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Nota di contenuto	Thermal Convection; Contents; Preface; Acknowledgements; 1 Equations, General Concepts and Methods of Analysis; 1.1 Pattern Formation and Nonlinear Dynamics; 1.1.1 Some Fundamental Concepts: Pattern, Interrelation and Scale; 1.1.2 PDEs, Symmetry and Nonequilibrium Phenomena; 1.2 The Navier-Stokes Equations; 1.2.1 A Satisfying Microscopic Derivation of the Balance Equations; 1.2.2 A Statistical Mechanical Theory of Transport Processes; 1.2.3 The Continuity Equation; 1.2.4 The Momentum Equation; 1.2.5 The Total Energy Equation; 1.2.6 The Budget of Internal Energy; 1.2.7 Newtonian Fluids 1.2.8 Some Considerations About the Dynamics of Vorticity 1.2.9 Incompressible Formulation of the Balance Equations; 1.2.10 Nondimensional Form of the Equations for Thermal Problems; 1.3 Energy Equality and Dissipative Structures; 1.4 Flow Stability, Bifurcations and Transition to Chaos; 1.5 Linear Stability Analysis: Principles and Methods; 1.5.1 Conditional Stability and Infinitesimal

Disturbances; 1.5.2 The Exponential Matrix and the Eigenvalue Problem; 1.5.3 Linearization of the Navier-Stokes Equations 1.5.4 A Simple Example: The Stability of a Parallel Flow with an Inflectional Velocity Profile 1.5.5 Weaknesses and Limits of the Linear Stability Approach; 1.6 Energy Stability Theory; 1.6.1 A Global Budget for the Generalized Disturbance Energy; 1.6.2 The Extremum Problem; 1.7 Numerical Integration of the Navier-Stokes Equations; 1.7.1 Vorticity Methods; 1.7.2 Primitive Variables Methods; 1.8 Some Universal Properties of Chaotic States; 1.8.1 Feigenbaum, Ruelle-Takens and Manneville-Pomeau Scenarios; 1.8.2 Phase Trajectories, Attractors and Strange Attractors 1.8.3 The Lorenz Model and the Butterfly Effect 1.8.4 A Possible Quantification of SIC: The Lyapunov Spectrum; 1.8.5 The Mandelbrot Set: The Ubiquitous Connection Between Chaos and Fractals; 1.9 The Maxwell Equations; 2 Classical Models, Characteristic Numbers and Scaling Arguments; 2.1 Buoyancy Convection and the Boussinesq Model; 2.2 Convection in Space; 2.2.1 A Definition of Microgravity; 2.2.2 Experiments in Space; 2.2.3 Surface Tension-driven Flows; 2.2.4 Acceleration Disturbances on Orbiting Platforms and Vibrational Flows; 2.3 Marangoni Flow 2.3.1 The Genesis and Relevant Nondimensional Numbers 2.3.2 Microzone Facilities and Microscale Experimentation; 2.3.3 A Paradigm Model: The Liquid Bridge; 2.4 Exact Solutions of the Navier-Stokes Equations for Thermal Problems; 2.4.1 Thermogravitational Convection: The Hadley Flow; 2.4.2 Marangoni Flow; 2.4.3 Hybrid States; 2.4.4 General Properties; 2.4.5 The Infinitely Long Liquid Bridge; 2.4.6 Inclined Systems; 2.5 Conductive, Transition and Boundary-layer Regimes; 3 Examples of Thermal Fluid Convection and Pattern Formation in Nature and Technology 3.1 Technological Processes: Small-scale Laboratory and Industrial Setups

Sommario/riassunto

Thermal Convection - Patterns, Stages of Evolution and Stability Behavior provides the reader with an ensemble picture of the subject, illustrating the state-of-the-art and providing the researchers from universities and industry with a basis on which they are able to estimate the possible impact of a variety of parameters. Unlike earlier books on the subject, the heavy mathematical background underlying and governing the behaviors illustrated in the text are kept to a minimum. The text clarifies some still unresolved controversies pertaining to the physical nature of the dominatin

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