ACOUSTICS2008/2179
A new integral equation method for elastic composites

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A new integral equation approach to elastodynamic homogenization has been proposed [1] to determine the effective properties of periodic fibre reinforced composite materials in the case of SH wave propagation. When all the fibres are aligned in the same direction and considered infinite in extent, the microstructure is two-dimensional.
The integral equation method is based on Navier's equations of elasticity in integral equation form, and uses the notion of separation of scales and averaging to find explicit expressions for the effective properties in a convenient form.
Here we discuss an extension to the in-plane problem: the response of periodic fibre reinforced composites to time harmonic (low frequency) P/SV wave propagation. For simplicity, we assume all fibres are identical and of circular cross-section, and that both host and fibre phases are isotropic; additionally we restrict attention to lattice geometries which result in, at most, orthotropic elastic symmetry. The governing equations are presented and the effective quasi-static material properties are determined via the integral equation methodology. Results are presented for the effective material properties and compared with existing methods.
[1] W.J. Parnell and I.D. Abrahams. "A new integral equation approach to elastodynamic homogenization". Submitted to Proc. Roy. Soc. A, 2007.