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学术论文

环境激励下宽频带模态参数识别研究

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摘要：

由于功率谱的模态阶次是频响函数模态阶次的2倍，直接使用响应信号的功率谱进行模态参数识别容易导致识别过程中需要过高的系统阶次、运算量加大、数值算法不稳定等问题。因此使用功率谱的模态识别方法多为窄频带算法，难以适用于宽频带识别。针对该问题，在使用相关图法估计功率谱的过程中，仅对正时延相关函数进行傅里叶变换(FFT)可以实现功率谱降阶，并且降阶后的模态参数不发生变化。根据频响函数与降阶功率谱具有相似数学表达式的特点，将试验模态分析中的多参考点最小二乘复频域(p-LSCF)宽频带算法与降阶功率谱相结合，实现了环境激励条件下的模态参数识别。通过一个二层单跨框架结构仿真算例与一个建筑结构的实测算例进行了验证，结果表明：该方法能够较准确识别模态参数，具有耦合模态的识别能力；在模态选择中，除了借助于模态指示函数，高阶模态应利用稳定图加以判断。

关键词： 环境激励 模态参数识别 p-LSCF算法 稳定图

Research on broadband modal parameters identification under ambient excitation

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Abstract:

Owing to the fact that the modal order of power spectra is twice of the modal order of frequency response function (FRF). Modal parameters identification methods using power spectra of response signals have some shortcomings. The higher modal order is needed for modal identification, which results in an increasing calculation time and bad numerical conditioning. These disadvantages can be overcome by calculating the FFT of the positive lag correlation function in correlogram approach. The modal parameters do not change after order reduction. According to the same expression between order reduction power spectra and FRF, the modal parameters were identified by poly-reference least square complex frequency-domain algorithm (p-LSCF) under ambient excitation. A simulation case of a two-storey building and an application case of a HCT building were employed to validate the combined method. The results show that the combined method can get better identification, especially for closely spaced modes. High order modes can be selected by means of stabilization chart.

Keywords: ambient excitation modal parameters identification p-LSCF algorithm stabilization chart

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