ECE5340/6340: Homework 9

Write your section (ECE5340 or ECE6340) by your name. Turn in a printed copy containing the problem solutions, plots, and the code used to generate them. Remember to comment and format the code so is legible to the graders. Label the plots appropriately, including units for each axis and for the values plotted. Assume all units to be SI units unless stated differently. Due Wednesday 3/7 BEFORE class begins.

Problem 1

Note: Use code with the D-H formulation for this simulation.

1. (50 points) Using dielectric slabs of $\epsilon_r = 6$ and $\sigma = 0$, construct a filter that when illuminated by a narrow Gaussian pulse attenuates the electric field at a frequency of 350Mhz to less than 30% of the value present in the incoming waveform. Report: code used, number of slabs and thickness of each (in cells and meters, include calculations and rationale), E field plots supporting your results (time and frequency domain).

2. (10 points) For the previous problem, and using simulations, determine what is the minimum separation (in cells) between slabs? Can the slabs be in contact with each other? Why?

3. (40 points) Modify the code in the problem so the material properties for each cell (model) and the source location can be read from an ASCII file. Report the code added to read the information, an example set of model file(s), and a time and frequency domain plot of the the simulation.

Problem 2 (Optional - Extra Credit)

1. On your own words: Describe what electric polarization inside a material is, and how it is related to permittivity.

2. On your own words: Describe what is the difference between a non-lossy dielectric medium, a lossy dielectric medium, and a lossy dispersive medium in terms of EM propagation.

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3. Read Yee's paper. What type of materials (non-lossy dielectric medium, a lossy dielectric medium, and a lossy dispersive medium) can be treated using the formulation used in that article?