Integration of the soliton hierarchy with self-consistent sources by inverse scattering transformation

Yunbo Zeng

Department of Mathematical Sciences, Tsinghua University, Beijing 100084, China

Email: yzeng@math.tsinghua.edu.cn

Abstract In contrast with the soliton equations, the evolution of the eigenfunctions in the Lax representation of soliton equation with self-consistent sources (SESCSs) possesses singularity. We present a general method to treat the singularity to determine the evolution of scattering data. The KdV hierarchy with self-consistent sources, the AKNS hierarchy with self-consistent sources, the MKdV hierarchy with self-consistent sources, the nonlinear Schrödinger equation hierarchy with self-consistent sources, the Kaup-Newell hierarchy with self-consistent sources and the derivative nonlinear Schrödinger equation hierarchy with self-consistent sources are integrated directly by using the inverse scattering method. The N soliton solutions for some SESCSs are presented. It is shown that the insertion of a source may cause the variation of the velocity of soliton. This approach can be applied to all other (1+1)-dimensional soliton hierarchies.