Application of Houston's Method to the Calculation of the Direction-Dependent Thermal Conductivity in Finite Crystals at Low Temperatures

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This paper presents significant advances in the analytical calculation of the low-temperature lattice thermal conductivity in finite crystals. It shows that an accurate prediction of the direction-dependent lattice thermal conductivity can be obtained at low temperatures when Houston's method is used to account for the anisotropy of the Brillouin zone in the calculation of the phonon spectrum. It also provides an approach to predict from a spatial-dependent Boltzmann equation the rate at which phonons are scattered by the sample boundary in the presence of intrinsic scattering mechanisms, which is crucial for the calculation of the lattice thermal conductivity in finite crystals.