Influence of Initial Stresses and Piezoelectric Constants on the Propagation Bulk Acoustic Waves in an Anisotropic Smart Material (Aluminum Nitrite)
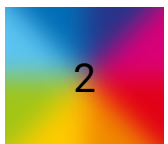
Authors: Abd-alla, Abo-el-nour N[1]; Alshaikh, Fatimah[1]; Mechai, Idir[1]; Abbas, I. A[2]

2

••• Abstract | 🔖 References | 99 Citations | ☰ Supplementary Data | ◓ Article Media | 📈 Metrics

➕ Suggestions

The aim of this paper is to illustrate the effect of initial stresses on the propagation of plane waves in a general anisotropic elastic medium. Therefore, an analytical analysis supported by numerical tests to calculate the bulk acoustic wave propagation in Aluminum Nitrite (AlN) as piezoelectric hexagonal elastic material has been presented. In addition, the Christoffel's equation has been solved and the corresponding eigenvalues and eigenvectors have been obtained. Then, an explicit expressions of the waves propagation with three distinct phase velocities in anisotropic piezoelectric material including the effect of the initial stresses have been derived. The three velocities of bulk acoustic waves (BAW) which are called quasi-longitudinal, quasi-shear vertical and quasi-shear horizontal for Aluminum Nitrite are numerically calculated. The numerical examples are considered to illustrate graphically the effect of initial stresses on the variations of velocities of the BAW versus the angle of the propagation. The velocities of BAW change significantly with initial stresses as well as piezoelectric constants. This research is theoretically useful in signal processing, sound system, wireless communication and for the design of surface acoustic wave (SAW) devices with high performance.

More about this publication?

We recommend

Identification of Acoustics Microwaves (Bulk Acoustic Waves) in Piezoelectric Substrate (LiNbO3 Cut Y–Z) by Classification Using Neural Network

Authors: Hichem et al., Journal of Nanoelectronics and Optoelectronics

The Frequency Equations for Shear Horizontal Waves in Semiconductor/Piezoelectric Structures Under the Influence of Initial Stress

Abd-alla, Abo-el-nour N et al., Journal of Computational and Theoretical Nanoscience

The Influence of Piezoelectric and Electromagnetic Effects on the Propagation of Rayleigh Surface Waves in Smart Material

Abd-Alla, Abo-El-Nour N et al., Journal of Computational and Theoretical Nanoscience

The Mathematical Model of Reflection and Refraction of Plane Quasi-Vertical Transverse Waves at Interface Nano-Composite Smart Material

Abd-alla, Abo-el-nour N. et al., Journal of Computational and Theoretical Nanoscience

Effect of Initial Stress, Rotation and Gravity on Propagation of the Surface Waves in Fibre-Reinforced Anisotropic Solid Elastic Media

Abd-Alla, A. M. et al., Journal of Computational and Theoretical Nanoscience

Chemistry and Mineralogy of Earth's Mantle. Hexagonal Na0.41[Na0.125Mg0.79Al0.085]2[Al0.79Si0.21]6O12 (NAL phase): Crystal structure refinement and elasticity

Martha G. Pamato et al., American Mineralogist

Structure and elasticity of MgO at high pressure

B.B. Karki et al., American Mineralogist

Potential of acoustic emissions from three point bending tests as rock failure precursors

AgioutantisZ.a, International Journal of Mining Science and Technology

Analysis of Smart Piezo-Magneto-Thermo-Elastic Composite and Reinforced Plates: Part II – Applications
D. A. Hadjiloizi et al., Curved and Layered Structures

Analysis of Smart Piezo-Magneto-Thermo-Elastic Composite and Reinforced Plates: Part I – Model Development
D. A. Hadjiloizi et al., Curved and Layered Structures