

F. Gesztesy, H. Holden: *Soliton Equations and Their Algebro-Geometric Solutions, vol. I: (1+1)-Dimensional Continuous Models*, Cambridge Studies in Advanced Mathematics 79, Cambridge University Press, Cambridge, 2003, 505 pp., £65, ISBN 0-521-75307-4

The field of completely integrable systems has developed enormously in the last decades. The book under review covers a part of this broad landscape. Its aim is to discuss in detail algebro-geometric solutions of five hierarchies of integrable nonlinear equations. The presented class of solutions form a natural extension of the classes of soliton and rational solutions, and can be used to approximate more general solutions (e.g. almost periodic ones). Basic tools in the description are spectral analysis and basic theory of compact Riemann surfaces and their theta functions. The basic KdV hierarchy is the most famous case, it contains the equation for solitary waves on channels, which were discovered by Scott Russell in 1834. The solutions of the KdV hierarchy are discussed in the first chapter. The discussion is presented in more detail for this first case than in the other four cases. The second hierarchy treated in Chapter 2 is a combined sine-Gordon and modified Korteweg-de Vries hierarchy. The third chapter contains a discussion of solutions of the AKNS (Ablowitz, Kaup, Newell, Segur) system and related classical Boussinesq hierarchies. The classical massive Thirring system is treated in Chapter 4. The last chapter describes solutions of the Camassa-Holm hierarchy. Individual chapters are organized in such a way that they can be read independently. To reach this goal, similar arguments in constructions are repeated in individual cases. Each chapter ends with detailed notes (e.g. notes for the first chapter have 17 pages) with references to literature, comments and additional results. In the Appendix (140 pages), it is possible to find a summary of many fields (e.g. algebraic curves, theta functions, the Lagrange interpolation, symmetric functions, trace formulae, elliptic functions, spectral measures), which are used in the main chapters. At the end, the reader can find an extensive bibliography (30 pages of references). The book is very well organized and carefully written. It could be particularly useful for analysts wanting to learn new methods coming from algebraic geometry. (vs)