Bounding Elastic Constants of an Orthotropic Polycrystal using Measurements of the Microstructure

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Abstract

We show how information about the elastic stiffness and compliance of an orthotropic polycrystal may be obtained from measurements of the statistical properties of the microstructure. We begin by discussing the statistical properties of the governing equations and the hierarchy that results when the equations are averaged. Perturbation solutions are obtained in terms of low-order statistical information. Using methods previously developed, we derive bounds for the elastic stiffnesses and compliances. A hierarchy of bounds is derived using the statistical information obtained from measurement of the microstructure. We discuss the methods used to obtain the the correlation functions of the microstructure and provide a specific example, using data obtained from a copper sample.