

颤振试验中加速度计信号的时频滤波方法研究

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基金项目: 航空基金资助项目(2007ZD53053), 西北工业大学基础研究基金(W01804)

摘要:

针对飞机颤振试飞试验数据信噪比偏低的问题, 提出了两种加速度计信号的时频域滤波算法, 分别借助小波和分数阶傅里叶变换对数据进行时频分析, 并在时域内滤波。该类算法的共同思想是利用扫频信号在时频域内的聚焦特性, 有效提取真实响应信号, 达到了信噪分离的目的。文中给出了具体的滤波算法, 并通过算例和实际试飞数据检验了滤波效果, 结果表明两种方法均可显著提高加速度计信号的信噪比。其中, 小波变换方法的通用性较好, 而分数阶傅里叶变换在处性扫频激励数据时表现了更优的去噪效果。

关键词: 颤振 试飞试验 加速度计 时频滤波

Filtering in Time-Frequency Domain for Measurement of Accelerometer in Flight Flutter Testing

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Abstract:

Two time-frequency filtering methods are presented for noise reduction of flight flutter testing data. These methods employ continuous wavelet transform and fractional Fourier transform (FRFT) for time-frequency (TF) analysis respectively, and utilize the local property of linear sweep signal in TF domain to separate true signal from noise. A complete procedure for the filtering is presented. Finally, the advantage of the filtering method is illustrated by means of simulated and real flight data. The results show that the two methods are all able to sharply improve the quality of signal measured by accelerometer. As a difference, FRFT method is only applicable to linear sweep excitation although it outperforms wavelet method when dealing with this kind of signal. However, wavelet method is applicable to all chirp-like signals that have concentration property in TF domain.

Keywords: Flutter; Flight testing; Accelerometer; Filtering in Time-Frequency Domain

投稿时间: 2008-09-27