Nonlinear stationary states in PT-symmetric lattices

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Abstract:

We will present results on the linear and nonlinear properties of two related PT-symmetric systems of the discrete nonlinear Schrödinger (dNLS) type.

First, we examine the parameter range, for which the finite chains have real eigenvalues and PT-symmetric linear eigenstates, as well as the nonlinear stationary states. We develop a systematic way of analyzing the nonlinear states with the implicit function theorem at an analogue of the anti-continuum limit for the dNLS equation.

Secondly, we consider the case of such finite PT-symmetric chains embedded as defects on the infinite dNLS lattice. In that case, we show that the PT-symmetry phase transitions are upshifted. We also prove existence of localized stationary states (discrete solitons) in the analogue of the anti-continuum limit. Numerical computations illustrate the existence, as well as the stability of such discrete solitons.

The presentation is based on the two recent works with P. Kevrekidis [1,2].

References:

1. J. Dowdall, D.E. Pelinovsky, and P.G. Kevrekidis, "Nonlinear stationary states in PT-symmetric lattices", in preparation (2013).
2. D.E. Pelinovsky, P.G. Kevrekidis, and D.J. Frantzeskakis, "PT-symmetric Lattices with extended gain/loss are generically unstable", Eur. Phys. Lett. **101** (2013), 11002 (6 pages).