ON THE HOMOGENIZATION OF MAXWELL'S EQUATIONS WITH SIGN-CHANGING COEFFICIENTS

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Abstract

In this presentation, we focus on the homogenization of Maxwell's equations in a composite medium containing small, periodically distributed inclusions made of a negative material, i.e., a material with negative permittivity and permeability. Due to the sign change of the coefficients, it is not straightforward to obtain uniform energy estimates and apply classical homogenization techniques. Our analysis is based on the study of two scalar problems for which we obtain a criterion based on the physical parameters guaranteeing the uniform invertibility of the associated operators as the size of the inclusions tends to zero. These results obtained for the scalar problems are then used to obtain uniform energy estimates for the Maxwell system. This requires resolving an additional difficulty related to the indefinite nature induced by the frequency term, which we achieve by obtaining a uniform compactness-type result.

The results presented are based on the common work in collaboration with Lucas Chesnel (Inria, Ensta Paris), Karim Ramdani (Inria Nancy) and Mahran Rihani (SNCF Réseaux).

References

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