Reflection at the Boundary of Two Periodic Media: a Generic Approach Applicable to Metamaterials

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One of the central problems of metamaterials research is concerned with the incidence of a plane electromagnetic wave upon a periodic medium [1]. A particularly simple solution, by neglecting the transition layer and higher order modes, for the reflection coefficient has been recently obtained by Tretyakov [2] for the one-dimensional case. An alternative approach to reflection at the boundary of two two-dimensional periodic media consisting of coupled optical waveguides was presented by Syms [3] in the 1980s. His basic idea was to write the recursion equation across the boundary (taking two columns on each side), assume the solution in the form of an incident, a reflected and a transmitted waves and treat interaction between nearest neighbours only. The latter approach is adopted in the present paper to derive generic reflection and transmission coefficients valid for a variety of periodic media which can be described by the nearest neighbour approximation. To show the generality of the expressions examples are given for acoustic waves, plasma waves on nanoparticles (both longitudinal and transverse polarisations), waves on loaded dipoles (both in the axial and in the side-by-side configuration) and magnetoinductive waves on magnetically coupled resonant metamaterial elements (both axial and planar configurations). Potential applications will be discussed

REFERENCES

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