Inverse Scattering Problem for Generalized Modified Korteweg-de Vries Equation

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Abstract

We consider the Cauchy problem for the generalized mKdV equation

$$u_t - 6uu^2 + u_{xxx} = \gamma(t)e^{-2\int_0^x u(s)ds},$$

$$u(x,0) = u_0(x).$$

The initial function $u_0(x)$ is supposed satisfying the following boundary conditions

$$u_0(x) \to \begin{cases} -a, & x \to -\infty, \\ a, & x \to \infty. \end{cases}$$

It is easily to verify that this equation is represented in the Lax form:

$$L_t = [L, A],$$

where

$$L = \frac{\partial^2}{\partial x^2} + 2u\frac{\partial}{\partial x},$$

$$A = 4\frac{\partial^3}{\partial x^3} + 12u\frac{\partial^2}{\partial x^2} + 6(u^2 + u_x)\frac{\partial}{\partial x} + f(x,t),$$

and the function $f(x,t)$ is a solution of the equation

$$f_{xx} + 2uf_x = 0,$$

having the form

$$f(x,t) = -\gamma(t)\int_{-\infty}^{x} e^{-2\int_0^y u(s,t)ds}\,dy.$$

The inverse scattering problem for this equation is considered and the simplest solutions are constructed.

Literature.

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