Applied Mathematics Seminar
INSCC 110, 3:30pm Monday
October 9, 2000

Partial differential microstructures

by

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Abstract

Many materials have microstructures with structure on widely separated length scales. It is sometimes mathematically convenient to consider microstructures with structure on infinitely many length scales each infinitely well separated from one another. In particular the differential scheme introduced by Bruggeman in 1935 corresponds to a microstructure where dilute concentrations of inclusions are added at successively larger length scales until one reaches a desired volume fraction. The effective tensor, governing the overall conductivity or elasticity of the material, satisfies an ordinary differential equation, with a continuous parameter t indexing the length scale. Here we introduce a class of microstructures where the effective tensor satisfies a partial differential equation. Such microstructures may be important in optimal design problems.