DYNAMICAL TRANSMISSION PROBLEMS FOR MULTI-FIELD MULTI-COMPONENT ELASTIC STRUCTURES CONTAINING INTERFACIAL CRACKS

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We investigate multi-field mixed dynamical problems for complex multi-layer elastic anisotropic structures containing interfacial cracks when in different adjacent components of the composed body different refined models of elasticity theory are considered. In particular, we analyse the case when we have the generalized thermo-electro-magneto elasticity model (GTEME model) in one region of the composed body and the generalized thermo-elasticity model (GTE model) in another adjacent region. Both models are associated with Green-Lindsay's model [1], [2]. This type of mechanical problem mathematically is described by systems of partial differential equations with appropriate boundary-transmission and initial conditions. In the GTEME model part we have six dimensional unknown physical field (three components of the displacement vector, electric potential function, magnetic potential function, and temperature distribution function), while in the GTE model part we have four dimensional unknown physical field (three components of the displacement vector and temperature distribution function). The diversity in dimensions of the interacting physical fields complicates mathematical formulation and analysis of the corresponding initial-boundary-transmission problems. We apply the Laplace transform technique, the potential method and the theory of pseudodifferential equations to prove uniqueness and existence theorems of solutions to different type basic and mixed initial-boundary-transmission problems in appropriate Sobolev spaces [2], [3]. We analyse the smoothness properties of solutions and establish asymptotic behaviour of the first derivatives near the exceptional curves (the crack edges and curves where different boundary conditions collide). It is shown that smoothness of solutions and stress singularity exponents at the exceptional curves essentially depend on the material parameters of the composed body. Moreover, we describe an efficient algorithm for evaluating the stress singularity exponents.

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