Othmar Koch, Department of Mathematics, University of Vienna
Joint with: W. Auzinger, C. Neuhauser, and M. Thalhammer

TITLE: Error Estimators for Adaptive Splitting Methods

ABSTRACT:

We put forward different estimators of the local error of split-step time integrators for evolution equations, to act as a basis for adaptive time-stepping. The first estimator is constructed from related pairs of splitting formulae of different orders, similarly to embedded Runge-Kutta methods, where several of the compositions coincide to save computational work. The second class of estimators is based on the defect correction principle and yields asymptotically correct estimates. The underlying idea is to form the defect of the splitting approximation and backsolve for the estimator using a related Sylvester equation. This results in an integral representation which can be approximated numerically with little computational effort. We demonstrate that both error indicators can successfully act as the basis for adaptive time-stepping which is commensurate with the solution behavior for a number of linear and nonlinear test problems comprising nonlinear Schroedinger equations and dissipative parabolic problems.