A NOVEL CELL-CENTERED POLYNOMIAL BASIS FOR THE PREDICTOR STEPS IN THE CONTEXT ADER FINITE VOLUME SCHEMES. THE ONE-DIMENSIONAL CASE

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Abstract. Here, we dealt with the family of high-order methods, ADER. These are globally explicit finite volume methods. ADER uses two building blocks, [1] i), the polynomial representation of the solution ii) the predictor step, which is a solution of a local initial value problem. This local solution is then used for an accurate evaluation of the numerical flux and the source term as well.

In this work, the predictor step is obtained as a weak solution via Galerkin approaches. Here a family of space-time polynomials is investigated, [2]. Polynomials are constructed from the tensor product between Lagrange polynomials in time and a special type of polynomials in space. The construction of these space polynomials requires less nodal points than those required to build a Lagrange basis, so the information required to find all the degrees of freedom are achieved by imposing nodal type condition on polynomial derivatives as well. As a result the Galerkin discretization is simple enough to deal with stiff source terms in a very efficient form. Convergence has been theoretically proved [3] and empirical convergence rate assessments are shown up to the fourth order of accuracy in both space and time.

Keywords: Finite volume schemes, ADER schemes, Generalized Riemann problems, Discontinuous Galerkin approach, Stiff source terms.

References

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