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NONLINEAR VIBRATIONS OF SHELLS: EXPERIMENTS, SIMULATIONS AND APPLICATIONS

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The present paper focuses on the theory and experiments for geometrically nonlinear vibrations of shell type structures made of traditional and advanced materials. Closed shells, curved panels and rectangular plates made of isotropic, sandwich and laminated composite materials are studied. Several original aspects of nonlinear vibrations of shells and panels including the effects of geometric imperfections, geometry and boundary conditions have been addressed and consistent reduced-order models essential to capture shell dynamics are obtained. The numerical analysis is based on multi-dimensional Lagrangian approach and pseudo arc-length continuation technique is used for bifurcation analysis. Moreover, the experimental analysis, an example of the set-up is shown in Figure 1, is carried out following a stepped-sine testing procedure and by increasing and decreasing the excitation frequency in very small steps at specific force amplitudes controlled in a closed-loop. Comparisons between experimental results and numerical simulations are performed and show good agreement for shells and panels oscillating at large-amplitude vibrations.

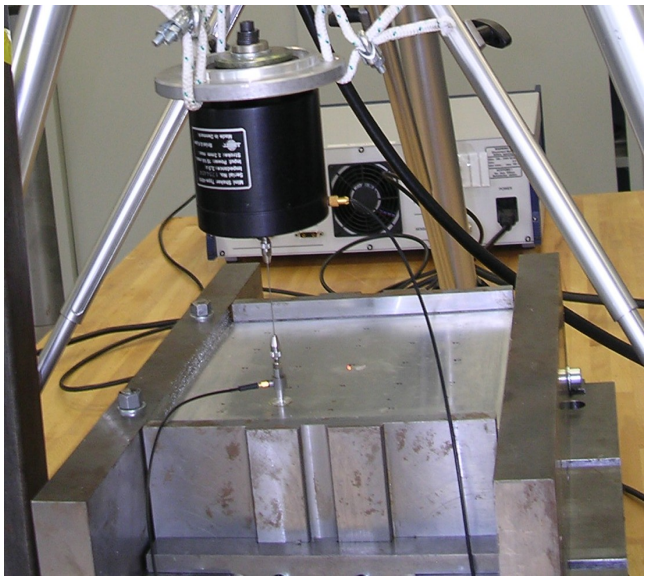

Figure 1. Experimental set-up for the imperfect circular cylindrical panel.

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