On new spectral methods for hyperbolic conservation laws

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In applications mainly in fluid dynamics nowadays robust but accurate solvers are needed. While good accuracy meant order of 2 some years ago it is now codes of orders of approximations of 4 and higher engineers want to deal with. There is, however, a subtle balance between robustness and order of accuracy and methods of very high order tend in generally to be less robust. In a joint project with colleagues from Kassel we have developed two new spectral methods on triangular meshes which should give us stability as well as robustness. Main ingredients of our methods are a powerful nodal/modal filtering as well as the use of different families of polynomials being orthogonal on simplices. We have developed a new shock detection technique with which we can derive Fourier modes of the numerical solution directly from the orthogonal polynomials. I will present some of the recent results and an outlook towards future research.