



航空学报 » 2003, Vol. 24 » Issue (2) :124-128 DOI:

论文

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制造误差对气体静压轴承涡流力矩影响分析方法研究

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Numerical Analysis of Manufacturing Error Influence on Vortex Torque of Externally Pressurized Gas Bearings

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摘要

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摘要 采用有限元方法研究了制造误差对狭缝节流气体静压轴颈—止推轴承的涡流力矩的影响。对于轴颈—止推相连结构的气体轴承,通过相容变换进行统一编程计算;在离散化过程中,利用加权余量法将二阶偏微分方程降低一阶,放松了对插值函数连续度的要求,便于借助有限元技术分析狭缝节流气体静压轴承的流场参数。分析了狭缝气膜宽度误差和轴颈圆度误差对涡流力矩的影响,以及轴颈的不同安装角度、偏心等因素对涡流力矩的影响。经对比验证,有限元计算结果与实测结果基本一致,研究结果对于气体静压轴颈—止推轴承的设计、装配优化和性能预测有重要指导意义。

关键词: 涡流力矩 气体静压轴颈—止推轴承 狭缝节流 制造误差

Abstract: This paper deals with the effects of part's manufacturing errors on the vortex torque of the externally pressurized gas journal-thrust bearings with slot restrictors by the finite element method. The consistent transform is adopted to program for journal and thrust bearings uniformly. The second-order partial differential equation, Reynolds equation, is reduced by one-order with a weighted residual method in the discretization procedure, which releases the requirement of continuity degree of the interpolation function while the finite element method is adopted. The analysis of this paper is centered on the influence of slot film width error and shaft surface roundness error on the vortex torque. The effects of the installation angle and the eccentricity of the journal on the vortex torque are discussed also. The predicted characteristics are in good agreement with experimental results. The research results have great significance for the design, assembly optimization and performance prediction of gas bearings.

Keywords: vortex torque externally pressurized gas journal thrust bearings slot restrictors manufacturing errors

Received 2002-01-29; published 2003-04-25

引用本文:

姚英学; 杜建军; 刘瞰; 谢大纲. 制造误差对气体静压轴承涡流力矩影响分析方法研究[J]. 航空学报, 2003, 24(2): 124-128.

YAO Ying-xue; DU Jian-jun; LIU Dun; XIE Da-gang. Numerical Analysis of Manufacturing Error Influence on Vortex Torque of Externally Pressurized Gas Bearings[J]. Acta Aeronautica et Astronautica Sinica, 2003, 24(2): 124-128.

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