

基于拓扑优化和形状优化方法的主轴承盖结构设计

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关键词: 主轴承盖 结构优化 拓扑优化 形状优化

摘要: 提出基于拓扑优化和形状优化的主轴承盖结构设计方法。在拓扑优化建模中,提出基于RAMP插值函数的ICM拓扑优化方法。在形状优化建模中,提出基于近似-差分灵敏度分析方法的形状优化方法。拓扑优化和形状优化模型以结构响应量为约束,体积最小化为目标,保证不同层次优化模型的承接性。针对某内燃机主轴承盖进行优化设计,优化结构分析结果表明,优化后的主轴承盖在满足结构刚度和强度条件下实现了结构体积最小化。证明提出的方法在主轴承盖结构设计中可行且有效。 A new methodology for main bearing cap design was presented based on topological optimization and shape optimization. In topological optimization, filter functions of elements with respect to the unit volume and stiffness matrices were selected based on RAMP interpolation scheme. In shape optimization, efficient derivatives have been obtained by using approximate-difference strategy. Structural volume was taken as objectives and structural responses such as displacements, stresses were taken as constraints. This kind of model ensured consistency in topological optimization and shape optimization model. Volume of main bearing cap has been minimized subject to rigidity and strength constraints. The feasibility and efficiency of the proposed methods were demonstrated by the experiment.

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