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NUMERICAL ANALYSIS OF AN UNBOUNDED OPERATOR ARISING FROM AN ELECTROMAGNETIC INTERIOR SCATTERING PROBLEM

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ABSTRACT. In this paper a 1-D singular integral equation motivated by the well-known singular volume integral equation associated with electromagnetic interior scattering is considered. In the 3-D case the kernel (the dyad Green's function) is $O(R^{-3})$ and in the present 1-D case the kernel is $O(R^{-1})$. The numerical solution is obtained by using a simple Nyström method. The mapping properties of the integral operator and the numerical integral operators are studied in various (Hölder) subspaces of $C([a,b])$. Convergence theorems for the numerical integral operators as well as for the numerical solutions are proved.

1. Introduction. For safety and health reasons, it is of considerable interest to assess the short- and long-term effects of electromagnetic (EM) radiation on people working near radars and other similar EM-wave-generating devices. Research to understand this can be classified as epidemiological, experimental and numerical. In numerical electromagnetic dosimetry one is led naturally to the problem of solving the Maxwell's equations inside a highly inhomogeneous and highly dispersive body. One of the solution approaches is to solve an equivalent problem in the frequency domain using a volume integral equation formulation.

Mathematically, in the time-harmonic case, if the body (V) is incident by an electric field $\mathbf{E}^{\mathbf{i}}(\mathbf{r})$ and if $\mathbf{E}(\mathbf{r})$ is the total electric field inside the body $(\mathbf{r} \in V)$, then the scattered field $\mathbf{E}^{\mathbf{s}}(\mathbf{r})$, defined through the relation

$$\mathbf{E}(\mathbf{r}) = \mathbf{E}^{\mathbf{s}}(\mathbf{r}) + \mathbf{E}^{\mathbf{i}}(\mathbf{r}), \tag{1}$$

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