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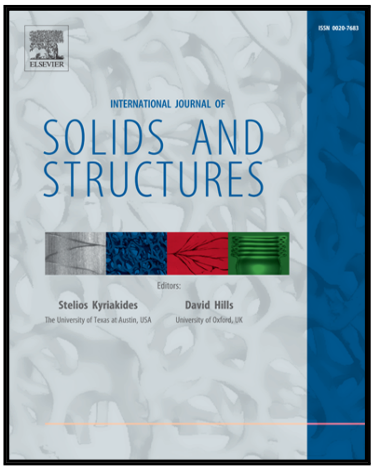

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Advanced Methods for Calculating Green's Function and Its Derivatives for Three-Dimensional Anisotropic Elastic Solids*

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Abstract

Three advanced methods are presented for constructing and evaluating Green's function and its derivatives for three-dimensional anisotropic elastic solids. The first one is obtained from a line integral followed by Cauchy's residue theorem, and expressed in terms of Stroh's eigenvalues. The second one is obtained by using the explicit solutions of Stroh's eigenvector matrix available in two-dimensional anisotropic elasticity. Whereas the last one is derived from the solution obtained from 2D Radon transform, and expressed in terms of the fundamental elasticity matrix in vertical planes, which makes the derivatives simpler than those obtained from the line integral operated on an oblique plane. The novelty of the first two methods lies in the construction and computation of the first and second derivatives of the Green's function, though the Green's function itself in the first two methods is rather known. In contrast, the third method is quite new for both the Green's function itself and its first and second derivatives. The advantages and disadvantages of these three solution methods are investigated and discussed through their derivations and numerical implementation for isotropic, transversely isotropic, and fully anisotropic elastic solids. Good agreement among the results calculated by these three methods is shown in all numerical examples. Among these three methods, the last one is proved to be the most efficient one.

Keywords: Green's function, Derivatives, Anisotropic elasticity, Three-dimensional problems, Stroh's formalism

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* This paper is dedicated to Professor Jan D. Achenbach, Northwestern University, USA, on the occasion of his 80th birthday.
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