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DYNAMIC STABILITY OF DOUBLY-CURVED MULTILAYERED SHELLS SUBJECTED TO ARBITRARILY ORIENTED ANGULAR VELOCITIES: NUMERICAL EVALUATION OF THE CRITICAL SPEED

Francesco Tornabene*[1], Michele Bacciocchi[1]

ABSTRACT. The paper is focused on the evaluation of the critical speed of rotating doubly-curved multilayered shell structures. The theoretical framework developed to this aim is based on a general formulation capable to define several Higher-order Shear Deformation Theories (HSDTs) in a unified manner. The current approach can deal easily with angular velocities applied about a generic axis of the structure. This aspect represents a clear advancement with respect to the formulations available in the literature, which are developed mainly to investigate the dynamic behavior of rotating shells of revolution (disks, circular cylinders and conical shells), in which the angular velocity is applied about their revolution axis. It is important to underline that the effects of both Coriolis and centripetal accelerations on the dynamic response of shell structures, characterized by various geometric shapes, are included in the model. The quadratic eigenvalue problem that lies behind the free vibration analysis in hand is solved numerically by means of the well-known Generalized Differential Quadrature (GDQ) method. The critical speed is obtained as a result of many parametric investigations, which are defined for increasing values of the applied angular velocities. Finally, it should be mentioned that the current research falls within the aim of the study of the dynamic stability of rotating structures. For this purpose, several considerations concerning the flutter and divergence phenomena are presented.

KEYWORDS: Critical speed; Rotating doubly-curved shells; Arbitrary axis of rotation; Laminated composite structures; Dynamic analysis.

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