EP440: Engineering Electromagnetics

Spring 2013, J. B. Snively

Numerical Project #N2: Due 4/25/2013 at 5:00 (Email to Snively)!

For this assignment... Investigate following problems in MATLAB.
Submit to me a digital PDF document file including brief discussion on each problem, copies of figures, plus the text of the modified MATLAB code.

Please make note: In the figure, E is plotted as E/eta, so that it has the same amplitude as H.

Using the MATLAB file "emwave.m":

1) Modify the code to include a second subplot in the figure window showing instantaneous Poynting vector flux *S*.

2) Generate a standing wave at ~2.4 GHz frequency, and a horizontal dimension sufficient to hold exactly 3 half-wavelengths. Note that the code calculates frequency based on horizontal dimension and number of desired wavelengths to fit in the box. So, you will do this by adjusting the grid point step size and number of desired wavelengths to fit in the box. (Hint: Pick a Gaussian width = 1/5 of total simulation time, that peaks at 1/2 simulation time.)

3) Print a plot of your standing wave field variables and instantaneous *S* after the simulation has completed. Discuss in a few sentences the features of *E*, *H*, and *S*.

4) Run a second case resulting in a ~2.4 GHz frequency, but now with a horizontal dimension able to hold 10 wavelengths. Adjust the Gaussian width and peak time (as fraction of total time) to produce a packet which is small relative to the total domain (similar to that which you saw in the initial example file).

5) Print a plot of your wave field variables at three interesting times: When the wave is left-going, when the wave is reflecting, and when the wave is right-going. Discuss in a few sentences the features of *E*, *H*, and *S*.