Influence of Inhomogeneity and Initial Stress on the Transient Magneto-Thermo-Visco-Elastic Stress Waves in an Anisotropic Solid

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Abstract

The object of the present paper is to study the transient magneto-thermo-visco-elastic stresses in a non-ho- mogeneous anisotropic solid under initial stress. The system of fundamental equations is solved by means of a dual reciprocity boundary element method (DRBEM). In the case of plane deformation, a numerical scheme for the implementation of the method is presented and the numerical computations are presented graphically to show the effects of initial stress and inhomogeneity on the displacement components and thermal stress components.

Keywords: *Magneto-Thermoviscoelastic Stresses; Initial Stress, Inhomogeneity; Anisotropic; Dual Reciprocity Boundary Element Method*

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A Time-Stepping DRBEM for Magneto Thermo-Viscoelastic Interactions in a Rotating Nonhomogeneous Anisotropic Solid

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Abstract

A numerical model based on the dual reciprocity boundary element method (DRBEM) for studying the transient magneto-thermo-viscoelastic stresses in a nonhomogeneous anisotropic solid subjected to a heat source is presented. The formulation is tested through its application to the problem of a solid placed in a constant primary magnetic field acting in the direction of the z-axis and rotating about this axis with a constant angular velocity. In the case of plane deformation, a numerical scheme for the implementation of the method is presented and the numerical computations are carried out for the temperature, displacement components and stress components. The validity of DRBEM is examined by considering a magneto-thermo-viscoelastic solid occupies a rectangular region and good agreement is obtained with existent results. The results obtained are presented graphically to show the effects of inhomogeneity and heat source on the temperature, displacement components and thermal stress components.

Keywords: *Magneto-thermo-viscoelasticity; rotation; inhomogeneity; heat source; dual reciprocity boundary element method.*

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Transient Magneto-Thermoviscoelastic Plane Waves in a Non-homogeneous Anisotropic Thick Strip Subjected to a Moving Heat Source

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Abstract

The aim of this paper is to study the transient wave propagations in a non-homogeneous anisotropic thermoviscoelastic thick strip placed in a constant primary magnetic field and subjected to a moving heat source. The governing equations for temperature and displacement fields are solved by means of a dual reciprocity boundary element method (DRBEM). In the case of plane deformation, a numerical scheme for the implementation of the method is presented and the numerical computations are carried out for the temperature, displacement components and thermal stress components. The validity of DRBEM is examined by considering a magneto-thermo-visco-elastic thick strip occupies a rectangular region and good agreement is obtained with existent results. The results obtained are presented graphically to show the effect of inhomogeneity on the displacement components and thermal stress components. Relevant results of previous investigations are deduced as special cases from this study.

Keywords: ***Magneto-thermoviscoelastic waves; Heat source; Inhomogeneity; Anisotropic; Dual reciprocity boundary element method***

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A Time-Stepping DRBEM for the Transient Magneto-Thermo-Visco-Elastic Stresses in a Rotating Non-Homogeneous Anisotropic Solid

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The main objective of this paper is to study the transient magneto-thermo-visco-elastic stresses in a non-homogeneous anisotropic solid placed in a constant primary magnetic field acting in the direction of the z-axis and rotating about it with a constant angular velocity. The system of fundamental equations is solved by means of a dual-reciprocity boundary element method (DRBEM). In the case of plane deformation, a numerical scheme for the implementation of the method is presented and the numerical computations are carried out for the temperature, displacement components and thermal stress components. The validity of DRBEM is examined by considering a magneto-thermo-visco-elastic solid occupies a rectangular region and good agreement is obtained with the results obtained by other methods. The results obtained are presented graphically to show the effect of inhomogeneity on the displacement components and thermal stress components.

Keywords: *Magneto-thermoviscoelastic stresses; Rotation; Inhomogeneity; Anisotropic; Dual reciprocity boundary element method*

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Transient Magneto-Thermo-Elastic Stresses in an Anisotropic Viscoelastic Solid With and Without a Moving Heat Source

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Abstract

The main purpose of this article is to study the effect of a moving heat source on the transient magneto-thermo-visco-elastic stresses in a nonhomogeneous anisotropic solid. The system of fundamental equations is solved by means of a dual reciprocity boundary element method (DRBEM). In the case of plane deformation, a numerical scheme for the implementation of the method is presented and the numerical computations are carried out for the temperature, displacement components, and thermal stress components. The validity of DRBEM is examined by considering a magneto-thermo-visco-elastic solid occupies a rectangular region and excellent agreement is obtained with existent results. The results obtained are presented graphically to show the effect of moving heat source on the displacement components and thermal stress components.

Keywords: *Stresses;Anisotropic; Viscoelastic solid; Heat source; Dual reciprocity boundary element method*

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Transient Magneto-Thermo-Viscoelastic Stresses in a Rotating Nonhomogeneous Anisotropic Solid with and without a Moving Heat Source

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Abstract

Transient magneto-thermo-viscoelastic stresses in a nonhomogeneous anisotropic solid with and without a moving heat source under rotation are studied. The system of fundamental equations is solved by means of the dual reciprocity boundary element method (DRBEM). In the case of plane deformation, a numerical scheme for the implementation of the method is presented, and the numerical computations are carried out for the temperature, displacement components, and thermal stress components. The validity of the DRBEM is examined by considering a magneto-thermo-viscoelastic solid that occupies a rectangular region, and good agreement with the existent results is obtained. The results indicate that the effects of a moving heat source and rotation are very pronounced.

