Floquet-Bloch waves in periodic chiral media

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Abstract: The Floquet-Bloch waves in periodically inhomogeneous chiral media are considered. The wave vectors are assumed to be arbitrarily oriented with respect to the grating vector. We have formulated general equations of the dynamical diffraction by such a medium and have analyzed them in the two-wave approximation under different conditions. It is shown that the band structure of the eigenmode spectrum can be qualitatively modified under the effect of chirality. At a sufficiently large chiral admittance, the band gap that is forbidden for a given circularly polarized wave is split into two—central band gap and chiral satellite—which are separated by an interval of transparency. The bandwidth of the satellite is strongly dependent on the propagation angle and approaches zero as the wave vectors tend to be collinear with the grating vector. A change from the conventional Bragg diffraction band structure to the complex-split one is through the range where points of *J* multiplicity and anomalous dispersion are characteristic of the spectrum.

The boundary-value problem under diffraction by a periodic chiral layer is also analyzed. A unified expression for the reflection coefficient of the layer suitable over the entire region of the two-wave diffraction was obtained in the case of the complex-split spectrum. It is shown that the presence of satellites in the spectrum results in the appearance of additional reflection band gaps spaced both above and below in frequency relative to the central band gap. Unlike the latter, the side band gaps each are opaque for a given circularly polarized component of an incident field whereas the oppositely polarized component passes through the layer without Bragg reflection.

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