DISPERSIVE EFFECTS FOR WAVE PROPAGATION IN PERIODIC MEDIA

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Résumé

I will review several works on dispersion phenomena for the propagation of waves in periodic media. Dispersion is classically defined as the phenomenon by which waves with different wavelengths propagate with different velocities. In practice, it induces severe deformations of the profile of the propagating waves in the long time limit. In periodic media and for "low frequency" waves, this effect was first described by Santosa and Symes in 1991 and mathematically analysed by Lamacz in 2011. Since then many further works on this topic have appeared, including numerical applications. In this "low frequency" setting, dispersion can be modelled by adding a fourth-order term in the homogenized equation. The corresponding fourth-order dispersive tensor is called Burnett tensor. In particular, I will discuss the numerical optimization of this tensor in order to minimize or maximize dispersion for an 8-fold symmetric two-phase composite. On the other hand, for "high frequency" waves (in resonance with the medium periodicity), dispersion is modelled by a new homogenized equation which is a Schr$^{\acute{}}${o}dinger equation. This effect appears for times longer than those for which geometric optics is the correct asymptotic regime. Therefore, there is a quite dramatic difference, as far as dispersion is concerned, between low and high frequencies. This is a review of several joint works with M. Briane, M. Palombaro, J. Rauch, M. Vanninathan and T. Yamada.

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