National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Buckling and Free Vibration of Doubly Curved Sandwich Shells with Viscoelastic Core and Functionally Graded Material Constraining Layer
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Abstract	: Vibration is one of the primary causes of failure and underperformance in a wide range of structures, machinery and machine components belonging to aerospace, defence and mechanical engineering-based industries. Vibration can affect these structures in different ways ranging from mild inaccuracy in operating performance to catastrophic failure of the structure depending on its severity. Based on these observations, the current research presented in this dissertation is primarily focused on the buckling and free vibration of doubly curved sandwich shells with viscoelastic core and functionally graded material constraining layer. The sandwich shell used in the present research comprises of three layers. The base layer is made up of isotropic elastic material core of soft viscoelastic material and the constraining top layer is made up of metal-ceramic functionally graded material (FGM). The mathematical modeling of the present sandwich shell panel is done using an eight noded isoparametric finite sandwich shell element based on the first order shear deformation theory (FOSDT). The governing equations of motion have been derived using finite element method in conjunction with the Hamilton&rsquos energy principle. This dissertation is primarily subdivided into four technical sections which are dedicated to the investigation of buckling and free vibration behavior of the current sandwich shell panel under different supports and loading conditions as well as environments of engineering importance. Free vibration and buckling of viscoelastic-FGM doubly curved sandwich shell panels under different boundary conditions along with a detailed parametric study is conducted. The critical observations reveals that all sides clamped (CCCC) boundary condition imparts additional strength and stiffness to the structure compared to other boundary conditions. Influence of high temperature environment on the free vibration and buckling behavior of viscoelastic-FGM doubly curved sandwich shell panels is investigated. As evident that increased temperatures negatively influence the strength and stiffness of many metallic structures, the same is also observed in the current findings. The investigation of free vibration and buckling behavior of viscoelastic-FGM doubly curved skewed sandwich shell panels reveals that the skewness of the panel plays an important role on its structural behavior. Investigations of the buckling and free vibration characteristics of viscoelastic-FGM doubly curved sandwich shell panels resting on two parameter elastic foundations suggests that both the Winkler&rsquos as well as the shear foundation parameters when increased are responsible in increasing the modal natural frequencies and the critical buckling loads of the structures.