夏冶宝,任兴民,秦卫阳,邓旺群.浮环挤压油膜阻尼器对模拟低压转子突加不平衡响应影响分析[J].航空动力学报,2015,30(11):2771~2778

浮环挤压油膜阻尼器对模拟低压转子突加不平衡响应影响分析

Analysis of the effect of floating ring squeeze film damper on sudden unbalance response of low pressure rotor

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中文关键词: 模拟低压转子 浮环挤压油膜阻尼器 突加不平衡响应 质量比 刚度 油膜间隙

英文关键词:low pressure rotor floating ring squeeze film damper sudden unbalance response mass ratio stiffness film clearance

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中文摘要:

为了研究浮环挤压油膜阻尼器对涡轴发动机模拟低压转子突加不平衡响应的影响,建立了考虑多种耦合的带浮环挤压油膜阻尼器模拟低压转子的动力学模型,推导其运动方程并采用数值方法进行了求解,分析了系统响应随浮环与轴承质量比值、支承刚度和油膜间隙等设计参数的变化.研究表明:相比传统挤压油膜阻尼器,浮环挤压油膜阻尼器更好地抑制了转子系统加速过临界时的瞬态响应以及稳速和升速过程中的突加不平衡响应;增大浮环与轴承质量比值、减小弹性支承刚度和挤压油膜间隙,能够更好地抑制突加不平衡响应的瞬态振幅和瞬态过程;转子系统由于油膜非线性引起的双稳态大振幅区会随浮环与轴承质量比值的增大而减小,而随挤压油膜间隙值的减小而增大.

英文摘要:

To research the depression effect of floating ring squeeze film damper on sudden unbalance response of low pressure rotor in turboshaft engine, a dynamical simplified model of low pressure rotor supported on floating ring squeeze film damper was built, considering multiple dynamical coupling. Its motion equations were derived and solved by the numerical method. The influence of some parameters, e .g ., mass ratio between floating ring and bearing, stiffness of elastic support, and film clearance, were analyzed. The main results are as follow: compared with traditional squeeze film damper, the floating ring squeeze film damper has better performance in depressing both critical transient responses and sudden unbalance responses in steady-state process or in accelerating process; with greater mass ratio between floating ring and bearing, smaller stiffness of elastic support and smaller film clearance, the floating ring squeeze film damper has better performance in depressing both transient amplitude and transient time of sudden unbalance responses; the speed range with large vibration of rotor system during passsing through the bistable region depends not only on the mass ratio between floating ring and bearing, but also on the film damper clearance; it decreases along with the mass ratio increases, and increases with the film clearance decreases.

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