solitons in mathematics and physics

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Abstrak

The soliton is a dramatic concept in nonlinear science. What makes this book unique in the treatment of this subject is its focus on the properties that make the soliton physically ubiquitous and the soliton equation mathematically miraculous. Here, on the classical level, is the entity field theorists have been postulating for years: a local traveling wave pulse; a lump-like coherent structure; the solution of a field equation with remarkable stability and particle-like properties. It is a fundamental mode of propagation in gravity- driven surface and internal waves; in atmospheric waves; in ion acoustic and Langmuir waves in plasmas; in some laser waves in nonlinear media; and in many biologic contexts, such as alpha- helix proteins.
This is not an encyclopedia of information on solitons in which every sentence is interrupted by either a caveat or a reference. Rather, Newell has tried to tell the story of the soliton as he would have liked to have heard it as a graduate student, with some historical development, lots of motivation, and frequent attempts to relate the topic at hand to the big picture.
The book begins with a history of the soliton from its first sighting to the discovery of the inverse scattering method and recent ideas on the algebraic structure of soliton equations. Chapter 2 focuses on the universal nature of these equations and how and why they arise in physical and engineering contexts as asymptotic solvability conditions. The third chapter deals with the inverse scattering method and perturbation theories. Chapter 4 introduces the t-function and discusses the relations between the various methods for constructing solutions to the soliton equations and their various properties. Finally, an algebraic structure for the equations is provided in Chapter 5.