

## 埋入被测结构体内涂覆光纤传感元的应变传递特性研究

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摘要:

埋入被测体内部的光纤传感元的应变是靠结构基体到裸光纤的层间应力传递作用产生的, 各层材料间的应力传递特性直接影响传感元对基体真实应变的反映程度。在对埋入基体光纤进行力学分析的基础上, 首次推导得出了裸光纤、涂覆层和基体各层材料内层间剪应力的径向分布函数。通过有限元仿真进一步给出了裸光纤应变的轴向和径向分布规律, 并对表征应变传递效应的埋入光纤端部应变不完全传递区的尺寸影响参数进行了研究。据此提出了保证精确测量的相应措施, 为感测测量结果正确评价基体应变提供了有力依据。

关键词: 光纤 应变传递 有限元 层间应力 涂覆层

## Research on the Strain Transferring Characteristics of Coated Optical Fiber Embedded Sensor in Measured Structure

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**Abstract:**

The strain of optical fiber sensing element embedded in measured structure was obtained by stress transferring effect from matrix to the bare fiber. The interlayer stress transferring characteristics will affect the reflection of sensor to the actual strain of measured structure. Based on the mechanical analysis for optical fiber embedded in measured structure, the distribution expression of interlayer shear stress among the bare fiber, coating and measured structure were deduced for the first time. Moreover the axial and radial stress distributions of bare fiber were obtained by using finite element simulations. The influence parameters of incomplete strain transferring region existing at the two free end of fiber, which represent the strain transferring effect, were also studied. Accordingly the certain measures for ensuring the accurate measuring were proposed, which provide a powerful foundation for assessing the strain of measured structure correctly based on the sensing results.

**Keywords:** optical fiber; strain transferring; finite element method; interlayer stress; coating

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