i> .....	311

