WAVE PROPAGATION IN INHOMOGENEOUS MEDIA: GENERALIZED PLANE WAVES FOR MAXWELL'S EQUATIONS

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Abstract. Trefftz methods rely, in broad terms, on the idea of approximating solutions to PDEs using basis functions which are exact solutions of the Partial Differential Equation, making explicit use of information about the ambient medium. But wave propagation problems in inhomogeneous media is modeled by PDEs with variable coefficients, and in general no exact solutions are available. Generalized Plane Waves (GPWs) are functions that have been introduced, in the case of the Helmholtz equation with variable coefficients in two dimnesions, to address this problem: they are not exact solutions to the PDE but are instead constructed locally as high order approximate solutions. We will discuss their extension to the case of Maxwell equation

$$\nabla \times \nabla \times \mathbf{E} - \omega^2 \epsilon(\mathbf{x}) \mathbf{E} = \mathbf{f}(\mathbf{x}).$$

The main challenge in this case does not come from the transition to three dimensions but rather from the coupling of the electric field components.

Keywords: Wave propagation, variable media, Generalized Plane Waves, Maxwell.

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