



Numerical Analysis Seminar

Approximation and conservation of energy in nonlinear Schrödinger equations

Professor Patrick Henning

Department of Mathematics, Ruhr-University Bochum

Abstract

In this talk, we consider the numerical treatment of nonlinear Schrödinger equations as they appear for example in quantum physics and fluid dynamics. We give numerical examples that demonstrate the influence of discrete energy on the accuracy of numerical approximations and that a spurious energy can create artificial phenomena such as drifting particles. In order to conserve the exact energy of the equation as accurately as possible, we propose a Crank-Nicolson-type time discretization that is combined with a suitable generalized finite element discretization in space. The space discretization is based on the technique of Localized Orthogonal Decompositions (LOD) and allows to capture general time invariants with a 6th order accuracy with respect to the chosen mesh size H . This accuracy is preserved due to the conservation properties of the time stepping method. The computational efficiency of the method is demonstrated for a numerical benchmark problem with known exact solution, which is however not solvable with traditional methods on long-time scales.

Date:	September 14, 2022 (Wednesday)
Time:	4:00 – 5:00pm
Venue:	ZOOM: https://hku.zoom.us/j/ Meeting ID: 913 6532 3891 Password: 310656

All are welcome