Inverse iterations for the non-linear Schrödinger eigenvalue problem

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This talk presents a new generalized inverse iteration for nonlinear eigenvector problems of Gross-Pitaevskii (or nonlinear Schrödinger) type. On the one hand, a simple damping strategy inspired by energy-decreasing discrete gradient flows yields global qualitative convergence towards an eigenfunction. On the other hand, a local linear rate of convergence is established. The latter quantitative convergence analysis is closely connected to the method's unique feature of sensitivity with respect to spectral shifts. Contrary to classical gradient flows this allows both the selective approximation of excited states as well as the amplification of convergence beyond linear rates in the spirit of the Rayleigh quotient iteration for linear eigenvalue problems. These advantageous convergence properties are demonstrated in a series of numerical experiments involving exponentially localized states under disorder potentials and vortex lattices in rotating traps.

References

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