

Exact solution of a boundary-value problem for a rectangular checkerboard field

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Abstract

A class of two-phase composite materials with a biperiodic structure is investigated by the methods of complex analysis. Two interface conditions - continuity of normal component of a desired vector w and tangential component of pw at the contact boundary as well as the double-periodicity condition - are involved in rigorous form. The exact analytic solution of the corresponding generalized Riemann boundary value problem is obtained. The explicit values of the effective parameters, namely effective resistivity and dissipation of energy of an elementary cell and resistivities along the symmetry axes are calculated in closed analytic form. The coincidence of our formulae with the well-known effective resistivity (conductivity) formula of Keller (1964), Dykhne (1970) and Mendelson (1975) and the dissipation formula of Dykhne (1970) is shown in the case of square checkerboard field. The Keller (1963) identity is generalized for the heterogeneous structure studied. © 1996 The Royal Society.
