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Theoretical-Experimental Investigations on Free Vibration of Glass Fiber/Polyester Composite Conical Shells Containing Fluid

Authors : Tran Ich Thinh, Nguyen Manh Cuong

Abstract : Free vibrations of partial fluid-filled composite truncated conical shells are investigated using the Dynamic Stiffness Method (DSM) or Continuous Element Method (CEM) based on the First Order Shear Deformation Theory (FSDT) and non-viscous incompressible fluid equations. Numerical examples are given for analyzing natural frequencies and harmonic responses of clamped-free conical shells partially and completely filled with fluid. To compare with the theoretical results, detailed experimental results have been obtained on the free vibration of a clamped-free conical shells partially filled with water by using a multi-vibration measuring machine (DEWEBOOK-DASYLab 5.61.10). Three glass fiber/polyester composite truncated cones with the radius of the larger end 285 mm, thickness 2 mm, and the cone lengths along the generators are 285 mm, 427.5 mm and 570 mm with the semi-vertex angles 27, 14 and 9 degrees respectively were used, and the filling ratio of the contained water was 0, 0.25, 0.50, 0.75 and 1.0. The results calculated by proposed computational model for studied composite conical shells are in good agreement with experiments. Obtained results indicate that the fluid filling can reduce significantly the natural frequencies of composite conical shells. Parametric studies including circumferential wave number, fluid depth and cone angles are carried out.

Keywords : dynamic stiffness method, experimental study, free vibration, fluid-shell interaction, glass fiber/polyester composite conical shell
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