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直升机中减速器谐响应分析与传感器优化布局

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Harmonic analysis and optimized vibration sensor locations of the helicopter intermediate gearbox

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摘要 研究了多自由度的振动数学模型.通过系统的故障频率来确定振动传感器的安装位置,提出了一种基于故障频率敏感的振动传感器优化布局方法,建立了直升机中减速器机匣有限元模型.利用谐响应分析方法,对中减速器机匣施加一故障激励信号.研究表明:机匣的不同位置对激励信号响应的振动幅值明显不同,齿轮故障时往往在啮合频率及其倍频处形成以转频为间隔的边频带,对该边频响应振幅最大的位置就是振动传感器安装的最佳位置,并提出了振动传感器优化布局函数.此方法同样适用于直升机传动系统其它部件的振动传感器位置选择,也适用于其它旋转机械的振动监测.

关键词: 直升机 振动测量 谐响应分析 传感器 建模

Abstract: Multi-freedom vibration model has been studied. A methodology of optimized vibration sensor location, in which the amplitude was sensitive to fault frequency, was presented. First, a finite element model of the helicopter intermediate gearbox was constructed, then a signal stimulus was forced to the gearbox of the model by the method of harmonic analysis. The study shows that different locations have clear different amplitudes according to the signal stimulus. So the location, where the amplitude was the largest, should be the best sensor location and a function of optimized sensor locations was presented. This optimized sensor location methodology is also applicable to other parts of the helicopter transmission and other rotating mechanics.

Keywords: helicopter vibration measurement harmonic analysis sensors modeling

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