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高维局部非线性转子-轴承动力系统的稳定性和分岔

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STABILITY AND BIFURCATION OF HIGH ORDER ROTOR DYNAMIC SYSTEM WITH LOCAL NON ANALYTICAL BEARING SUPPORTS

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摘要

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摘要 采用模态缩减方法对具有非解析轴承的高维局部非线性转子系统进行自由度降阶。提出基于变分不等方程的有限元互补解的数值方法,在几乎不增加计算量的情况下,使得实际轴承油膜力的 Jacobian 矩阵可与油膜力自身计算同时完成,并取得协调一致的精度。结合打靶法和 Floquet 理论对实际转子-轴承系统的非线性不平衡响应及其分岔行为进行计算分析,数值结果表明,所提出的方法不仅极大地降低了计算量,而且具有足够高的精度。

关键词: 高维局部非线性系统 转子-轴承系统 有限元方法

Abstract: The modal reduction technique is utilized to a high order finite element model of flexible rotor systems with local non analytical bearing supports. Based on the finite element method and complimentary solution for the variational inequalities, an efficient numerical method for calculating the lubrication problem of the real bearings is presented, which calculates nonlinear forces and their Jacobian matrix simultaneously and obtains compatible accuracy with few increases of computing efforts. The periodic unbalance responses of the system are calculated by the Shooting method and their bifurcations are identified by analyzing the Floquet multipliers numerically. The numerical examples show that the schemes of this study not only save computing efforts greatly but also have good enough precision.

Keywords: high or der local nonlinear systems rotor -bearing systems finite element method

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