

动力机械与工程

非线性油膜力和啮合力作用下齿轮系统的振动特性研究

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摘要: 同时考虑非线性齿轮啮合力和非线性油膜力的影响, 建立齿轮-转子-滑动轴承系统的动力学模型。研究2种强非线性因素的共同作用下, 系统的非线性动态响应。研究表明: 转速相对较低时, 非线性啮合力对系统振动的影响较大; 随着转速的升高, 非线性油膜力对振动的影响逐渐增大, 并出现“半频涡动”现象, 而非线性啮合力的作用相对减小; 在一定的转速范围内, “半频涡动”引起的频率成分的振幅甚至超过不平衡质量引起的1倍频的振幅。这是考虑非线性油膜力和非线性啮合力作用时得到的新的结论, 这些结论是过去采用线性油膜力模型时难以得到的。

关键词: 齿轮-转子-滑动轴承系统 非线性振动 非线性油膜力 非线性啮合力

Research on Vibration Characteristics of Gear System With Nonlinear Oil Film Force and Mesh Force

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Abstract: The nonlinear gear mesh force and nonlinear oil film force were considered synchronously, the dynamic model of geared rotor-oil journal bearing system was proposed. The nonlinear dynamic responses of system with the two strongly nonlinear factors were investigated. The results show that the vibration of system is affected by nonlinear mesh force mainly, when the rotational speed is low relatively. With the increase of rotational speed, the influence of nonlinear oil film force on the vibration also increases gradually, and the 'half frequency precession' phenomena occurs, the effect of nonlinear mesh force decreases relatively. In certain range of speed, the amplitude of frequency which caused by unbalance is exceed by the amplitude of frequency which caused by 'half frequency precession'. These new conclusions come from considering the effect of nonlinear oil film force and nonlinear mesh force, and they are difficult to be gained by linear oil film force model applied previously.

Keywords: geared rotor-oil journal bearing system nonlinear vibration nonlinear oil film force nonlinear mesh force

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