MODELING POISSON EQUATIONS WITH STRONG LOCALIZED SOURCE TERMS USING THE VIRTUAL ELEMENT METHOD WITH EXTRINSIC ENRICHMENT

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ABSTRACT. In this work, we develop a new method for solving Poisson equations with strong localized source terms over polygonal meshes. Inspired by the extended finite element method [2], extrinsic enrichment is added to the degrees of freedom of the nodes affected by the strong localized source terms; and the element stiffness matrix and element force vector are constructed using the theoretical underpinnings of the virtual element method [1]. Some numerical experiments will be presented to show that the proposed virtual element method with extrinsic enrichment exhibits improved accuracy with respect to the standard virtual element method in this class of problems. The proposed methodology puts forth a modeling framework that has the potential to be extended to crack growth simulations.

Keywords: virtual element method, extrinsic enrichment, polygonal meshes, Poisson equation.

REFERENCES

[1] L. Beirão da Veiga, F. Brezzi, A. Cangiani, G. Manzini, L.D. Marini, A. Russo. Basic principles of virtual element methods. *Mathematical Models and Methods in Applied Sciences*, 23(01):199–214, 2013.

[2] N. Moës, J. Dolbow, T. Belytschko. A finite element method for crack growth without remeshing. *International Journal for Numerical Methods in Engineering.* 46(1): 131–150, 1999.

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