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Stacking Sequence Optimization of Composite Corrugated Bearing Cylinder with Two-level Approximation and GA

Yanjie Liu [1], Shenyan Chen[1] , Haichao An[1,] Hai Huang[1] , Ma Haiquan[2] , Gao Feng[2] , and Bai Gang[2]

[1] Beihang University, Beijing, China
[2] Beijing Institute of Spacecraft System Engineering, Beijing, China

Abstract

A principle bearing cylinder supports all the functional components that are housed in a satellite structure. In order to reduce the weight of the composite corrugated cylinder and maintain good mechanical properties, then to form a better structure scheme, the stacking sequence of the corrugated bearing cylinder is optimized under the given constraints in this paper. Considering strength constraints of each layer and the global natural frequencies constraints, an optimization model was established with the minimum weight as the objective, in which the stacking sequence of multi-parts were taken as design variables. The two-level approximations and adaptive genetic algorithm [1], which was proposed recently by authors, is applied as the optimization algorithm. This algorithm improves the efficiency of the operation and avoids the selection of some control parameters which is time consuming in the general genetic algorithm. It also puts forward the concept of temporary delete technology to processing the optimization problems with strength constraint. According to the engineering demands, the optimization is conducted by starting from different ground stacking sequences to search the final results. After optimization, the weight of the main cylinder was decreased 8 kg (ranking 43.76% of the total weight) with more reasonable stacking sequences.

Keywords: stacking sequence optimization; corrugated bearing cylinder; strength constraints; two-level approximation; genetic algorithm.

[1] An H, Chen S, Huang H, Laminate stacking sequence optimization with strength constraints using two-level approximations and adaptive genetic algorithm, Structural and Multidisciplinary Optimization,(11)(2014).