

论文

## 垂直磁压电材料界面三维裂纹的超奇异积分法

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**摘要** 应用有限部积分概念和广义位移基本解, 垂直于磁压电双材料界面三维复合型裂纹问题被转化为求解一组以裂纹表面广义位移间断为未知函数的超奇异积分方程问题. 进而, 通过主部分析法精确地求得裂纹尖端光滑点附近的奇性应力场解析表达式. 然后, 通过将裂纹表面位移间断未知函数表达为位移间断基本密度函数与多项式之积, 使用有限部积分法对超奇异积分方程组建立了数值方法. 最后, 通过典型算例计算, 讨论了广义应力强度因子的变化规律.

**关键词** [磁压电双材料](#) [超奇异积分方程](#) [裂纹](#) [复合型](#) [应力强度因子](#)

**分类号** [0346.1](#), [0302](#)

## Application of hypersingular integral equation method to a three-dimensional crack perpendicular to the interface in electromagnetoelastic bimetals

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### Abstract

This paper proposes a hypersingular integral equation method to analyze the three-dimensional mixed-mode crack perpendicular to the interface in anisotropic electromagnetoelastic (EME) bimetals under extended electro-magneto-elastic coupled loads through theoretical analysis and numerical simulations. Using the Green's functions, the general extended displacement solutions of three-dimensional mixed-mode crack meeting the interface in anisotropic EME bimetals under extended loads is analyzed by the boundary element method. Then this crack problem is reduced to solve a set of hypersingular integral equations coupled with boundary integral equations. The exact analytical solution of the extended singular stresses and extended stress intensity factors near the crack front are obtained. At last, a numerical method for the hypersingular integral equation for a three-dimensional mixed-mode rectangular crack subjected to extended loads by the body force method is proposed. Numerical solutions of the extended stress intensity factors of some examples are obtained.

**Key words** [electromagnetoelastic bimerial](#) [hypersingular integral equations](#) [crack](#) [mixed-mode stress intensity factors](#)

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