Accepted Manuscript

Static response of a layered magneto-electro-elastic half-space structure under circular surface loading

Jiangyi Chen , Junhong Guo

PII: S0894-9166(17)30090-3
DOI: 10.1016/j.camss.2017.03.003
Reference: CAMSS 15

To appear in: *Acta Mechanica Solida Sinica*

Please cite this article as: Jiangyi Chen , Junhong Guo , Static response of a layered magneto-electro-elastic half-space structure under circular surface loading, *Acta Mechanica Solida Sinica* (2017), doi: 10.1016/j.camss.2017.03.003

Static response of a layered magneto-electro-elastic half-space structure under circular surface loading

Jiangyi Chen[a], Junhong Guo[b]

(a. School of Mechanical Engineering, Zhengzhou University, Zhengzhou 450001, China)
(b. Department of Mechanics, Inner Mongolia University of Technology, Hohhot, 010051, China)

Abstract: A cylindrical system of vector functions, the stiffness matrix method and the corresponding recursive algorithm are proposed to investigate the static response of transversely isotropic, layered magneto-electro-elastic (MEE) structures over a homogeneous half-space substrate subjected to circular surface loading. In terms of the system of vector functions, we expand the extended displacement and stresses, and deduce two sets of ordinary differential equations, which are related to the expansion coefficients. The solution to one of the two sets of these ordinary differential equations can be evaluated by using the stiffness matrix method and the corresponding recursive algorithm. These expansion coefficients are then integrated by adaptive Gaussian quadrature to obtain the displacements and stresses in the physical domain. Two types of surface loads, mechanical pressure and electric loading, are considered in the numerical examples. The calculated results show that the proposed technique is stable and effective in analyzing the layered half-space MEE structures under surface loading.

Key words: Magneto-electro-elastic Material; Layered and Half-Space Structure; Stiffness Matrix Method; Surface Loading

1. Introduction

Solving the problem of surface loading over layered structures is very meaningful work in various engineering applications. The static deformation in elastic layered structures induced by surface loading was discussed in many early publications. Related techniques on this area were introduced in the literature[1-3]. For example, Singh[1] solved this problem using the propagator matrix method and the generalized Love's strain potential. Pan[3] also investigated a similar problem by employing the propagator matrix method and expansion of vector functions in the Cartesian and cylindrical systems. Due to their powerful ability of converting one type of energy into another (among the magnetic, electric, and mechanical fields), the MEE materials and structures have shown widely potential applications in smart actuators and sensors[4]. For instance,