1. Record Nr. UNISA996466395103316

Titolo	Waves in flows / / Tomas Bodnar, Giovanni P. Galdi, Sarka Necasova, editors
Pubbl/distr/stampa	Cham, Switzerland : , : Birkhauser, , [2021] ©2021
ISBN	3-030-67845-8
Descrizione fisica	1 online resource (362 pages)
Collana	Advances in mathematical fluid mechanics
Disciplina	531.1133015118
Soggetti	Waves - Mathematical models Fluid dynamics - Mathematical models Ones Models matemàtics Dinàmica de fluids Llibres electrònics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Intro -- Preface -- Contents -- 1 A Priori Estimates from First Principles in Gas Dynamics -- 1.1 Introduction -- 1.2 Compensated Integrability -- 1.2.1 Evolution Problems -- A Homogeneous Estimate -- Integrating in Time First -- 1.3 Applications to Gas Dynamics (I): Euler Equations -- 1.3.1 Euler Equations for a Compressible Inviscid Fluid -- 1.3.2 Why Do We Care? -- 1.3.3 Estimating the Velocity Field -- 1.3.4 Flows in a Bounded Domain -- 1.3.5 Relativistic Gas -- 1.3.6 Flows with External Force -- 1.4 Applications (II): Kinetic Models -- 1.4.1 Boltzmann-Like Models -- The Cauchy Problem -- An Extra Estimate for Boltzmann-Like Equations -- 1.4.2 What Should a Dissipative Model Be? -- 1.4.3 Discrete Velocity Models -- 1.5 Applications (III): Mean-Field Models -- 1.5.1 Vlasov-Type Models -- 1.5.2 The DPT of a Single Vlasov-Type Equation -- 1.5.3 Genuine Plasmas -- 1.6 Applications (IV): Molecular Dynamics -- 1.6.1 Mass-Momentum Tensor of a Single Particle -- 1.6.2 Long-Range Forces -- 1.6.3 Hard Spheres -- References -- 2 Equatorial Wave-Current Interactions -- 2.1 Introduction -- 2.2 Preliminaries -- 2.3 The

Equatorial f-Plane Approximation -- 2.4 The Equatorial -Plane Approximation -- 2.5 An Exact -Plane Solution (Equatorially Trapped Wave) -- 2.5.1 Analysis of the Equatorially Trapped Wave Motion -- 2.5.2 Quantitative Aspects -- 2.6 The Ocean Flow in the Equatorial Pacific -- 2.6.1 The El Nino Phenomenon -- 2.6.2 A Model for the Equatorial Currents -- 2.6.3 Equatorial Wave-Current Interactions -- 2.6.4 Linear Wave Theory -- 2.6.5 Weakly Nonlinear Models -- References -- 3 Linear and Nonlinear Equatorial Waves in a Simple Modelof the Atmosphere -- 3.1 Introduction -- 3.2 Linear Equatorial Waves -- 3.3 Weakly Nonlinear Long Equatorial Waves -- 3.3.1 Long Linear Rossby and Kelvin Waves -- 3.3.2 Nonlinear Slow Dynamics of Long Waves.
3.4 Equatorial Modons -- 3.5 Equatorial Adjustment: Initial-Value Problem on the Equatorial Beta-Plane -- 3.6 Brief Summary and Discussion -- References -- 4 The Water Wave Problem and Hamiltonian TransformationTheory -- 4.1 Introduction -- 4.2 Water Waves and Hamiltonian PDEs -- 4.2.1 Physical Derivation of the Governing Equations -- 4.2.2 General Notions on Hamiltonian Systems -- 4.2.3 Examples of Hamiltonian PDEs -- Quasilinear Wave Equation -- Boussinesq System -- Korteweg-de Vries Equation -- Nonlinear Schrodinger Equation -- 4.2.4 Zakharov's Hamiltonian for Water Waves -- 4.3 Dirichlet-Neumann Operator and Its Analysis -- 4.3.1 Legendre Transform -- 4.3.2 Shape Derivative of H -- 4.3.3 Invariants of Motion -- 4.3.4 Taylor Expansion of G -- 4.4 Birkhoff Normal Forms -- 4.4.1 Significance of the Normal Form -- 4.4.2 Complex Symplectic Coordinates and Poisson Brackets -- 4.4.3 Resonances -- 4.4.4 FormalTransformationTheoryandBirkhoffNormalForm -- 4.4.5 Solving the Third-Order Cohomological Equation -- 4.4.6 Normal Forms for Gravity Waves on Infinite Depth -- Third-Order Normal Form and Burgers' Equation -- Fourth-Order Normal Form -- Integrable Birkhoff Normal Form -- 4.5 Model Equations for Water Waves -- 4.5.1 Linearized Problem -- 4.5.2 Non-dimensionalization -- 4.5.3 Canonical Transformation Theory -- 4.5.4 Calculus of Transformations -- Amplitude Scaling -- Spatial Scaling -- Surface Elevation-Velocity Coordinates -- Moving Reference Frame -- Characteristic Coordinates -- 4.5.5 Boussinesq and KdV Scaling Limits -- 4.5.6 Modulational Scaling Limit and the NLS Equation -- Normal Form Transformation -- Modulational Ansatz -- Expansion and Homogenization of Multiscale Functions -- NLS Equation -- Reconstruction of the Free Surface -- 4.6 Initial Value Problems -- 4.6.1 Local Well-Posedness.
4.6.2 Recent Results on Global Well-Posedness for Small Data -- 4.6.3 Water Waves in a Periodic Geometry -- 4.7 Numerical Simulation of Surface Gravity Waves -- 4.7.1 Tanaka's Method for Solitary Waves -- 4.7.2 High-Order Spectral Method -- Space Discretization -- Time Integration -- 4.7.3 Collision of Solitary Waves -- References -- 5 Gravity Wave Propagation in Inhomogeneous Media -- 5.1 Introduction -- 5.2 Water Waves -- 5.2.1 Propagation on Uneven Bottoms: First Order StokesWaves -- 5.2.2 Second Order Stokes Waves -- 5.2.3 Propagation in the Presence of Current or Through Porous Media -- Propagation in the Presence of Current -- Propagation Through Porous Media -- 5.3 Wave Scattering: 2D Case -- 5.3.1 Standing Wave in a Tank: Resonance and Sloshing -- 5.3.2 Case of Smooth Bathymetries: Sinusoidal Beds -- Perturbation Method with Multiple-scale Expansion for Sinusoidal Beds of Finite Extend -- Mild-Slope and Modified Mild-Slope Equations -- 5.3.3 Case of Abrupt Bathymetries -- General Expression of the Velocity Potentials -- Integral Matching Conditions Method -- 5.3.4 Examples -- Sloping Beds -- Sinusoidal Beds -- Reflection Due to Structures -- 5.4 Water Focusing: 3D Case -- 5.4.1

