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## 粘贴形状记忆合金丝的复合树脂板振动分析

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## Vibration Analysis of Composite Resin Plate Embedded with Shape Memory Alloy

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**摘要** 在复合结构中粘贴形状记忆合金(shape memory alloy, SMA)丝, 利用其受限回复时产生较大回复应力和其弹性模量随温度变化的特性, 实现对结构变形和振动响应的主动控制. 基于Liang模型并取其相变系数  $\Omega = -700$  MPa, 求出受限约束下的回复应力与弹性模量. 根据应力应变关系, 把回复应力转化为回复应变. 用ANSYS模拟复合薄板在两端固定条件下, 加热SMA丝对其固有频率以及振动响应的影响. 同时试验研究同样约束条件下, 粘贴SMA丝复合薄板的固有频率随温度的变化特性, 发现二者的结果很吻合, 证明相关思想和技术方法是正确的.

**关键词:** 形状记忆合金 机敏复合薄板 回复应力 ANSYS分析

**Abstract:** Shape memory alloy (SMA) has advantages of great recovery stress and elastic modulus varied with the temperature, and therefore can be embedded in composite structure to actively control structure deformation and vibration. We derive recovery stress and elastic modulus at different temperatures by modifying the phase change coefficient  $\Omega$  of Liang's constitutive model. Based on the stress-strain relation, the recovery stress is translated into recovery strain. Using ANSYS, we simulate the influence of recovery stress on the natural frequency and vibration response of composite plate under both ends of fixed conditions. In the experiments on composite plate with both ends under the same condition, we find characteristics of the natural frequency varying with temperature. The analysis results obtained with ANSYS are closed to experimental results, verifying correctness of the related method.

**Keywords:**

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