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球轴承多体接触动力学研究

Multibody contact dynamics research on ball bearing

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英文关键词:contact dynamics angular contact ball bearing multibody system dynamics triangle mesh method cage

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中文摘要:

考虑钢球、套圈和保持架的动态接触关系,提出了机械系统中球轴承多体动力学分析的新方法.基于套圈滚道的三角网格模型,实现了钢球和套圈滚道的动态接触力的预测搜索算法,建立了计及润滑和Hertz接触作用的三维角接触球轴承多体接触动力学模型.运用广义-α方法计算分析了预紧力和旋转径向力作用下角接触球轴承的多体接触动力学特性,获得了球轴承的动态接触力、拖动力和运动轨迹及频谱等振动响应,并利用Gupta经典实例模型进行了实验验证.轻载中等速度下钢球的角速度以184.5rad/s^{-2}波幅周期变化,旋滚比以0.01波幅周期变化,角加速度与动态接触载荷的频谱具有相同的56.1,112.2Hz等谐波倍频成分.中等载荷高速下保持架中心的运动轨迹呈现出以83.3Hz和200Hz双频率拟周期的平动运动.

英文摘要:

Considering the dynamic contact relationship between balls,rings and cage,a new method was brought out for multibody dynamics analysis of ball bearings in mechanical systems.The searching algorithm for prediction of dynamic contact force was carried out based on the triangle mesh models of ring races.The three dimensional multibody contact dynamics model of angular contact ball bearing was constructed with lubrication and Hertz contact and calculated by generalized-α algorithms under axial preload and rotated radial load.The results of dynamic contact force,trajectory of motion,phase diagram and frequencies were achieved and verified by the Gupta classical model.The angular acceleration and ratio of revolution to rolling of a ball were periodic varying with amplitude 184.5 rad/s^{-2} and 0.01 respectively under light load and middle speed.The harmonic frequencies of angular acceleration and dynamic contact force were similar such as 56.1Hz and 112.2Hz.The vibration of cage center was quasi-periodic with two frequencies 83.3Hz and 200Hz under middle load and high speed.

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