Numerical Study of Gradient Catastrophe Stability in Integrable Dispersive Equations

Nikola Stoilov, Christian Klein

Institut de Mathématiques de Bourgogne
Université de Bourgogne,
9 avenue Alain Savary, 21078 Dijon Cedex, France
Nikola.Stoilov@u-bourgogne.fr

Keywords: Integrable systems, Gradient Catastrophe, GPU computing

Nonlinear dispersive partial differential equations such as the non-linear Schrödinger type equations posses solutions that develop a singularity in finite time. We numerically study the long time behaviour and potential gradient catastrophe of solutions to the focusing Davey-Stewartson II equation by analysing perturbations of the lump and the Ozawa exact solutions as well as evolution of Gaussian initial data. We demonstrate that the lump is unstable so perturbations either cause it blow-up or disperse, whereas the blow-up in the Ozawa solution is generic and they posses their respective blow up rates. We will also briefly discuss the implementation on Graphical Processing Units.