



## NONLINEAR SPECTRAL PROBLEMS AND BLOCH WAVES IN CRYSTALS

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We consider electromagnetic wave propagation in periodic and frequency dependent materials. The underlying operator has a band-structure, which by appropriate choice of the geometrical structure has gaps. The spectral parameter is usually related to the time frequency and the Floquet-Bloch wave vector is a parameter. This however, leads to a very difficult non-polynomial spectral problem when the frequency dependence of the material is included. We propose an approach that is based on a quadratic spectral problem in the amplitude of the Floquet-Bloch wave vector. We show that the quadratic spectral problem has a discrete spectrum and that eigenvalues are symmetrically placed with respect to the real and imaginary axis. The importance of preserving this eigenvalue symmetry in numerical computations is discussed and illustrated by numerical calculations.