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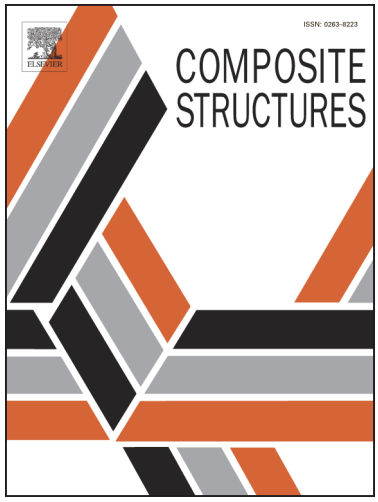

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Hygrothermal Analysis of Magneto-Electro-Elastic Plate using 3D Finite Element Analysis

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Abstract

In this article, the static response of magneto-electro-elastic (MEE) plate subjected to hygrothermal loads is investigated using the finite element (FE) method. A FE formulation is derived using the principle of total potential energy and linear coupled constitutive equations of MEE materials by taking into account the thermal and hygroscopic field effects. A uniform temperature rise and moisture concentration rise has been considered. The variations of static parameters are estimated along the MEE plate length by considering the temperature and moisture dependant elastic stiffness coefficients. The coupled FE equilibrium equations in terms of displacements, electric and magnetic potentials are solved directly using condensation procedure. Numerical examples of the FE results are presented and discussed in detail to understand the significant effects of hygrothermal loading, temperature and moisture dependent material properties, boundary conditions and aspect ratio on the direct (displacements, electric potential and magnetic potential) and derived quantities (stresses, electric displacement and magnetic flux density) of MEE plate.

***Keywords*:** hygro-thermo-magneto-electro-elastic; hygrothermal field; moisture; empirical constants; temperature; MEE

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