Efficient meshless techniques for the nonlinear analysis of structures

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ABSTRACT

Meshless methods are discrete numerical techniques that do not require a structured mesh to discretize the problem domain. In fact, this unique discretization capability it the most attracting feature of meshless methods.

In the literature [1], it is possible to find numerous meshless techniques capable to numerically analyse structural problems. Nevertheless, the several numerical approaches described in the literature are fundamentally very dissimilar, leading to distinct numerical performances. Consequently, the computational mechanics research community continuously seeks the best numerical approach to reproduce and predict the structural response of complex structures.

Here, radial point interpolation meshless methods (RPIMs) are used to analyse nonlinear structural problems. Thus, in this work, RPIMs are combined with elasto-plasticity to predict the nonlinear behaviour of elasto-plastic materials, such as steels and bone tissue. Additionally, the nonlinear geometric assumption is applied to the meshless formulation. This inclusion allows to visualize the effects of large deformations. Furthermore, in this work, the contact and the crack opening path is extended to the RPIMs and several benchmark examples are solved and the results are presented.

The results presented in this work allow to understand that meshless methods are efficient and accurate numerical techniques capable to simulate complex structural problems.

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