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SEMINÁRIO DE ANÁLISE E EQUAÇÕES DIFERENCIAIS

Dia 29 de Novembro (quinta-feira), às 13h30, na sala 6.2.33

Topological Sensitivity Analysis in Damage and Fracture Mechanics

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Abstract:

The topological derivative is a scalar field that measures the sensitivity of a given shape functional with respect to an infinitesimal singular domain perturbation, such as the insertion of holes, inclusions, source-terms or even cracks. In this work, the concept of topological derivative is applied in the context of damage and fracture mechanics. In particular, the nucleation and propagation damaging process are studied.

Initially, the topological derivative is applied together with the Griffith-Francfort-Marigo damage model to propose a simple numerical scheme in order to determine the damage nucleation/propagation in brittle materials. The proposed numerical scheme is able to capture the whole nucleation and propagation damaging process, including important features like kinking and bifurcations. These properties are confirmed through several numerical experiments and by comparison with available laboratory experiments. Taking into account the promising obtained results, a simple adaptation of the Griffith-Francfort-Marigo damage model to the context of hydraulic fracture is proposed. The new model can be seen as a simplified version with respect to the real hydraulic fracture. In this sense, this second study aims to develop a simple numerical scheme which can be applied in more realistic situations later. However, important features associated with hydraulic fracture process are captured with the simplified model. Finally, in order to study the hydraulic fracture process in more realistic scenarios, the whole developed methodology is applied together with the Biot hydro-mechanical model.

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