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AN INTEGRAL EQUATION METHOD FOR THE TIME-HARMONIC MAXWELL EQUATIONS WITH BOUNDARY CONDITIONS FOR THE NORMAL COMPONENTS

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ABSTRACT. The reflection of electromagnetic waves at an anistropic medium leads to boundary conditions for the normal components. A new integral equation approach is developed for multiply connected domains. The existence of a solution is established by using the second part of Fredholm's alternative.

Introduction. The mathematical description of the scattering of time-harmonic electromagnetic waves with frequency $\omega > 0$ by an obstacle, say D, surrounded by a homogeneous isotropic medium in $\mathbf{R}^3$ leads to exterior boundary-value problems for the reduced Maxwell equations

$$\mathrm{curl\,E - ikH = 0,\ \ curl\,H + ikE = 0}$$

for the electric field E and the magnetic field H. Here, the wave number k is given in terms of ω, the electric permittivity ε, the magnetic permeability μ and the electric conductivity σ by

$$k^2 = \Big(\varepsilon + \frac{i\sigma}{\omega}\Big)\mu\omega^2,$$

and the sign of k is chosen such that $\mathrm{Im\,k} \geq 0$. The scattering of a given incoming electromagnetic wave E^i, H^i by a perfect conducting body gives rise to a boundary condition of the form

$$[\nu, E] = 0 \text{ on } \partial D \tag{0.1}$$

describing vanishing tangential components of the electric fields for the total wave $E = E^i + E^s, H = H^i + H^s$ where E^s, H^s are the scattered fields.

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