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J Steel Struct Constr 2018, Volume 4
DOI: 10.4172/2472-0437-C2-012

Static analysis of cylindrical composite shells using 8-noded 3D degenerated shell elements

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Composite shells and structures with variable thickness are widely used in various fields such as civil engineering, aerospace engineering, marine and off-shore engineering, rocket, aviation, submarine technology, etc. Authors have formulated an 8-noded degenerated shell finite element for modeling and analysis of laminated composite shell structures. This element is developed by using the degenerate solid approach based on Reissner-Mindlin assumptions which allows the shear deformation and rotary inertia effect to be considered and the 3D field is reduced to a 2D field in terms of mid-surface nodal variables. The degenerated shell element is not based on any shell theories and is applicable over a wide range of curvatures and thicknesses. This allows the element to be free from limitations such as over-prediction of bending moments (in case of flat elements), difficulty in finding appropriate deformation idealizations which allow truly strain-free rigid body movements (in case of curved shell elements), high computation cost and over-prediction of transverse stiffness of thin shells (in case of 3D solid elements). Authors have developed a MATLAB code to for the static analysis of laminated composite cylindrical shells based on the formulation. The results obtained from the program are compared with and are in good agreement with the results available in the open literatures and software. Use of degenerated shell elements has allowed the formulation to be used for any type of shells with various shapes and thickness ratios. The formulation can solve both isotropic and laminated composite shells.

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