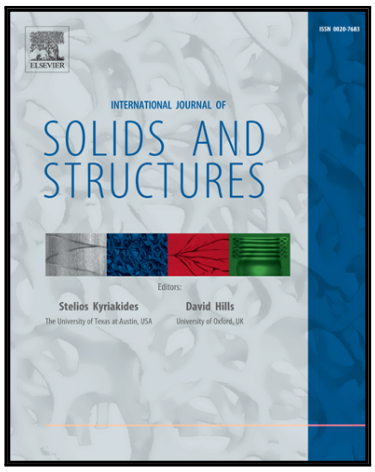

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Analytical solutions for the elastic fields caused by eigenstrains in two frictionlessly joined half-spaces

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Abstract

Analytical solutions to the elastic fields induced by eigenstrains, such as plastic strains, in materials subjected to different types of joints are important for developing numerical simulations of advanced materials. This paper reports the derivation of a set of explicit integral kernels for the eigenstrain-induced elastic fields in two frictionlessly joined half-space solids or bi-materials. The elastic responses caused by arbitrary inclusions inside one of the two joined half-spaces are solved for the cases of known Galerkin vectors for the inclusion in the half-space solid. By discretizing the arbitrarily shaped single or multiple inclusions into a number of small elementary cuboids, the entire elastic response to the inclusions can be obtained through summation of the contributions from all elements with the assistance of the fast Fourier transform algorithms for convolution or correlation involved in the solutions. Cases for the elastic fields which subjected to a cuboidal, and a spherical, as well as multiple cuboidal inclusions are analyzed; and key results compared with the corresponding results for perfectly bonded half spaces. The phenomenon of probable interface separation associated with frictionless interfacial condition is further discussed.

Keywords: Micromechanics, inclusion, frictionlessly joined half-spaces, and fast Fourier transform (FFT)