Title: Numerical analysis of approximation of nonpolygonal domains for discontinuous Galerkin method

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Abstract: In this work we use the discontinuous Galerkin finite element method for the semidiscretization of a nonlinear nonstationary convection-diffusion problem defined on a nonpolygonal two-dimensional domain. Using so called approximating curved elements we define a piecewise polynomial approximation of the boundary of the domain and a space on which we search for a solution. We study the convergence of the method considering a symmetric as well as nonsymmetric discretization of diffusion terms and with the interior and boundary penalty. The obtained results allow us to derive an error estimate for the Discontinuous Galerkin method employing the approximating curved elements. This estimate depends on the order of the approximation of the solution and also on the order of the approximation of the boundary. We describe one possibility of the construction of the approximating curved elements with the aid of a polynomial mapping given by an interpolation of points on the boundary. We present numerical experiments.

Keywords: nonlinear convection-diffusion equation, discontinuous Galerkin finite element method, approximations of nonpolygonal boundaries, method of lines, error estimates