

论文

基于HHT法的煤冲击破坏SHPB测试信号去噪

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摘要:

针对分离式霍普金森杆(SHPB)测试信号的高噪声、持时短、突变快等特点,利用希尔伯特-黄变换(HHT)分析技术对煤冲击破坏的测试信号进行去噪处理。用经验模式分解法(EMD)分解实测的煤冲击破坏SHPB测试信号,可以得到各固有模态函数(IMF)分量及其频谱和各IMF分量的能量百分比,从而利用低通滤波将原始信号中的高频噪声有效的分离出去。利用快速傅里叶变换(FFT)频谱和Morlet小波时频谱对比分析去噪前后信号的特征,定性的说明HHT法可以用于煤冲击破坏SHPB信号的去噪处理。通过计算去噪后信号的信噪比和能量百分比,定量的说明HHT法充分保留了煤冲击破坏SHPB信号本身的瞬态非平稳特征,去噪效果显著,方法简捷,结果可靠。

关键词: 煤冲击破坏; SHPB试验; 信号去噪; HHT法

Coal impact damage SHPB testing signal de-noising based on HHT method

Abstract:

According to Split Hopkinson Pressure Bar (SHPB) test signal characteristic with high noise, short lasting time, mutant fast, the Hilbert-Huang transform (HHT) analysis technique was used to de-noise testing signal on the coal impact failure. The intrinsic mode function (IMF) components and its' frequency spectrum and the energy percentages of IMF components were got by using empirical mode decomposition (EMD) decomposition to measure coal impact damage SHPB test signal. Thus the high frequency noises were effectively separated out from the original signal by the low-pass filtering. Through the comparison of original signal and de-noised signal characteristic by using fast Fourier transform (FFT) spectrum and Morlet spectrum analysis, the qualitative conclusion that the HHT method could be used in coal impact damage SHPB testing signal de-noising were obtained. From the calculation of the de-noised signal noise ratios and energy percentages, it was indicated that the de-noised signals were fully retained the signals' transient non-stationary featured and the de-noising effect was obvious by HHT method in quantitative description. The HHT method, which is applied for coal impact damage SHPB testing signal de-noising, is simple and can obtain reliable results.

Keywords: coal impact damage; SHPB test; signal de-noising; HHT method

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