

This thesis is concerned with analysis and implementation of Time discontinuous Galerkin method. Important part of it is constructing of algorithm for solving nonlinear convection-diffusion equations, which combines Discontinuous Galerkin method in space (DGFEM) with Time discontinuous Galerkin method (TDG). Nonlinearity of the problem is overcome by damped Newton-like method. This approach provides easy adaptivity manipulation as well as high order approximation with respect to both space and time variables. The second part of the thesis is focused on Time discontinuous Galerkin method, applied to ordinary differential equations. It is shown that the solution of Time discontinuous Galerkin equals the solution obtained by Radau IIA implicit Runge-Kutta method in the roots of right Radau Quadrature. By virtue of this relation, error estimates of the order higher by one than the standard order can be obtained in these points. Furthermore, almost two times higher order can be achieved in the endpoints of the intervals of time discretization. Finally, the thesis deals with the phenomenon of stiffness, which may dramatically decrease the order of the applied method. The theoretical results are verified by numerical experiments.