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N. A. Ispulov

RESEARCH OF PHYSICAL AND MECHANICAL PROCESSES OF THE PROPAGATION OF THERMOELASTIC WAVES IN ANISOTROPIC MEDIA

Monograph

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Reviewers:

M. E. Abishev - doctor of physical and mathematical sciences, professor, Al-Farabi Kazakh National University, Academician of the NAS of the Republic of Kazakhstan;

T. B. Duishenaliev - doctor of physical and mathematical sciences, professor, National Research Moscow Power Engineering Institute;

A. Zh. Zhumabekov - PhD of physics, assoc. professor of Toraighyrov University.

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The monograph uses the matricant method to explore the propagation of thermoelastic waves in anisotropic media across various symmetry classes.

This work will be valuable to students, master's and doctoral candidates specializing in "Physics" and "Mechanics," as well as to research institutions in geophysics and seismology, particularly in addressing issues related to wave phenomena in anisotropic thermoelastic media.

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Introduction. Literature review. Scientific novelty, purpose, method, object and practical significance of the research

This work explores theoretical aspects of the fundamental patterns governing thermoelastic wave propagation in anisotropic media across all crystal symmetries.

The research uses the analytical matrix method to thoroughly examine the propagation behavior of thermoelastic waves in these complex media. By deriving a system of first-order differential equations with variable coefficients from the closed system of thermoelasticity equations, the work provides a mathematical framework for understanding wave phenomena in anisotropic materials.

The research develops coefficient matrices for anisotropic media belonging to the cubic, hexagonal, tetragonal, orthorhombic, monoclinic, and triclinic syngonies, considering different scenarios such as volumetric, planar, and one-dimensional wave propagation. This comprehensive analysis enables a deeper understanding of the unique wave behaviors in materials with various symmetries.

This research provides an in-depth examination of coefficient matrices, uncovering the mechanisms of interaction between waves of different polarizations and illustrating how waves with distinct properties influence each other. The fundamental solutions to the system of first-order differential equations describing thermoelastic wave propagation in anisotropic media are systematically developed, forming a robust basis for subsequent investigations.

Additionally, this research derives dispersion equations for elastic and thermoelastic waves in infinite periodic structures, contributing to a deeper understanding of wave behavior in complex periodic systems. It also explores the interdependence of wave velocities, attenuation coefficients, and frequencies for coupled thermoelastic waves, demonstrating how these properties are affected by the medium's characteristics. Graphical illustrations of these dependencies, depicting variations in wave velocities and attenuation coefficients with frequency as material parameters change, provide a clear and intuitive visualization of the associated physical phenomena.

Moreover, the monograph delves into the reflection and refraction of waves at the boundary between homogeneous anisotropic thermoelastic media, focusing particularly on scenarios involving coefficient matrices of the fourth order. This provides important insights into wave behavior at boundaries and interfaces, which is crucial for practical applications in materials science, geophysics, and other fields.

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