**2D FEM with Boundary Conditions**

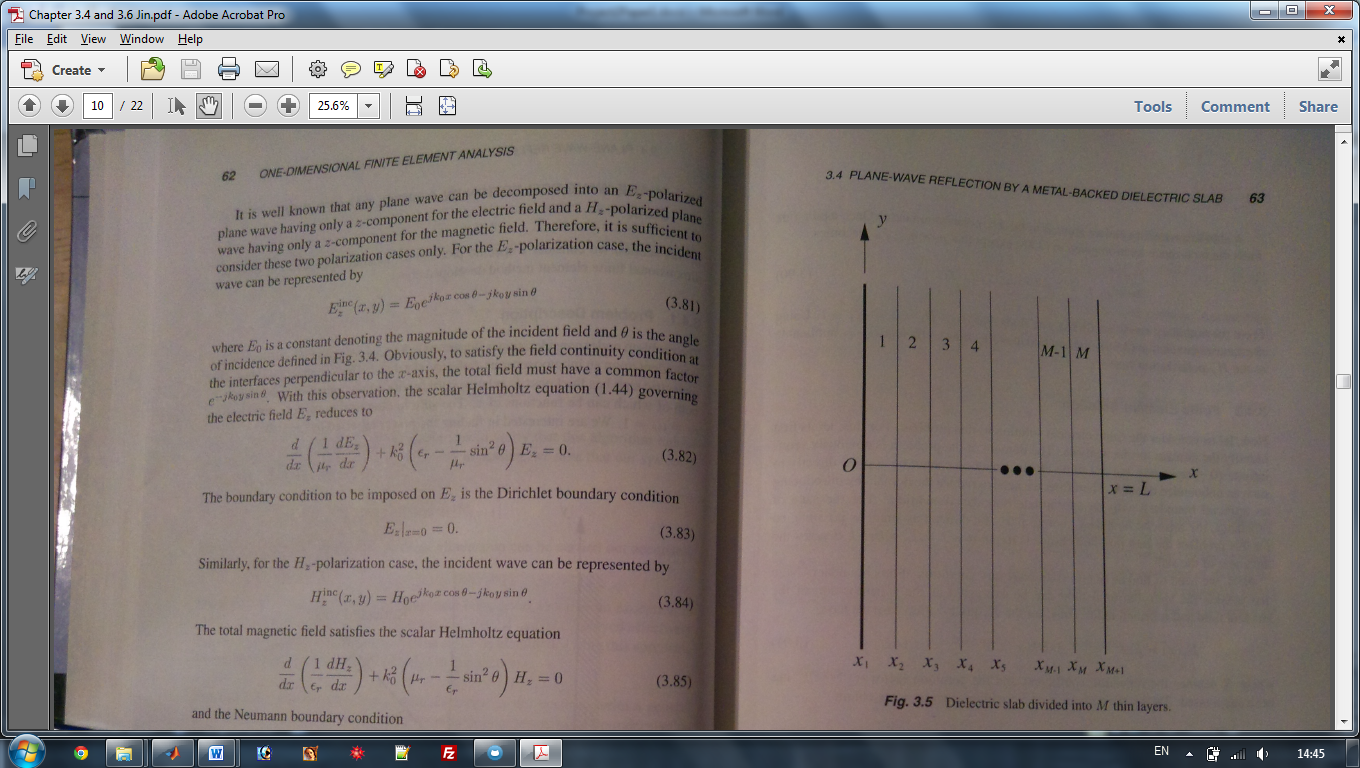
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**Abstract – A two dimensional finite element method (FEM) simulation is presented. An obliquely incident plane wave propagates through an inhomogeneous media backed with a perfect electric conductor (PEC).**

1. **INTRODUCTION**

In various types of computational sciences, the reduction of one spatial dimension can reduce the computational cost. For an obliquely incident plane wave onto an inhomogenous dielectric slab in two-dimensional space, analysis can be performed without any loss of generality in a one-dimensional space. Figure 1 shows the an obliquely incident plane wave on a dielectric space backed by a PEC in two dimensions and its reduction into one dimension respectively.

Figure 1 Left: 2D problem. Right: 1D simplified version



1. **FORMULATION**
   1. **Definition of Parameters**
   2. **Discretization**
   3. **Fundamental Equations**

Fundamental equation:

Matrix Equations:

and

* 1. **Boundary Condition**

Boundary Conditions:

* 1. **Higher Order Basis Functions**

Figure 4 2D Perfectly Matched Layer (PML)2

1. **RESULTS**
   1. **Error**
   2. **Gaussian Quadrature**
2. **CONCLUSION**
3. **REFERENCES**
4. J. Jin, *The Finite Element Method in Electromagnetics*, 2nd edition, Wiley, 2002.