

MATHEMATICAL PROBLEMS OF GENERALIZED THERMO-ELECTRO-MAGNETO-ELASTICITY THEORY

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The presentation is dedicated to the theoretical investigation of basic, mixed and crack type three-dimensional initial-boundary value problems of the generalized thermo-electro-magneto-elasticity theory associated with Green-Lindsay's model.

The essential feature of the generalized model under consideration is that heat propagation has a finite speed.

We analyze dynamical initial-boundary value problems and the corresponding boundary value problems of pseudo-oscillations which are obtained from the dynamical problems by the Laplace transform.

The dynamical system of partial differential equations generate a nonstandard 6×6 matrix differential operator of second order, while the system of partial differential equations of pseudo-oscillations generates a second order strongly elliptic formally non-selfadjoint matrix differential operator depending on a complex parameter.

First we prove uniqueness theorems of dynamical initial-boundary value problems under reasonable restrictions on material parameters and afterwards we apply the Laplace transform technique to investigate the existence of solutions.

This approach reduces the dynamical problems to the corresponding elliptic problems for pseudo-oscillation equations.

The fundamental matrix of the differential operator of pseudo-oscillations is constructed explicitly by the Fourier transform technique, and its properties near the origin and at infinity are established.

By the potential method the corresponding three-dimensional basic, mixed and crack type boundary value problems and the transmission problems for composite elastic structures are reduced to the equivalent systems of boundary pseudodifferential equations.

The solvability of the resulting boundary pseudodifferential equations are analyzed in appropriate Sobolev-Slobodetskii, Bessel potential, and Besov spaces and the corresponding

uniqueness and existence theorems of solutions to the boundary value problems under consideration are proved.

The smoothness properties and singularities of thermo-mechanical and electro-magnetic fields are investigated near the crack edges and the curves where the different types of boundary conditions collide.

It is shown that the smoothness and stress singularity exponents essentially depend on the material parameters and an efficient method for their computation is described.

By the inverse Laplace transform the solutions of the original dynamical initial-boundary value problems are constructed and their smoothness and asymptotic properties are analyzed in detail.