ESTIMATION OF RESPONSE OF COMPOSITE SHELLS TO ACOUSTIC EXCITATION USING SEA AND ITS EXPERIMENTAL VERIFICATION

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Abstract

Shells made up of composite material are extensively used in aerospace structures as they offer excellent specific strength and stiffness properties over their metallic counterparts. These elements experience high frequency and high intensity acoustic loads during the launch. Response behaviour of structures in the high frequency region is analyzed in a Statistical Energy Analysis (SEA) framework. Though the methodology of estimating the response using SEA exists, its applications to composite cylindrical shells and how they compare with experimental results are seldom reported. Present work fills this gap. Acceleration and strain responses of a typical composite sandwich cylinder under diffused acoustic field are estimated in SEA framework. Modal densities and coupling loss factors are estimated using expressions. The dissipation loss factors are determined experimentally. Same cylinder is subjected to diffused acoustic field in reverberation chamber and the accelerations and strains are measured. The work presents how much the theoretically estimated responses compare with the experimentally obtained results. It is seen that the acceleration responses compare reasonably well, but needs improvement. The strain-velocity relations compare very well. Acceleration and strain bounds such that 99 % of all measurements are within are also predicted which could be used in the structural design.

Keywords: Acoustics, Composite Cylindrical Shells, Diffuse Field, Ring Frequency, Response, SEA