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STOCHASTIC INTEGRODIFFERENTIAL EQUATIONS IN HILBERT SPACES WITH APPLICATIONS IN ELECTROMAGNETICS

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ABSTRACT. In this work we present some results on deterministic and stochastic integrodifferential equations in Hilbert spaces, motivated from and applied to problems arising from the mathematical modeling of electromagnetics fields in complex random media. We examine the mild, strong and classical well posedness for the Cauchy problem of the integrodifferential equation which describes Maxwell's equations complemented with the general (and therefore nonlocal in time) linear constitutive relations describing such media, with either additive or multiplicative noise.

1. Introduction. The propagation of electromagnetic waves in bianisotropic (general linear) media is the subject of many studies, and numerous references are available in the literature. Bianisotropic media find a wide range of applications from medicine to thin film technology. The mathematical modeling of such media is done through the modification of the constitutive relations for the well known Maxwell's equations in a region $\Omega \subset \mathbf{R}^3$, $t > 0$:

$$\frac{\partial D}{\partial t} - \operatorname{curl} H = -J_e, \qquad \frac{\partial B}{\partial t} + \operatorname{curl} E = -J_m \tag{1}$$

where E is the electric field, H is the magnetic field, D is the electric displacement, B is the magnetic induction and J_e, J_m are the densities of the electric and magnetic current, respectively. The complete constitutive relations for bianisotropic media are nonlocal in time and have the form:

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