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航空发动机中介轴承的故障特征与诊断方法

Fault characteristics and diagnosis method of intershaft bearing in aero-engine

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作者	单位
廖明夫	西北工业大学 动力与能源学院，西安 710007
马振国	西北工业大学 动力与能源学院，西安 710007
刘永泉	中国航空工业集团公司 沈阳发动机设计研究所，沈阳 110015
王德友	中国航空工业集团公司 沈阳发动机设计研究所，沈阳 110015

中文摘要:

提出了转差域频谱和转差域包络谱的概念，建立了诊断航空发动机中介轴承故障的方法.利用发动机高、低压转差作为触发信号，对发动机振动信号进行等转差周期采集，并在转差域对振动信号进行频谱和包络谱分析.结果表明：不平衡响应、不对中响应以及外环静止的轴承故障响应等振动信号在转差域频谱和转差域包络谱上的位置随转速变化；而中介轴承的故障响应在转差域频谱上的边频成分间距不随转速变化，具有倍频“恒间距”特征；在转差域包络谱上的位置也不随转速变化，具有“恒频”特征.带外环故障的中介轴承实验表明：转速变化时，在转差域包络谱中，外环故障特征倍频成分位置不变；在转差域频谱中，出现间隔宽度恒定为外环故障特征倍频的频率成分.

英文摘要:

Spectrum and envelope spectrum analysis of vibrations measured on aero-engines were developed in rotary-speed-difference-domain for detection of faults in inter-shaft bearings. Rotary-speed-difference of high pressure rotor and low pressure rotor is used as triggering signal. Vibration signals were sampled at the whole cycles of rotary-speed-difference,and their spectrum and envelope spectrum were analyzed in rotary-speed-difference-domain. The result shows that the position of vibration components caused by rotor imbalance, misalignment and defects in normal bearings(outer race fixed) will change in the horizontal coordinate(octave form in rotary-speed-difference-domain) when the rotary speed changes. However the side-band components in the vibration spectrum resulting from defects in inter-shaft bearings will keep constant space between any two components when the rotary speed changes. This phenomenon is referred to as "constant space " feature. Furthermore, vibration components in envelope spectrum caused by defects in inter-shaft bearings will keep constant location in the horizontal coordinate(octave form in rotary-speed-difference-domain) when the rotary speed changes. This phenomenon is referred to as "constant octave " feature. The experimental results obtained from the measurements on a test rig of inter-shaft bearing with defects in outer race show that the two features really present in the spectrum and envelope spectrum in in rotary-speed-difference-domain respectively.