Convergence and adaptivity at the PDE/stiff ODE interface

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In this talk I will emphasize on the use of different time integrators in combination with adaptive finite element discretizations in space. After briefly discussing general approaches for combining adaptivity in space and time, convergence results for one-step, multistep and peer-methods for the discretization of time-dependent PDE that can be interpreted as stiff ODEs in function spaces are summarized. In this case, most of the classical methods like Runge-Kutta-Rosenbrock and DG-methods suffer from order reduction, that is, the classical order cannot in general be achieved. I will discuss well established and also recently discovered opportunities to overcome this serious drawback. Throughout my talk I will present academic as well as real-life problems to illustrate the observations.

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