Central Runge-Kutta finite volume schemes for balance laws

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The purpose of the talk is to present a family of recently developed shock capturing schemes for the numerical solution of hyperbolic systems of conservation (balance) laws. All the schemes are constructing by starting from the time evolution equation of cell averages. A Runge-Kutta type approach is used for time discretization. The conservative numerical solution is advanced by a conservative schemes, while the so called stage values are obtained pointwise at cell edges, by adopting a non conservative scheme. Staggered and non staggered versions of the schemes are presented. The non staggered version is obtained by combining central Runge-Kutta with the ADER approach developed by Toro and Titarev, in which the solution on cell edges is obtained by a Taylor expansion in time. In particular, it is shown that the replacement of the Taylor expansion by a Runge-Kutta scheme produces essentially the same results at a lower computational cost. Source terms can be taken into account. In the case of stiff source, Implicit-Explicit schemes can be effectively used. The use of Central Runge-Kutta approach allows to construct high order finite volume schemes in which the source terms at the different space cells are not coupled, thus allowing an efficient implicit treatment. Several numerical tests show the accuracy and robustness of the methods.