Karlsruhe Institute of Technology

Seminar of the Work Group
Nonlinear Partial Differential Equations
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Speaker: Konstantin Zerulla
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Approximations to a nonlinear Schrödinger equation and discrete Strichartz estimates

Abstract

Strichartz estimates are essential to prove the well-posedness of nonlinear Schrödinger equations. They furthermore describe important qualitative properties of the linear Schrödinger equation. Numerical space-discrete approximations to the 1D linear Schrödinger equation do, however, in general not satisfy these estimates uniformly with respect to the mesh size. Modifying such schemes to solve the cubic nonlinear Schrödinger equation can consequently result in a sequence of iterates that blows up as the mesh size tends to zero.

To obtain suitable space-discrete approximations to nonlinear Schrödinger equations, a scheme is first constructed for the linear homogeneous problem. The main ingredient is a filtering technique that rules out spurious high frequency components of the numerical solutions. The resulting approximations satisfy discrete Strichartz estimates that are uniform with respect to the spatial mesh. Based on the linear method, a convergent scheme for the nonlinear problem is finally formulated.

This talk is based on the paper Ignat, L.I., and Zuazua, E.: *Numerical dispersive schemes for the nonlinear Schrödinger equation*, SIAM J. Numer. Anal. 47 (2) (2009), 1366–1390.