

The uniqueness theorems in the electromagnetic wave theory and quasi-periodical solutions of the periodical diffraction problems

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Abstract

The simple method to prove the uniqueness of the solution of the electromagnetic wave diffraction problems is proposed in the case of loss-free media. The set of the diffraction problems on the thin conducting screens in the wave-guided structures are considered. The over-determined boundary value problem method is used. It is shown that the limited absorption principle is correct for the considered problems. The uniqueness conditions of the solution of the integral equations with difference kernel are obtained as an auxiliary result. These conditions are used to prove the Floquet theorem: the solution of the quasi-periodical wave diffraction on the periodical set of the heterogeneities can be the quasi-periodical wave (Floquet wave) only. The case of diffraction problem on the bi-periodical set of thin conducting screens in the opened space is considered in detail as an example. The boundary value problem is equivalent to the dual summatorial functional equation for the Floquet coefficients. It is proved that this problem is equivalent to the regular infinite set of the linear algebraic equations for the coefficients of decomposition of the electromagnetic field by Floquet harmonics. By this set of equations the algorithms are constructed for numerical solving the diffraction problem.
