# Robust shape optimization method for shell structures with unknown loadings

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**Abstract**

In this paper, we propose a robust shape optimization method for a shell structure with unknown loadings. The concept of the principal compliance minimization for minimizing the maximal compliance is applied to the shape optimization design of a shell structure. The principal compliance minimization problem can be transformed to the equivalent maximization problem of the fundamental eigenvalue of the stiffness term, and this problem is formulated as the distributed-parameter optimization problem based on the variational method. The derived shape gradient function is applied to the H1 gradient method for shells to determine the optimal shape variation, or the optimal free-form. With this method, the optimal smooth curvature distribution of a shell structure can be determined without shape parameterization. The calculated results show the effectiveness of the proposed method for robust shape optimization of a shell with unknown loadings.

**Keywords:** robust shape optimization; shell structure; loading uncertainties; principal compliance; H1 gradient method.