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★Line integral methods for conservative problems.

Monographs and Research Notes in Mathematics.
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This book deals with the numerical methods for solving differential equations and partial differential equations within the framework of geometric Hamiltonian formalism. Using appropriate tools of numerical analysis the authors obtain valuable geometric properties of the associated continuous vector field. They study the problem of finding the *conservation laws* (or constants of motion) for differential problems and, in particular, for Hamiltonian systems.

The book contains six valuable chapters and one appendix with some basic properties of Legendre polynomials and an example of a Matlab function.

The first chapter contains an introduction to symplectic methods, line integral methods and a short introduction to Hamiltonian problems. The second chapter is devoted to the presentation of some classical examples of Hamiltonian systems. In the third chapter the authors present a valuable analysis of HBVMs (Hamiltonian Boundary Value Methods). In this chapter we find the main theoretical results derived from the line integral methods. In the fourth chapter an implementation of these methods is given with numerical illustrations.

Numerical solutions for some Hamiltonian partial differential equations (the semilinear wave equation and the nonlinear Schrödinger equation) are obtained in chapter five, by using the HBVM tools. Chapter six deals with some generalizations of the basic energy-conserving methods. An extension to the case of multiple invariants is made and a study of the case of general conservative problems is done for obtaining numerical solutions for Hamiltonian boundary value problems.

The large number of examples and applications and, also, the clarity of presentation of the theoretical results make this work very useful for the study of Hamiltonian dynamical systems using numerical methods. *Florian F. Munteanu*