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Stability analysis of the rational solutions of the nonlinear Schrodinger equation

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The family of rational solutions of the nonlinear Schrodinger (NLS) equation, which includes the Peregrine solution as the lowest order rational, is one of the proposed models for rogue waves. In this talk we address the linear stability of these rational solutions. Studying instabilities of nonlinear waves on unbounded or large bounded domains is numerically challenging. As a result we develop a highly accurate Chebyshev pseudo-spectral method (CPS4) which can be used to investigate the stability of this type solution. A broad numerical investigation using CPS4 and involving ensembles of perturbed initial data indicates that the Peregrine soliton and second order rational solution are linearly unstable [1]. These numerical results are confirmed with a stability analysis of the Peregrine soliton which makes use of the "squared eigenfunction" connection between the Zakharov-Shabat system and the linearized NLS equation [2].

[1.] A. Islas and C. M. Schober, App. Math. Comput. 305, pp 17-26 (2017).

[2.] A. Calini and C. M. Schober, App. Math. Comput. Submitted (2017).