Nonlinear Dispersive Waves

The field of nonlinear dispersive waves has developed enormously since the work of Stokes, Boussinesq, and Korteweg and de Vries (KdV) in the nineteenth century. In the 1960s researchers developed effective asymptotic methods for deriving nonlinear wave equations, such as the KdV equation, governing a broad class of physical phenomena. These equations admit special solutions including those commonly known as solitons.

This book describes the underlying approximation techniques and methods for finding solutions to these and other equations, such as the nonlinear Schrödinger, sine–Gordon, Kadomtsev–Petviashvili and Burgers equations. The concepts and methods covered include wave dispersion, asymptotic analysis, perturbation theory, the method of multiple scales, deep and shallow water waves, nonlinear optics including fiber optic communications, mode-locked lasers and dispersion-managed wave phenomena. Most chapters feature exercise sets, making the book suitable for advanced courses or for self-directed learning. Graduate students and researchers will find this an excellent entry to a thriving area at the intersection of applied mathematics, engineering and physical science.

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Asymptotic Analysis and Solitons

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