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A POSTERIORI STRESS AND STRAIN RECOVERY PROCEDURE FOR THE STATIC ANALYSIS OF LAMINATED SHELLS RESTING ON NONLINEAR ELASTIC FOUNDATION

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ABSTRACT. The numerical analysis of laminated composite plates and shells resting on nonlinear elastic foundation is the main topic of the paper. The generalized differential quadrature (GDQ) technique and the Newton-Raphson iteration are employed to obtain the solution of the static problems under consideration. The nonlinear elastic foundation is modeled using the Winkler-Pasternak model embedded with quadratic and cubic nonlinearities in order to a have a more complete description of the interaction. The structural behavior is modeled by means of higher-order displacement fields developed in the framework of a unified formulation. Several lamination schemes are studied. The class of sandwich structures with an inner soft-core is also taken into account with the help of the Murakami's function, which correctly captures the so-called zig-zag effect. The presented approach can deal with doubly-curved surfaces characterized by two radii of curvature that can vary in each point of the reference domain, whereas most of the examples available in the literature considers only shells with constant curvature, such as spherical and cylindrical shells. Solutions are presented in terms of through-the-thickness variations of strains, stresses, and displacements. For these purposes, a posteriori recovery procedure based on the GDQ method is introduced. The accuracy and effectiveness of the proposed approach are proven by means of the comparison with the numerical results obtained by a three-dimensional finite element model.

KEYWORDS: Laminated composite structures, Nonlinear elastic foundation, Stress recovery, Differential quadrature, Higher-order shear deformation theories.

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