Wave Propagation in Metamaterial Multi-Layered Structures

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Abstract

Expressions have been given for the overall reflection and transmission coefficients of a multi-layered structure consisting of metamaterial and dielectric slabs. Small-reflection approximations have been discussed. Two applications have been proposed: anti-reflection coatings and high-reflection coatings. For the first application, a structure consisting of two slabs of the same width and opposite permittivities has been studied. If the structure is placed between two semi-infinite media of the same kind, the reflection vanish, while if these two media are different, the reflection depends only on their characteristics and on the angle of incidence. This device could be advantageously used as an antenna radome. For the second application, a structure consisting of a large number of identical pairs of slabs of high and low opposite permittivities and of the same widths, embedded in the same medium, has been studied. The transmittance variation with frequency of this structure shows no ripples, it has a large passband and a monotonous quasi-symmetric rise to the right and to the left of the central frequency. The distinctive feature of these devices is the weakening of the influence of the frequency, the angle of incidence or the polarization on the propagation processes.

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