The inelastic analysis of plates considering meshless methods

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ABSTRACT

In this research, plates submitted to transversal and in-plane loads are studied considering a three dimensional analysis and assuming material nonlinearity. Here, in order to obtain the field variables two meshless methods are considered: Radial Point Interpolation Method (RPIM) [1] and the Natural Neighbour RPIM (NNRPIM) [2].

Both the RPIM and the NNRPIM are flexible and accurate meshless methods. The RPIM uses the influence-domain concept to enforce the nodal connectivity. Alternatively, the NNRPIM uses the Natural Neighbour concept to define the influence-cell (similar to the influence-domain concept). Additionally, a background distribution of integration points is necessary to numerically integrate the integro-differential equations governing the studied phenomenon. These background integration points can be obtained using a regular background integration grid (for the RPIM) or using the Delaunay triangles coming from the Natural Neighbour concept (for the NNRPIM). Both RPIM and NNRPIM shape functions are constructed using the Radial Point Interpolators (RPI). The obtained interpolation functions possess the delta Kronecker property, which simplifies the imposition of the natural and essential boundary conditions.

In this work, all plate examples are analysed considering the complete 3D domain. Thus, assuming the 3D deformation theory the plate displacement field is obtained from the weak-form of Galerkin. Since the scope of this work is to show the efficiency of the NNRPIM to deal with material nonlinearities, non-linear solution algorithms were combined with the meshless formulations. In order to demonstrate the effectiveness of the method, several non-linear problems are studied. The numerical results indicate that NNRPIM handles the material nonlinearity effectively and provides accurate solutions.

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