

RESUMO N° 116

THE CRACK PROPAGATION NUMERICAL ANALYSIS USING A MESHLESS METHOD

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The efficient and accurate explicitly prediction of the crack propagation path is one of the most challenging problems in computation mechanics. In this work the Natural Neighbour Radial Point Interpolation Method (NNRPIM) [1,2] is extended to this field of the fracture mechanics.

The NNRPIM is a meshless method that uses the Natural Neighbour mathematical concept to determine the integration mesh and establish the nodal connectivity. Thus, the NNRPIM only needs the information regarding spatial location of the nodes discretizing the problem domain. The Radial Point Interpolations (RPI) are used to construct the NNRPIM interpolations functions. Being an interpolator meshless method, within the NNRPIM the essential and natural boundary conditions can be enforced directly on the stiffness matrix.

In this work the crack propagation path is numerically simulated taking advantage of the unique features of the NNRPIM. Allowing the crack path to iteratively extend in line segments, an adapted crack path opening algorithm was developed. Using the obtained stress field, the crack propagation direction is determined in each iteration considering the maximum circumferential stress criterion. It was found that the increasing domain discontinuities do not represent a numerical difficulty, due to the flexibility of the natural neighbour concept. In order to show the efficiency of the NNRPIM several opening crack path benchmark examples are solved.

[1] Dinis L., Jorge R.N., and Belinha J., Analysis of 3D solids using the natural neighbour radial point interpolation method. Computer Methods in Applied Mechanics and Engineering, vol. 196, pp: 2009-2028, (2007).

[2] J. Belinha, Meshless Methods in Biomechanics - Bone Tissue Remodelling Analysis, Vol.16 ed. Lecture Notes in Computational Vision and Biomechanics, Springer Netherlands, 2014, p. 320.