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Inclusion Dispersion: Effects on Stress and Effective Properties

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A 3D stress analysis method based on Mura's eigenstrains and Eshelby's equivalency principle is proposed. Multiple inclusion interaction is considered, thus the eigenstrains in each inclusion are no longer uniform. The multiple inclusion problem is solved from the governing elasticity equations to give a set of coupled singular integral equations in the unknown eigenstrains of each inclusion. The set of coupled singular integral equations are solved using numerical integration, to give the unknown eigenstrains. For illustrative purposes the inclusions are dispersed in a regular cubic arrangement with 27 inclusions. 4 different inclusion separation distances are considered and in each of the 4 situations 3 different inclusion stiffnesses are considered. The stresses from the analysis are seen to be highly influenced by inclusion separation. It is found that the center inclusion is shielded by the other inclusions and this shielding effect displays a local minimum as the separation distance changes.

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