ECE 742 Final Project

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1 Theory

1.1 PML

Perfectly Matched Layer (PML) boundary conditions are absorbing boundary conditions. PML BCs decay the wave within a boundary layer at the edge of the simulation. The edge of the simulation BC can be implemented as PEC. Well-implemented PML BCs completely decay the wave from the time it enters the boundary layer to the time after it reflects and attempts to leave.

1.2 Graded Conductivity

Reflection Factor

$$R(\theta) = \exp^{-2\eta cos(\theta) \int_0^d \sigma_x(x)dx}$$

Where σ_x is the graded conductivity of the PML layer material. We want to minimize relfection R but also make sure the wave decays completely in the PML boundary layer.

We are going to compare the error for different types of grading profiles.

1.2.1 Polynomial grading

Where the graded conductivity is:

$$\sigma_x = (\frac{x}{d})^m \sigma_{x,max}$$

And the graded value for κ_x is:

$$\kappa_x = 1 + (\kappa_{x,max} - 1)(\frac{x}{d})^m$$

1.2.2 Geometric grading

Where the graded conductivity is:

$$\sigma_x = (g^{\frac{1}{\Delta}})^x \sigma_{x,0}$$

And the graded value for κ_x is:

$$\kappa_x = [(\kappa_{max})^{\frac{1}{d}} g^{\frac{1}{\Delta}}]^x$$

2 Code

3 Error Analysis

Insert Error Analysis Here

PMLs are exact for continuous functions, but error is introduced for discrete functions. Having a large step discontinuity can

4 Fix me: Bibliography

Susan's book - third edition