複合材料殼購件力學行為分析與最佳化設計

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摘 要

本文主要以殼的有限元素法進行複合材料圓柱殼構件(Cylindrical Shell)及球殼構件(Spherical Shell)的力學行為分析及使用三種最佳化方法進行殼構件的最佳化設計。利用3D的殼理論來模擬複合材料殼構件的位移量，其分析結果與文獻的數據差異甚小，可做為最佳化設計的目標函數。最佳化設計部份，針對對稱的複合材料殼構件，以疊層角度及層組厚度為設計變數，與等厚度及不等厚度的限制條件，在不同長寬比、長厚比、半徑-長度比，受力情況及邊界條件下，應用粒子群最佳化演算法(Particle Swarm Optimization 簡稱PSO)、及雙遺傳基因演算 (Double Genetic Algorithms 簡稱 DGA)，及自行開發的混合式粒子群最佳化演算法(Hybrid Particle Swarm Optimization 簡稱HPSO)尋找最佳設計參數，使其殼構件的位移量達到最小。希望能達到節省殼結構設計開發所需的人力及工時，進而減少殼構件之質量以及提高強度的效果。

關鍵詞 : 有限元素法 ; 殼構件 ; 最佳化設計 ; 粒子群最佳化演算法 ; 雙基因演算法 ; 混合式粒子群最佳化演算法

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