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ELECTROMAGNETIC SCATTERING FROM AN ORTHOTROPIC MEDIUM

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ABSTRACT. We investigate electromagnetic wave propagation in an inhomogeneous anisotropic medium. For the case of an orthotropic medium we derive the Lippmann-Schwinger equation, which is equivalent to a system of strongly singular integral equations. Uniqueness and existence of a solution is shown and we examine the regularity of the solution by means of integral equations. We prove the infinite Fréchet differentiability of the scattered field in its dependence on the refractive index of the anisotropic medium and we derive a characterization of the Fréchet derivatives as a solution of an anisotropic scattering problem.

1. Introduction. Integral equation methods play a central role in the study of electromagnetic scattering problems. This is primarily due to the fact that the mathematical formulation of scattering problems leads to equations defined over unbounded domains, and hence by the reformulation in terms of integral equations one can replace the problem over an unbounded domain by one over a bounded domain. They also form a powerful tool to study the various features of the problem and to treat the corresponding inverse scattering problems, cf., [**3**].

Although integral equation methods for electromagnetic scattering from obstacles and *isotropic* inhomogeneous media have been quite far developed, the corresponding theory for *anisotropic* media is yet in its infancy. In many cases of practical importance, however, the assumption of an isotropic medium is unwarranted. There is a wide range of materials with an anisotropic behavior in the presence of electromagnetic waves. For example, in medical imaging the nerves and organs such as the brain, the heart and the liver are strongly anisotropic.

With this paper we want to start the investigation of electromagnetic scattering from *anisotropic* inhomogeneous bounded media by means of integral equations. For the sake of simplicity we will restrict our

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