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Satoshi Masaki, Jun-ichi Segata

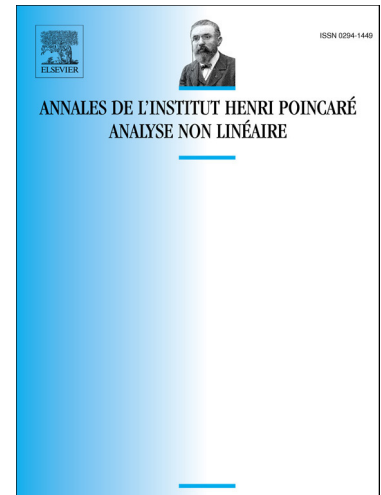
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Existence of a minimal non-scattering solution to the mass-subcritical generalized Korteweg-de Vries equation

Satoshi Masaki

*Graduate School of Engineering Science, Osaka University,
1-3 Machikaneyama, Toyonaka, Osaka 560-8531 Japan*

Jun-ichi Segata*

*Mathematical Institute, Tohoku University,
6-3, Aoba, Aramaki, Aoba-ku, Sendai 980-8578, Japan*

Abstract

In this article, we prove the existence of a non-scattering solution, which is minimal in some sense, to the mass-subcritical generalized Korteweg-de Vries (gKdV) equation in the scale critical \hat{L}^r space where $\hat{L}^r = \{f \in \mathcal{S}'(\mathbb{R}) \mid \|f\|_{\hat{L}^r} = \|\hat{f}\|_{L^{r'}} < \infty\}$. We construct this solution by a concentration compactness argument. Then, key ingredients are a linear profile decomposition result adopted to \hat{L}^r -framework and approximation of solutions to the gKdV equation which involves rapid linear oscillation by means of solutions to the nonlinear Schrödinger equation.

Keywords: generalized Korteweg-de Vries equation, scattering problem, threshold solution

2010 MSC: Primary 35Q53, 35B40; Secondary 35B30

1. Introduction

In this article, we consider the generalized Korteweg-de Vries (gKdV) equation

$$\begin{cases} \partial_t u + \partial_x^3 u = \mu \partial_x (|u|^{2\alpha} u), & t, x \in \mathbb{R}, \\ u(0, x) = u_0(x) \in \hat{L}^\alpha(\mathbb{R}), & x \in \mathbb{R} \end{cases} \quad (\text{gKdV})$$

where $u : \mathbb{R} \times \mathbb{R} \rightarrow \mathbb{R}$ is an unknown function, $u_0 : \mathbb{R} \rightarrow \mathbb{R}$ is a given data, and $\mu = \pm 1$ and $\alpha > 0$ are constants. The space \hat{L}^r is defined for $1 \leq r \leq \infty$ by

$$\hat{L}^r = \hat{L}^r(\mathbb{R}) := \{f \in \mathcal{S}'(\mathbb{R}) \mid \|f\|_{\hat{L}^r} = \|\hat{f}\|_{L^{r'}} < \infty\},$$

*Corresponding author

Email addresses: masaki@sigmath.es.osaka-u.ac.jp (Satoshi Masaki),
segata@m.tohoku.ac.jp (Jun-ichi Segata)

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