Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXVI, págs. 1605-1605 (resumen)
José G. Etse, Bibiana M. Luccioni, Martín A. Pucheta, Mario A. Storti (Eds.)
San Miguel de Tucumán, 6-9 Noviembre 2018

THE VIRTUAL ELEMENT METHOD FOR DISCRETE FRACTURE ANALYSIS OF QUASI-BRITTLE MATERIALS

Matías F. Benedetto[a], Guillermo Etse[a,b] and Antonio Caggiano[c]

[a]*INTECIN (UBA - CONICET), Facultad de Ingeniería, Universidad de Buenos Aires, Paseo Colón 850 Buenos Aires, Argentina, intecin@fi.uba.ar, http://intecin.fi.uba.ar/*

[b]*Universidad Nacional de Tucumán, Ayacucho 49 San Miguel de Tucumán, Argentina, infoweb@rectorado.unt.edu.ar, http://www.unt.edu.ar/*

[c]*Technische Universität Darmstadt, Karolinenplatz 5 Darmstadt, Alemania, presse@tu-darmstadt.de, https://www.tu-darmstadt.de*

Keywords: Virtual Element Method, Interface elements, Discrete Fracture, Heterogeneous material, Mesoscopic.

Abstract. A novel numerical methodology for analyzing fracture processes in cementitious materials is presented, introducing the combined use of zero-thickness Interface Elements (IEs), and the Virtual Element Method (VEM). A discrete crack approach is chosen to model failure, which allows very efficient and effective spacial discretizations and numerical procedures. The simulation of the non-linear mechanical response and cracking process of cement-based composites is done at the mesoscopic level of observation, where material heterogeneities are explicitly represented in the discretization. On one hand, a VEM discretization of the bulk material allows for an accurate representation of complex geometries due to the greater mesh versatility that the method provides with respect to standard FEM discretizations. In particular, composite inclusions can be easily handled through the use of Virtual Elements with an arbitrary number of edges and, due to the robustness of the approach, hanging nodes, flat angles and/or collapsing nodes can be introduced in the mesh while retaining the same approximation properties of FEM. On the other hand, stress-crack opening processes are modeled by means of classical zero-thickness IEs which are placed in between the solid virtual elements. Thereby, failure and crack phenomena are represented by the use of appropiate cohesive laws on both bulk-bulk as well as inclusion-bulk interfaces. Several numerical results are studied to assess the capabilities of the proposed approach.