DISCONTINUOUS GALERKIN METHODS AND APPLICATIONS

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During the last ten years Discontinuous Galerkin methods become more and more popular for the space discretization of problems in application, in particular for convection dominated flows. There are a lot of new theoretical results for Discontinuous Galerkin methods on unstructured grids in several space dimension like convergence proofs and a priori as well as a posteriori error estimates. In particular for problems with additional constraint like the divergence constraint for the transport equation for the magnetic field the Discontinuous Galerkin methods with special Ansatz functions turned out to be most powerful.

A direct comparison between Discontinous Galerkin schemes and finite volume schemes concerning the efficiency turned out to be superior for discontinous Galerkin schemes in many situations. In particular for higher order schemes they turned out to be more powerful at least for smooth solutions. For discontinuous solution the situation is slightly different. Many numerical tests show the results for these comparisons.

Because of the local structure of higher order Discontinuous Galerkin methods they are very well applicable for parallelization. This has been done in the programming environment DUNE in a very general setting. This software tool has been used for the numerical simulation of many applications like atmospheric flows, dam breaking problems and supersonic flows around corners. A slightly different approach has been used for the computation of problems concerning phase transitions.