## **Contents**

Introduction	1
Part I General Concepts	
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
Part II Topological Aspects of Wave Motion	
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
Part III Catastrophes in Infinite Dimensions	
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)	.22
Part IV Defects and Dislocations	
Stable Defects in Ordered Media. By R. Thom (With 1 Figure) 1	129
Structural Stability in Evolving Flow Fields. By J.F. Nye (With 3 Figures) $\dots$ 1	L34
Wavefront Dislocations and Their Analysis Using Catastrophe Theory By F.J. Wright (With 10 Figures)	١41

## 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. Dukek (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 $ \ldots $	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)	
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. Dal 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