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带气膜阻尼环的转子系统动力特性试验

Experiment on rotor dynamics of rotor system with air film damper

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中文关键词: [气膜](#) [金属橡胶](#) [阻尼减振](#) [转子系统](#) [动力响应](#)

英文关键词: [air film](#) [metal rubber](#) [vibration reduction](#) [rotor system](#) [dynamic response](#)

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中文摘要:

提出一种具有金属橡胶弹性外环的气膜阻尼环(AFD)作为转子系统的辅助支承阻尼元件. 建立AFD的力学模型, 解释其工作机理. 建立带AFD转子系统的试验台和测控系统, 对比无AFD转子系统的动力特性, 验证AFD的辅助支承阻尼性能. 通过对AFD振动位移和相位的测量, 说明气膜环在转子运转过程中的跟踪振动响应过程. 通过对比气膜环和转子轴颈在转子系统运转过程中的相位差, 验证AFD的工作机理和阻尼减振性能. 最后研究初始气膜间隙对AFD性能的影响. 研究结果表明: 由于AFD具有可动金属橡胶环, 气膜环能够跟随转子轴颈的振动量, 自动调整偏心振动量和相位, 具有自适应特性. 在金属橡胶和气膜的刚度和阻尼作用下, AFD作为转子系统的辅助支承阻尼元件, 为转子系统提供附加支承刚度和有效阻尼, 起到限幅减振的作用. 而初始气膜间隙越小, 辅助支承阻尼作用的效果越明显.

英文摘要:

An air film damper (AFD) with metal rubber as the outer ring was presented, which was designed as the assistant support and damping component for rotor systems. The mechanical model of AFD was established and the mechanism of AFD was explained. A rotor system with AFD and the testing rig were constructed in order to verify the performances of AFD as an assistant support and damping component comparing with a rotor system without AFD. Based on the measurements of the displacements and the phases of AFD, the tracking vibration response process of the air film ring was captured. Comparing the phases of the air film ring with the journal, the mechanism and damping properties of AFD was testified. Moreover, the effects of the original air film clearance on the properties of AFD were studied. The results show that due to the moveable metal rubber ring, the air film ring can adjust the displacement and phase with the vibration of the journal automatically, which presents an automatic adaptability of AFD. Combining the stiffness and damping of the metal rubber ring and the air film, AFD, being an assistant support and damping component, can provide additional support stiffness and effective damping to the rotor system, which can reduce the vibration of the rotor system. Furthermore, a smaller original air film clearance would result in a more additional stiffness and better damping effect.

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