Development of a three-dimensional volume integral equation method

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Abstract

A three-dimensional volume integral equation method (VIEM) is applied for the analysis of elastostatic problems in an unbounded isotropic matrix containing multiple anisotropic inclusions. It should be noted that this numerical method does not require the use of the Green's function for the anisotropic inclusion - only the Green's function for the unbounded isotropic matrix is needed. A detailed analysis of stress field at the interface between the isotropic matrix and the central orthotropic inclusion is carried out for simple cubic packing arrangements of multiple spherical inclusions. The effects of multiple orthotropic spherical inclusions on the stress field at the interface between the matrix and the central inclusion are investigated. The accuracy of the volume integral equation method for the interfacial stress field is compared by the finite element method (FEM). The VIEM is shown to be very accurate and efficient for solving general three-dimensional elastostatic and elastodynamic problems involving multiple anisotropic inclusions whose shape and number are arbitrary.

Keywords: Volume integral equation method, Multiple orthotropic spherical inclusions, Finite element method, Multiple anisotropic inclusions of arbitrary shapes, Boundary integral equation method

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