Homogenization and composite materials

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This project is divided in two complementary sub-projects. The first sub-project deals with the homogenization of partial differential equations, for instance the Stokes equation, in a periodic heterogeneous domain. This consists in finding equivalent, or effective, equations as the size of the heterogeneities tends to zero. The homogenization procedure leads us to composite materials the phases of which have been arranged with a specific geometry and prescribed volume fractions. The aim of the second sub-project is then to study the effective properties of composites and to possibly derive anomalous properties playing on the geometry and the contrast of the phases. This general setting will be applied to the study of the Burnett coefficients for two-phase composites in connection with waves propagation.

The objectives of the project are:

_ Homogenization of the Stokes equation in a periodic heterogeneous domain using the Bloch wave theory.

_ Derivation of possibly optimal bounds for the Burnett coefficients.

_ Construction (if possible) of a high-contrast composite for the change sign of the Burnett coefficients.