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Stroh formalism in evaluation of 3D Green's function in thermomagnetoelectroelastic anisotropic medium

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Highlights

- We consider a thermomagnetoelectroelastic Green's function.
- We apply Stroh formalism to reduce it to the improper integral.
- We use residue calculus to evaluate this integral.

Abstract

The paper presents studies on the Green's function for thermomagnetoelectroelastic medium and its reduction to the contour integral. Based on the previous studies the thermomagnetoelectroelastic Green's function is presented as a surface integral over a half-sphere. The latter is then reduced to the double integral, which inner integral is evaluated explicitly using the complex variable calculus and the Stroh formalism. Thus, the Green's function is reduced to the contour integral. Since the latter is evaluated over the period of the integrand, the paper proposes to use trapezoid rule for its numerical evaluation with exponential convergence. Several numerical examples are presented, which shows efficiency of the proposed approach for evaluation of Green's function in thermomagnetoelectroelastic anisotropic solids.

Keywords: thermomagnetoelectroelastic, anisotropic, Stroh formalism, Green's function.

1. Introduction

Modern smart structures often incorporate materials, which can couple different fields, thus allowing energy transformation or serving as sensors and actuators. Thermomagnetoelectroelastic (TMEE) composites are those, which couple thermal, magnetic, electric and mechanical fields. They are widely used in smart structures, micro-electro-mechanical systems etc. This raises broad scientific attention to experimental [1] and theoretical [2] studies on the behavior of these multifield materials.

Particular theoretical interest is paid to the Green's functions, since the latter are the powerful tool in derivation of the solutions for complex problems by means of integral equation approaches [3]. There is a wide range of publications concerning Green's functions in anisotropic elastic, piezoelectric and magnetoelectroelastic solids. Hou et al. [4] obtained 3D Green's functions for transversely isotropic magnetoelectroelastic media for point force, point charge and magnetic monopole for all cases of distinct and multiple eigenvalues. Wang and Shen [5] presented the general solution of 3D magnetoelectroelasticity in terms of the five potential harmonic functions and obtained Green's functions for infinite space and half-space. Pan and Yuan [6] presented three-dimensional Green's function for anisotropic bimaterials. Pan and Chen [7] derived Green's functions for transversely isotropic and generally anisotropic magnetoelectroelastic space, half-space and bimaterial. Buroni and Sáez [8] presented the Radon – Stroh formalism in