Extraordinary transmission through complex periodic structures

Agnès Maurel
Inst. Langevin,
1 rue Jussieu, Paris, France
Email: agnes.maurel@espci.fr

Simon Felix
LAUM, CNRS, Université du Maine,
av. O. Messiaen, Le Mans, France
Email: simon.felix@univ-lemans.fr

Jean-François Mercier
Poems, CNRS, ENSTA ParisTech,
828 bld des Maréchaux, Palaiseau, France
Email: jean-francois.mercier@ensta-paristech.fr

Broadband perfect transmission through sub-wavelength gratings is analyzed in terms of homogenized medium. The gratings consist in a periodic microstructure made of a penetrable material, say a dielectric structure; limiting cases include the Neumann case (hard material) and the non magnetic case (electromagnetic waves in dielectric material). The enhanced transmission of waves impinging at oblique incidence on such grating is shown to occur at an optimal angle depending on the contrasts between the grating material and the host medium, a limiting case being the already reported Brewster angle. The effect of the geometry of the grating is considered, revealing a strong dependence of the transmission spectrum on this parameter, beyond the usually considered filling fraction.