HIGH-ORDER INTERPOLATORY/QUASI-INTERPOLATORY SERENDIPITY VIRTUAL ELEMENT METHOD FOR SEMILINEAR PARABOLIC PROBLEMS

SERGIO GÓMEZ

ABSTRACT. We present an efficient virtual element method [**?**] for the numerical approximation of a general class of semilinear parabolic problems of the form

$$\partial_t u - \Delta u + r(u) = 0.$$

The proposed approach exploits the properties of the serendipity version of the virtual element method (VEM), which allows for the elimination of some internal-moment degrees of freedom (DOF) on each element. More precisely, we approximate the nonlinear reaction term $r(u)$ in the problem by its DOF interpolant $\mathcal{I}_h r(u_h)$ in the serendipity VEM space. Such an approximation is computable from the DOF of the discrete solution u_h with a low computational cost. This technique can be easily extended to nonlinear reaction-difussion systems.

The accuracy and efficiency of the proposed method when combined with a second order Strang operator splitting time discretization is illustrated with several numerical experiments.

Keywords: semilinear parabolic problem; serendipity; virtual element method; interpolation operator.

Mathematics Subject Classifications (2010): 65M60; 65M12; 35K57; 35K58.

REFERENCES

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UNIVERSITY OF MILANO-BICOCCA
Email address: sergio.gomezmacias@unimib.it