

背衬对埋入混凝土中压电陶瓷电-声特性的影响

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摘要:

传统超声脉冲法不能对混凝土质量进行实时健康监测, 将压电陶瓷埋入混凝土中构成的压电埋入式混凝土机敏模块能够进行混凝土结构的在线监测, 但由于压电陶瓷在埋入混凝土后其电-声性能受到较大影响, 能够激励的声信号能量弱、信噪比低, 很难应用于噪声干扰强、待检测结构厚的场合。针对这一问题, 提出了通过在埋入混凝土中的压电陶瓷上层合金属背衬的方法, 提高声能的利用率和指向性。分析了在不同背衬厚度和不同激励频率条件下接收信号的时、频域特征。结果表明, 经过层合金属背衬处理后的超声信号的能量提高了2-12倍, 且这种方法并没有影响超声检测信号的波形及频率成分, 具有较高的可行性。

关键词: 超声检测; 混凝土; 压电埋入式; 金属背衬; 能量

Research on the influence of the backing to the electricity-acoustic characteristics of the piezoelectric ceramic embedded in concrete

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Abstract:

Conventional ultrasonic pulse method cannot process real-time health monitoring to the concrete quality, instead piezoelectric embedded concrete alert module that embedded the piezoelectric ceramic in concrete, can achieve the on-line monitoring on concrete structures. But because the electric acoustic performance was severely affected after the piezoelectric ceramic embedded in concrete, including weak energy of acoustic signal which can be stimulated, low SNR, it is difficult to apply to the occasions which has strong noise and thick structure to be detected. To solve this problem, methods that combined metal backing upon the piezoelectric ceramic embedded in concrete to improve energy efficiency and sound directivity is proposed. Time domain and frequency domain characteristics of the received signal under the conditions different of backing thickness and different excitation frequency are analyzed. The results show that, after processing of metal backing the energy of ultrasound signal increases 2-12 times, and this method does not affect waveform and frequency components of the ultrasonic signal with high feasibility.

Keywords: Ultrasonic testing; concrete; piezoelectric submerged; metal backing; energy

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