Refraction-Snell-Descartes' Law -- 5.4.2 Refraction-Diffraction -- 5.4.3 Diffraction -- Analytic Solution: Semi-Infinite Dike -- Channels of Finite Width -- 5.4.4 Examples -- Wave Scattering in the Presence of Underwater Mound -- Wave Scattering by Surface Piercing Structures -- Wave Scattering by Emerging Porous Media -- 5.5 Application to Wave Energy Device -- 5.5.1 Oscillating Water Column -- 5.5.2 Pressure Oscillation -- References -- 6 Physical Models for Flow: Acoustic Interaction -- 6.1 Introduction -- 6.2 Fluid Dynamics -- 6.2.1 Conservation Equations -- Conservation of Mass -- Conservation of Momentum -- Conservation of Energy -- 6.2.2 Constitutive Equations. 6.2.3 Characterization of Flows by Dimensionless Numbers -- 6.2.4 Vorticity -- 6.2.5 Towards Acoustics -- Formulation for Scalar Potential -- Formulation for Vector Potential -- 6.3 Acoustics -- 6.3.1 Wave Equation -- 6.3.2 Simple Solutions: d'Alembert -- 6.3.3 Impulsive Sound Sources -- 6.3.4 Free-Space Green's Functions -- 6.3.5 Monopoles, Dipoles, and Quadrupoles -- 6.3.6 Calculation of Acoustic Far Field -- 6.3.7 Compactness -- 6.3.8 Solution of Wave Equation Using Green's Function -- 6.4 Aeroacoustics -- 6.4.1 Lighthill's Acoustic Analogy -- 6.4.2 Curle's Theory -- 6.4.3 Vortex Sound -- 6.4.4 Perturbation Equations -- 6.4.5 Comparison of Different Formulations -- 6.4.6 Acoustic Feedback Mechanisms -- 6.5 Applications -- Coupling strategy of flow and acoustics -- Fluid dynamics -- Acoustics -- Conclusions of workflow -- 6.5.1 Human Phonation -- 6.5.2 Axial Fan -- 6.5.3 Cavity at Low Mach Number schoder2020numerical -- 6.5.4 Cavity at High Mach Number -- Appendix -- References.