عنوان مقاله:

Vibration Optimization of Fiber-Metal Laminated Composite Shallow Shell Panels Using an Adaptive PSO Algorithm

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خلاصه مقاله:

The paper illustrates the application of a combined adaptive particle swarm optimization (A-PSO) algorithm and the finite strip method (FSM) to the lay-up optimization of symmetrically fiber-metal laminated (FML) composite shallow shell panels for maximizing the fundamental frequency. To improve the speed of the optimization process, adaptive inertia weight was used in the particle swarm optimization algorithm to modify the search process. The use of the inertia weight provided a balance between global and local exploration and exploitation and resulted in fewer iterations on average to find an optimal solution. The fitness function was computed with a semi-analytical FSM. The number of layers, the fiber orientation angles, edge conditions, length/width (a/b) ratios, and length/radii of curvature (a/R) ratios were considered as design variables. The classical shallow shell theory (Donnell's formulation) was applied to calculate the natural frequencies of FML cylindrical curved panels. A program using Maple software was developed for this purpose. To check the validity, the obtained results were compared with some other stacking sequences. The numerical results of the proposed approach were also compared with other algorithms, which showed that the A-PSO algorithm provides a much higher convergence and reduces the required CPU time in searching for a global optimization solution. With respect to the first natural frequency and weight, a bi-objective optimization strategy for the optimal stacking sequence of FML panels is also presented using the weighted summation method.

کلمات کلیدی:

Fiber Metal Laminate, Shallow Shell, Optimization, Adaptive PSO Algorithm