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A GENERALIZATION OF THE VOIGT-REUSS BOUNDS FOR A BINARY MEDIUM

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In the present note a certain generalization of the well-known Voigt-Reuss bounds on the effective conductivity κ^* of a binary medium is proposed. For a fixed binary constitution the scalar function $f(\alpha)$ that gives the undimensional effective conductivity as a function of the ratio α of the constituents conductivities is considered. Certain inequalities for the derivative $f'(\alpha)$ of this function, which include α, $f(\alpha)$ and the volume fractions of the constituents, are derived. The inequalities are sharp if these fractions are solely known. More precisely, they turn into equalities for the familiar laminate media loaded along and across the layers. The Voigt and Reuss bounds on κ^* follow from the proposed inequalities, but the latter are stronger than the former bounds, since estimates are put here on the rate at which the effective conductivity changes when the constituents properties are varied at a fixed binary constitution of the medium. It is in this sense, namely, when it is claimed that our inequalities generalize the Voigt-Reuss bounds.

Keywords: random two-phase media, variances, effective properties, bounds on the effective conductivity

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