Discontinuous Galerkin Methods and Applications

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For a long time Finite Volume schemes on unstructured grids have been the most frequently used numerical tool for the discretization of systems of conservation laws in complex geometries. But recently the comparison of the efficiency of higher order Finite Volume schemes and higher order Local Discontinuous Galerkin schemes has pointed out that the last one could be more efficient in some cases. 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. New rigorous a posteriori error estimates developed by Dedner, Makridakis and Ohlberger have been used for the dynamically adaptive grid refinement. A slightly different approach has been used by Diehl for the computation of problems concerning phase transitions. In this contribution we will give an overview of the schemes, the theoretical results and the numerical experiments.