Mathematical Physics

The Maxwell system in waveguides with several ends

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A waveguide coincides with a three-dimensional domain G having finitely many cylindrical outlets to infinity; the boundary of G is smooth. In G, we consider the stationary Maxwell system with real spectral parameter k and identity matrices of dielectric and magnetic permittivity. The boundary of G is supposed to be perfectly conductive. In the presence of charges and currents we investigate the solvability of the corresponding boundary value problem supplemented with "intrinsic" radiation conditions at infinity. For all k in the continuous spectrum of the problem (including the thresholds and eigenvalues), we describe a basis in the space of continuous spectrum eigenfunctions, define the scattering matrix, and prove it is unitary. To this end, we extend the Maxwell system to an elliptic one and study the latter in detail. The information on the Maxwell boundary value problem comes from that obtained for the elliptic problem.

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