Virtual Element Methods for Elasticity Problems in mixed form

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Talk Abstract

The Virtual Element Method (VEM) is a methodology for the approximation of partial differential equation problems, whose popularity is growing fast, both in the mathematical and in the engineering community. The initial motivation of VEM is the need to construct an accurate conforming Galerkin scheme with the capability to deal with highly general polygonal/polyhedral meshes, including "hanging vertexes" and non-convex shapes. In the framework of the infinitesimal elasticity problems, we present some 2D and 3D Virtual Element schemes based on the Hellinger-Reissner variational principle, see [1, 2, 3]. As it is well-known, imposing both the symmetry of the stress tensor and the continuity of the tractions at the inter-element is typically a great source of troubles in the framework of classical Galerkin schemes, such as the Finite Element Method (FEM), for instance. We exploit the great flexibility of VEM to present an alternative to FEM, which provide symmetric stresses, continuous tractions and is reasonably cheap with respect to the delivered accuracy. A significant feature of our methods is the possibility to employ the so-called hybridization procedure to solve the resulting linear system in an efficient way, see [4]. In addition, the hybridization strategy leads to the construction of a post-processed displacement approximation of higher accuracy.

In this talk, we detail the ideas which led to the design of our VEM schemes and their hybridization, we state the theoretical results, and we present several numerical tests to assess the actual computational performance of our approach.

Keywords: virtual element method, Hellinger-Reissner formulation, hybridization.

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