Keywords: *magneto-thermo-viscoelastic stress; rotation; inhomogeneity; anisotropy; dual reciprocity boundary element method.*

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Numerical Modeling of Transient Magneto-Thermo-Viscoelastic Waves in a Rotating Nonhomogeneous Anisotropic Solid Under Initial Stress

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Abstract

A numerical model based on the dual-reciprocity boundary element method (DRBEM) for studying the transient magneto-thermo-viscoelastic waves in a rotating nonhomogeneous anisotropic solid is presented. The formulation is tested through its application to the problem of an initially stressed solid placed in a constant primary magnetic field acting in the direction of the z-axis and rotating about this axis with a constant angular velocity. In the case of plane deformation, a numerical scheme for the implementation of the method is presented and the numerical computations are carried out for the temperature, displacement components and thermal stress components. The validity of DRBEM is examined by considering a magneto-thermo-viscoelastic solid occupies a rectangular region and good agreement is obtained with existent results. The results obtained are presented graphically to show the influence of initial stress on the displacement components and thermal stress components.

Keywords: *Magneto-thermo-viscoelastic stresses; rotation; inhomogeneity; anisotropic; dual reciprocity boundary element method.*

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The Effect of Rotation and Inhomogeneity on the Transient Magneto-Thermoviscoelastic Stresses in an Anisotropic Solid

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Abstract

The main objective of this paper is to study the transient magneto-thermoviscoelastic stresses in a nonhomogeneous anisotropic solid placed in a constant primary magnetic field acting in the direction of the z-axis and rotating about it with a constant angular velocity. The system of fundamental equations is solved by means of a dual-reciprocity boundary element method (DRBEM). The results indicate that the effects of inhomogeneity and rotation are very pronounced.

Keywords: magneto-thermoviscoelastic stresses; rotation; inhomogeneity; anisotropic; dual reciprocity boundary element method.

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Implicit–explicit time integration DRBEM for generalized magneto-thermoelasticity problems of rotating anisotropic viscoelastic functionally graded solids

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A numerical computer model based on the dual reciprocity boundary element method (DRBEM) is extended to study the generalized theories of magneto-thermoelasticity problems in a rotating anisotropic viscoelastic functionally graded solid placed in a constant primary magnetic field acting in the direction of the z-axis and rotating about this axis with a constant angular velocity. In the case of plane deformation, a predictor–corrector implicit–explicit time integration algorithm was developed and implemented for use with the DRBEM to obtain the solution for the displacement and temperature fields in the context of the Green and Naghdi theory of type III. A comparison of the results is presented graphically in the absence and presence of magnetic field. Numerical results that demonstrate the validity of the proposed method are also presented graphically.

Keywords: *Magneto-thermoelasticity; Rotation; Functionally graded material; Anisotropic; Dual reciprocity boundary element method*

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A Three-Dimensional Generalized Magneto-Thermo-Viscoelastic Problem of a Rotating Functionally Graded Anisotropic Solids with and without Energy Dissipation

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Abstract

A numerical model based on the dual reciprocity boundary element method (DRBEM) is extended to study the generalized magneto-thermo-viscoelastic problem in a rotating solid of functionally graded material (FGM) in the context of the Green and Naghdi theory of type III. The material properties of the solid have a gradient in the thickness direction and are anisotropic in the plane of the solid. An implicit-implicit staggered strategy was developed and implemented for use with the DRBEM to obtain a solution for the displacement and temperature fields. The accuracy of the proposed method was examined and confirmed by comparing the obtained results with those known previously. In the case of three-dimensional, a numerical scheme for the implementation of the method is presented and the numerical computations are presented graphically to show the effect of the energy dissipation on the temperature and displacement components.

Keywords: *generalized magneto-thermo-viscoelastic problem; rotation; functionally graded anisotropic solids; energy dissipation dual reciprocity boundary element method.*

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Generalized Magneto-Thermo-Viscoelastic Problems of Rotating Functionally Graded Anisotropic Plates by the Dual Reciprocity Boundary Element Method

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A numerical model based on the dual reciprocity boundary element method (DRBEM) is extended to study the generalized theories of magneto-thermo-viscoelasticity in a rotating plate of functionally graded material (FGM). The material properties of the FGM plate have a gradient in the thickness direction. and are anisotropic in the plane of the plate. In the case of plane deformation, an implicit-implicit staggered scheme was proposed and implemented for use with the DRBEM to obtain the solution for the displacement and temperature fields. A comparison of the results for different theories of magneto-thermo-viscoelasticity is presented graphically. Numerical results that demonstrate the validity of the proposed method are also presented graphically.

Keywords: *Anisotropic; Dual reciprocity boundary element method; Functionally graded material; Generalized magneto-thermo-viscoelasticity; Rotation*

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