hp-adaptive Discontinuous Galerkin method for convection dominated evolution equations based on an a-posteriori error estimate

Andreas Dedner[1]

In this talk we present an hp-adaptive scheme in space and time for the discretization of a non-linear system of evolution equations

$$\partial_t U(t,x) + \nabla \cdot \big(F(U(t,x),t,x) + a(U(t,x),t,x)\nabla U(t,x)\big) = S(U(t,x),t,x) \ .$$

We base our method on the higher order Discontinuous Galerkin method in space and explicit multistep methods in time. We use h-adaptivity, i.e., general grid structures with non-conform adaptivity and local time stepping, to achieve a high degree of efficiency. Since our focus is on the convection dominated case, we discuss approaches for gradient limiting and p-adaptivity for stabilizing the scheme in the regions of strong gradients or discontinueties. The basis of our scheme is an a-posteriori error estimate for the semi-discrete method which will be briefly discussed and compared with a heuristic approach. For the implementation of the scheme we use the software environment DUNE.

[1]University Freiburg, Department of Applied Mathematics, Hermann-Herder Str. 10, 79104 Freiburg, Germany,
dedner@mathematik.uni-freiburg.de