SEMI-MEMBRANE SHELL THEORY OF HYBRID ANISOTROPIC MATERIALS

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ABSTRACT

A semi-membrane shell theory of hybrid anisotropic materials is developed by means of asymptotic integration method starting from a three dimensional elastic element. A very long effective length scale of cylindrical shell is adopted for the formulation, edge effects due to the prescribed boundary condition penetrate differently depending on material orientation of each layer but all within the limit of length scale $(ah)^{1/2}$ where Donnell-Vlasov bending theory is valid. Demonstrated that beyond the limit of edge effective zone, membrane or pseudo-membrane state dominates, it is traditionally named semi-membrane state. Governing equations of semi-membrane theory of cylindrical shell are formulated and the physical interpretation of the theory is described. The theory is very useful to analyze and design long cylindrical shells such as rocket fuel storage tanks, open top oil stage tanks and chimney structures.

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