High-order interpolatory/quasi-interpolatory serendipity virtual element method for semilinear parabolic problems

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Talk Abstract

An efficient method for the numerical approximation of a general class of two dimensional semilinear parabolic problems on polygonal meshes is presented. The proposed approach takes advantage of the properties of the serendipity version of the virtual element method (VEM), which not only reduces the number of degrees of freedom compared to the classical VEM, but also allows for the introduction of an interpolatory or quasi-interpolatory approximation of the nonlinear term that is computable from the degrees of freedom of the discrete solution with a low computational cost, thus significantly improving the efficiency of the method. An error analysis for the semi-discrete formulation is carried out, and an optimal estimate for the error in the L_2-norm is obtained. The accuracy and efficiency of the proposed method when combined with a second order Strang operator splitting time discretization is illustrated with numerical experiments, with approximations up to order 6.

Keywords: serendipity virtual element method, interpolant operator, operator splitting method, semilinear parabolic equations.