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A HYSTERETIC MITC9 SHELL FINITE ELEMENT

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In this work, a hysteretic shell finite element for the inelastic static and dynamic analysis of structures is presented. The Bouc-Wen model ([6], [7]) is utilized as a smooth hysteretic, rate independent model, capable of expressing the hysteretic behavior that can be easily extended to account for stiffness degradation, strength deterioration and pinching phenomena. On the basis of the classical theory of plasticity [2], the generalized 3D Bouc-Wen model is expressed in tensorial form incorporating the yield criterion and linear or nonlinear, isotropic or kinematic hardening law. Based on this approach, a hysteretic shell finite element is developed following the steps of FEM in which the shell is considered as a number of fully bonded layers [5]. The classical elastic formulation of the shell element [1] is employed following the Mixed Interpolation of Tensorial Components (MITC) approach in MITC9 shell element ([3], [4]). This is extended by considering as additional hysteretic degrees of freedom the plastic strains at the Gauss points of each interface between layers, the evolution of which is determined by a Bouc- Wen evolution equation. The solution provides the nodal displacements, the elastic and plastic strains and the stresses at every Gauss point of each interface. Numerical results are presented that validate the proposed formulation, which are further compared against those obtained using Abaqus code. A good agreement is achieved between the standard FEM and the proposed formulation which computationally results as more efficient for the same accuracy.

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