Minimum Weight Design and Manufacture of Laminated Composite Sandwich Shells

廖偉智、賴?民

E-mail: 9711009@mail.dyu.edu.tw

ABSTRACT

In order to make the composite shell achieve the goal of the high stiffness and weight-light, so this research developed the theory analysis on the composite sandwich shell component and molding technology. As for theory analysis, make use of 3D shell element of the multi-layer theory to analyze the mechanics behaviour of the composite sandwich shell component with different aspect ratio (B/A) , radius -to- length ratio (R/A) , side -to -thickness ratio (A/H) , boundary condition and various loading. In manufacturing, is put face materials and core materials in the mold to foaming forming the composite sandwich shell, the face materials is glass fiber composites or carbon fiber composites; the core materials is EVA630 which is light weight and made by single screw granulating machine or resin foam. Not only can less whole weight of structure, but also improve the resistance to bend and resistance to impact ability of composite sandwich shell structure. In the optimal design, this research uses the particle swarm optimization (PSO) algorithm for search optimal process parameters (orientation angle and thickness) of composite sandwich shell with different aspect ratio (B/A) , radius -to- length ratio (R/A) , side -to - thickness ratio (A/H) , boundary condition and various loading , in order to make the composite sandwich shell component reach the goal of maximum stiffness or minimum weight. Finally, verify the correct of the theory analysis and optimal design by the experimental data.

Keywords : Foam ; Composite ; Sandwich ; Shells structures ; Minimum weight design ; Stiffness ; Particle Swarm Optimization

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