Abstract

Homogenization of Maxwell's Equations

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Abstract: If the typical spatial length scale in a heterogeneous material is much smaller than the wavelength of an electromagnetic field then the field can not resolve the fine scales. In numerical implementations the fine scales require a numerical mesh which is far too large for any computer. One way to take care of that problem is to homogenize the Maxwell equations, i.e. to find the effective material properties of the heterogeneous material. The effective properties correspond to a homogeneous material which is a good approximation of the heterogeneous material in the sense that the solutions of the homogenized equations are good approximations of the solutions of the original equations. The effective material properties are obtained by solving local problems on the unit cell and taking suitable averages. I will give examples of how the Maxwell equations can be homogenized, using two-scale convergence, in some linear and nonlinear cases. In particular I will address homogenization of varistor ceramics, nonlinear resistors used as devices for protection against surges in power lines.

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