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soliton dynamics; 5 Kinks; 5.1 Bogomolny bounds and vacuum structure; 5.2 Φ^4 kinks; 5.3 Sine-Gordon kinks; 5.4 Generalizations; 6 Lumps and rational maps; 6.1 Lumps in the $O(3)$ sigma model; 6.2 Lumps on a sphere and symmetric maps; 6.3 Stabilizing the lump; 7 Vortices; 7.1 Ginzburg-Landau energy functions; 7.2 Topology in the global theory; 7.3 Topology in the gauged theory; 7.4 Vortex solutions; 7.5 Forces between gauged vortices; 7.6 Forces between vortices at large separation; 7.7 Dynamics of gauged vortices; 7.8 Vortices at critical coupling; 7.9 Moduli space dynamics; 7.10 The metric on MN ; 7.11 Two-vortex scattering; 7.12 First order dynamics near critical coupling; 7.13 Global vortex dynamics; 7.14 Varying the geometry; 7.15 Statistical mechanics of vortices; 8 Monopoles; 8.1 Dirac monopoles; 8.2 Monopoles as solitons; 8.3 Bogomolny-Prasad-Sommerfield monopoles; 8.4 Dyons; 8.5 The Nahm transform; 8.6 Construction of monopoles from Nahm data; 8.7 Spectral curves; 8.8 Rational maps and monopoles; 8.9 Alternative monopole methods; 8.10 Monopole dynamics; 8.11 Moduli spaces and geodesic motion; 8.12 Well separated monopoles; 8.13 $SU(m)$ monopoles; 8.14 Hyperbolic monopoles; 9 Skyrmions; 9.1 The Skyrme model; 9.2 Hedgehogs; 9.3 Asymptotic interactions; 9.4 Low charge Skyrmions; 9.5 The rational map ansatz; 9.6 Higher charge Skyrmions; 9.7 Lattices, crystals and shells; 9.8 Skyrmion dynamics; 9.9 Generalizations of the Skyrme model; 9.10 Quantization of Skyrmions; 9.11 The Skyrme-Faddeev model; 10 Instantons; 10.1 Self-dual Yang-Mills fields; 10.2 The ADHM construction; 10.3 Symmetric instantons; 10.4 Skyrme fields from instantons; 10.5 Monopoles as self-dual gauge fields; 10.6 Higher rank gauge groups; 11 Saddle points - sphalerons; 11.1 Mountain passes; 11.2 Sphalerons on a circle; 11.3 The gauged kink; 11.4 Monopole-antimonopole dipole; 11.5 The electroweak sphaleron; 11.6 Unstable solutions in other theories; References; Index

Sommario/riassunto

Topological solitons occur in many nonlinear classical field theories. They are stable, particle-like objects, with finite mass and a smooth structure. Examples are monopoles and Skyrmions, Ginzburg-Landau vortices and sigma-model lumps, and Yang-Mills instantons. This book is a comprehensive survey of static topological solitons and their dynamical interactions. Particular emphasis is placed on the solitons which satisfy first-order Bogomolny equations. For these, the soliton dynamics can be investigated by finding the geodesics on the moduli space of static multi-soliton solutions. Remarkable scattering processes can be understood this way. The book starts with an introduction to classical field theory, and a survey of several mathematical techniques useful for understanding many types of topological soliton. Subsequent chapters explore key examples of solitons in one, two, three and four dimensions. The final chapter discusses the unstable sphaleron solutions which exist in several field theories.

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