OS7201 Electromagnetic Optics Analysis Using FDTD Method

Homework #2 Due: 10/25/2022 at 2 p.m.

1. (100%) In this homework, you are required to implement 1D-FDTD code for a Gaussian pulse propagating in the $\pm z$ directions. Assume the wavelength range of interest is from 500 nm to 700 nm. To practice implementing the grid resolution into the code, a dummy dielectric slab ($\epsilon_r = 1.0$ and $\mu_r = 1.0$) of 250 nm in thickness is assumed to exist in 1D free space (such that no actual structure exists within the simulation region). The length of the 1D grid is set to 1650 nm.

   Revise your 1D-FDTD MATLAB code for the E_y/H_x mode developed in Homework #1 to include the following:

   - Incorporate a simple Gaussian soft source emerging from the midpoint of the grid by modifying the field amplitude there.
   - Implement the perfect boundary conditions (i.e. perfectly absorbing conditions) on both edges of the 1D grid.
   - Show the propagation of both E_y and H_x fields.

   Make sure your code is clean and well-commented and the figures look professional. You should be able to repeat the animation similar to the one shown on p. 14 of video lecture 6 provided by Prof. Rumpf.

   Upload your m-file to the Homework 2 folder on the course website.

   Note:

   1. Initialize the fields to zero before the main FDTD loop starts.
   2. Follow exactly the block diagram at the end of Lecture 6.