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两微极磁热弹性固体分界面上波的反射与折射

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摘要 给出了磁场、热场和弹性场多场耦合作用下微极广义热弹性固体的一般控制方程. 该方程既包含了磁场、热场和弹性场的耦合作用, 又在其广义热传导方程中涵盖了耦合热弹理论 (C-D)及其5类推广(L-S理论, G-L理论, G-N(II, III)理论和C-T理论). 运用该微极广义磁热弹性控制方程, 研究了在定常磁场作用下, 具有均匀初始温度的两理想接触微极弹性介质平面分界面上磁热弹性波的反射和折射现象. 给出了分别在缺少磁场、热场作用或不同广义热传导理论下反射或折射热波、纵向位移波、耦合横向和微旋转波与入射纵向位移波的振幅比随入射角变化的关系曲线. 对缺少磁、热和微极性以及热松弛时间时对应的反射、折射系数进行了对比. 结果表明磁、热和微极性以及热松弛时间对振幅比均有不同程度的影响, 与磁、热和微极性一样, 热松弛时间对不同类型波的影响能力差别明显, 但对同一类型的反射波和折射波的影响相似.

关键词 微极广义磁热弹性,纵向位移波,耦合横向和微旋转波,反射,折射,振幅比,热松弛时间

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Reflection and refraction of longitudinal displacement wave at an interface between two different micropolar magneto-thermoelastic solid in welded contact

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Abstract

The general governing equations of micropolar generalized magneto-thermoelasticitic solid affected by multi-physical field,such as magnetic field ,thermal field and elastic field,are presented in this paper. The magnetic effect, thermal effect and mechanical effect are included in the general equations. Also the coupled thermalelasticity and its five extended theories are in its generalized heat conduction equation. The five extended theories are the Lord-Shulman theory with one relaxation time (L-S), the Green-Lindsay theory with two relaxation times(G-L), the Green-Naghdi theories of type II(without energy dissipation,G-N II) and of type III(G-N III),and the Chandrasekharaiah and Tzou theory(dual-phase-lag,C-T). Using this general governing equations, the reflection and refraction at the plane interface of two-welded semi-infinte micropolar elastic solid are studied for incident longitudinal displacement wave in the presence of a constant magnetic field and an uniform initial temperature field. Using continuous conditions at the interface, the amplitude ratios of reflected and/or refracted thermal wave,longitudinal displacement wave(LD wave) and coupled transverse and microrotational wave(CD I and CD II) to incident LD wave are studied and described graphically with the incident angle,which variates from 0 degree to 90 degree. The thermal effect, the magnetic effect and the affection of thermal relaxation on them are discussed. The numerical results show that all reflected and refracted waves are affected by thermal field, magnetic field and thermal relaxtion. And there is a striking discrepancy between different type wave for thermal effect, such as that for the effect of magnetic field or thermal relaxtion,but it is similar for reflected and refracted waves of the same type.

Key words micropolar generalized magneto-thermoelasticity longitudinal displacement wave coupled transverse and microrotational wave reflection refraction amplitude ratio thermal relaxation time

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