A FAMILY OF THREE-DIMENSIONAL VIRTUAL ELEMENTS FOR HELLINGER-REISSNER ELASTICITY PROBLEMS

MICHELE VISINONI

The Virtual Element Method (VEM) is a recent technology for the approximation of partial differential equation problems, which shares the same variational background of the Finite Element Method (FEM). The main features of this technique are its robustness to deal with general polygonal and polyhedral meshes, including hanging nodes and non-convex elements, and its flexibility to handle some interesting properties of the problem.

In this talk, we focus on the resolution of linear elasticity problems. More precisely, we consider the Hellinger-Reissner variational principle as the basis of our discretization procedure. In this framework it is well known that, for classical Galerkin schemes, designing an accurate method that preserves both the symmetry of the stress tensor and the continuity of the tractions at the inter-element is typically not a simple task. The fundamental reason behind this difficulty lies in the rigid structure of the polynomial approximation space. Therefore, our idea is to exploit the great flexibility of the VEM to avoid these troubles and design stable methods. Recently some Virtual Element schemes have been proposed and analyzed both for two and three-dimensional problems [1, 2, 3].

The aim is to present an extension to the three-dimensional case for a family of Virtual Element Methods. Some numerical tests are provided in order to show the validity and the potential of our analysis.

References

[1] E. Artioli, S. de Miranda, C. Lovadina, L. Patruno: "A stress/displacement Virtual Element method for plane elasticity problems", CMAME, 325: 155-174, 2017.

[2] E. Artioli, S. de Miranda, C. Lovadina, L. Patruno: "A family of virtual element methods for plane elasticity problems based on the Hellinger-Reissner principle", CMAME, 340: 978-999, 2018.

[3] F. Dassi, C. Lovadina, and M. Visinoni, "A three-dimensional Hellinger-Reissner Virtual Element Method for linear elasticity", CMAME, 364: 112910, 2020.

[4] M. Visinoni, "A family of three-dimensional Virtual Elements for Hellinger-Reissner elasticity problems", in preparation.

Dipartimento di Matematica, Università degli studi di Milano
Email address: michele.visinoni@unimi.it