NONCONFORMING VIRTUAL ELEMENTS FOR THE BIHARMONIC EQUATION WITH MORLEY DEGREES OF FREEDOM ON POLYGONAL MESHES

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ABSTRACT

The lowest-order nonconforming virtual element is an extension of the Morley finite element on triangles to polygons. We approximate the weak solution to the biharmonic problem in a polygonal domain Ω with a general source function and discuss abstract framework, which fits to all available discrete spaces for nonconforming virtual element method in literature for the biharmonic problem. The *a priori* and *a posteriori* error analysis circumvents any trace of second derivatives and all the results hold even for small $\sigma = 0$. The main tool is a computable conforming companion operator J from the nonconforming virtual element space to the Sobolev space V. This is a right-inverse of the interpolation operator and leads to the optimal error estimates in piecewise Sobolev norms. The design of J modifies the discrete right-hand side and allows a quasi-best approximation property. An explicit residual-based *a posteriori* error estimator is reliable and efficient up to data oscillation. Numerical examples show the predicted empirical convergence rates for uniform and the optimal rates for adaptive mesh-refinement.

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