Numerical spectral synthesis of soliton and breather gas

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Soliton gas was introduced by Zakharov [1] as an infinite ensemble of interacting KdV solitons randomly distributed in velocity and positions. This concept has been extended by El and Tovbis [2], in their development of the spectral theory of soliton and breather gases, in the framework of the focusing Nonlinear Schrodinger (fNLS) equation. Moreover, it has been shown in a recent work by Gelash et al. [3] how the spectral soliton gas formalism could lead to a new understanding of the evolution of random processes in integrable systems, the so-called integrable turbulence. In this context, the ability to numerically build the soliton and breather gas solutions from the nonlinear spectral plane is a key element for testing the mathematical model and investigating its physical applications. In this work, we present the algorithms for the synthesis of soliton and breather gases in the KdV and fNLS framework and we discuss the theoretical and numerical challenges that arise in the implementation.

Références

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