Numerical solution of unstationary nonlinear convection-diffusion problems by higher order finite elements methods

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We deal with the numerical solution of a scalar nonstationary nonlinear convection-diffusion equation. We employ a combination of the discontinuous Galerkin finite element method for the space semi-discretization and the k-step backward difference formula for the time discretization. The diffusive and stabilization terms are treated implicitly whereas the nonlinear convective term is treated by an higher order explicit extrapolation, which leads to the necessity to solve only linear algebraic problem at each time step. We analyse this scheme and derive a priori asymptotic error estimations in the discrete $L^\infty(L^2)$–norm and $L^2(H^1)$–seminorm with respect to the mesh size h and time step τ for $k = 2, 3$. Several numerical examples verifying the theoretical results are presented.

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