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电磁轴承故障仿真系统研究与开发

摘要

本文针对一套电磁轴承-转子系统，开发仿真程序来模拟各种工况下系统的响应情况。根据电磁轴承使用的磁极建立了十六极磁极电磁力模型；建立了 5 自由度转子模型；建立了包括碰摩、不平衡的故障模型；建立了 5 自由度分散 PID 控制的控制器模型。根据建立的各个理论模型，在 Matlab/Simulink 中使用 Simscape 工具箱，建立各个部分对应的仿真模型，并进行模块化。之后进行各个模块之间的装配，完成整体仿真系统的搭建。对各种正常工况以及故障工况进行仿真模拟，测试仿真系统工作的准确性。对故障工况进行简单分析，寻找故障产生的原因，以及各类故障对转子行为的影响。

关键词

电磁轴承；故障仿真；碰摩；不平衡响应

Abstract

In this paper, a simulation program is developed for an AMB-rotor system to simulate the response under various operating conditions. A sixteen-pole pole electromagnetic force model is developed based on the magnetic poles used in the AMB; a 5 DOF rotor model is developed; a fault model including rub-impact and unbalance is developed; and a controller model with 5 DOF decentralized PID control is developed. According to each theoretical model established, the simulation model corresponding to each part is established and modularized in Matlab/Simulink using Simscape toolbox. After that, the assembly between each module is carried out to complete the construction of the overall simulation system. Simulation of various normal and fault conditions is carried out to test the accuracy of the simulation system. A simple analysis of the fault conditions is carried out to find the causes of the faults and the effects of each type of fault on the rotor behavior.

Keywords

Active magnetic bearing; Fault simulation; Rub-impact; Unbalance response

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