A Virtual Element Method for Elasticity

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Abstract

In the present talk we show an application of *Virtual Elements* to elasticity problems, including the nearly incompressible case. The Virtual Element Method (in short VEM, introduced in [2]) is a very recent generalization of the Finite Element Method that takes inspiration from modern Mimetic Finite Differences (see for instance [3] and references therein). The advantage of Virtual Elements is the ductility that allows to have easily high order accuracy and high order continuity, in addition of being able to represent in an exact way certain physical properties (conservation, incompressibility, etc.) and of being applicable in very general geometries. The VEM allows, in particular, to make use of general polygonal and polyhedral meshes (also for high order schemes) without the need (as in polygonal FEM) of complicated integration on the elements.

In the present contribution we introduce a Virtual Element Method for linear elasticity [1] that is free of volumetric locking. After describing the method, a complete theoretical convergence analysis and a set of numerical tests will be shown. Finally, first developements for the nonlinear case will be shown.

Keywords: polygonal meshes, virtual elements, structural mechanics.

References

[1] L. Beirão da Veiga, F. Brezzi, L.D. Marini. Virtual Elements for linear elasticity problems. *SIAM J. Numer. Anal.*, Vol. **51**, 794–812, 2013.

[2] L. Beirão da Veiga, F. Brezzi, A. Cangiani, L.D. Marini, G. Manzini, A. Russo. Basic principles of Virtual Element Methods. *Math. Models and Meth. Appl. Sci.*, Vol. **23**, 199–214, 2013.

[3] L. Beirão da Veiga, K. Lipnikov, G. Manzini. *The Mimetic Finite Difference Method for Elliptic Problems*. MS&A, Vol. 11, Springer, 2014.