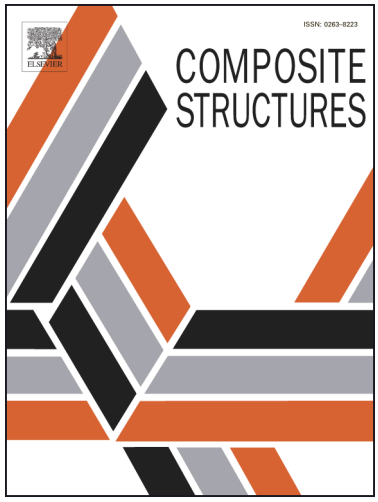


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# Evaluation of effective material properties in magneto-electro-elastic composite materials

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**Abstract:**

The meshless local integral equation method is developed to analyze general two-dimensional boundary value problems in size-dependent magnetoelectroelastic solids. A consistent theory is developed for size dependent magnetoelectroelasticity. The strain gradients are considered in the constitutive equations for electric displacement and magnetic induction. The governing equations are derived with the corresponding boundary conditions using the variational principle. The local integral equations are subsequently derived and the meshless moving least square (MLS) numerical method is implemented to solve these equations.

**Keyword**: meshless local integral equation, gradient theory, size effect, magnetoelectroelastic solid, effective material parameters

## 1. Introduction

Modern smart structures made of piezoelectric and piezomagnetic materials offer certain potential performance advantages over conventional ones due to their capability of converting energy from one type to another, among magnetic, electric, and mechanical [1-2]. It is well known that some composite materials can provide superior properties compared to their virgin monolithic constituent materials [3]. The irregularity in the spatial arrangement of the fibres and their geometry can influence the estimation of the effective material properties of the unidirectional composite. The experimental approaches are not convenient for an optimal design of composites due to the expensive cost of the measurements and the low efficiency. Therefore, mathematical and numerical models are frequently utilized to get homogenized material properties directly from