动力机械与工程

圆瓦滑动轴承油膜力近似解析模型

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摘要：

能够准确描述滑动轴承油膜力特性的数学模型是转子－轴承系统非线性动力学分析的基础和关键。该文针对圆瓦径向滑动轴承，基于周向动态 p 油膜边界条件，利用分离变量法，将雷诺方程分解为类似长轴承模型方程和轴向压力方程，获得圆瓦轴承油膜压力分布近似解析表达式。通过对油膜域内压力进行积分，得到圆瓦滑动轴承油膜力表达式。基于该文提出的模型，研究了圆瓦轴承油膜压力分布，对比分析该文模型与长轴承、短轴承、有限差分法模型，结果表明该文模型能够在较宽长径比范围较准确地描述圆瓦轴承油膜特性。基于该文模型对刚性转子－轴承系统进行动力学特性分析，仿真结果验证了该文模型的有效性。

关键词： 有限长轴承　分离变量　油膜力　近似解析模型

Approximate Analytical Model of Oil-film Force for Cylindrical Journal Bearing

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Abstract:

The mathematical model of journal bearing oil-film forcre is the basic and key work for analyzing the nonlinear dynamic stability of rotor-bearing systems. Based on dynamic p boundary conditions of oil-film for cylindrical journal bearing, the pressure control Reynolds equation was solved using separation of variables method, and was decomposed into a similar long bearing model equation and the axial pressure equation because of the characteristics of separation of variables method, and the approximate analytical expression of oil film pressure distribution for cylindrical bearing was obtained. By integrating the pressure within the oil film region, we got the analytical expression of oil film force. The expression of the pressure was analyzed to study the pressure distribution, and the present model was compared with the long bearing oil film force, short bearing oil film force, and the finite difference method results. The results show that the proposed model in a wider length-diameter ratio range can accurately describe the oil film characteristics of plain journal bearing. And the proposed model is proved good efficiency by analyzing dynamics characteristic of a rigid rotor-bearing system.

Keywords: finite length journal bearing　separation of variables　oil-film force　approximate analytical model

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