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### 失谐周期压电复合材料结构中的波动局部化研究

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### Study on Wave Localization in Disordered Periodic Piezoelectric Composite Structures

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摘要

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**摘要** 考虑机电耦合效应的影响,研究了层状失谐周期压电复合材料结构中的波动局部化问题。根据界面上力电连续条件,推导出结构中相邻单胞间的传递矩阵。以力场和电场变量为状态向量,给出了结构中局部化因子的表达式。作为算例,计算了结构中的波动局部化因子。计算结果表明,压电陶瓷的压电效应对周期压电复合材料的波动局部化特性有显著影响,压电常数越大局部化因子值越大,结构的局部化程度越强;结构的失谐度越大,频率通带区内的局部化因子值越大,局部化程度越强。分析结果对于周期压电复合材料结构的优化设计和振动控制具有理论参考价值。

**关键词:** 压电复合材料 失谐周期结构 机电耦合 波动局部化 传递矩阵

**Abstract:** By considering mechanical and electrical coupling characteristics of piezoelectric composite materials, the wave localization in disordered periodic layered piezoelectric composite structures is studied. According to the mechanical and electrical continuity conditions, the transfer matrix between two consecutive unit cells is obtained. The expression for calculating the localization factors in disordered periodic structures is presented by means of the variables in mechanical and electrical fields. As an example, numerical results of localization factors are presented. It can be seen from the results that the piezo-effect of the piezoelectric ceramics has significant effects on the characteristics of wave localization in periodic piezoelectric composites. The larger the piezoelectric constant of the piezoelectric ceramics and the degree of disorder of the structure are, the larger the localization factor or the stronger the wave localization is. The conclusions have theoretical significance for optimization design and vibration control in periodic piezoelectric composite structures.

**Keywords:** piezoelectric composite disordered periodic structure mechanical-electrical coupling wave localization transfer matrix

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