Homework 3
EE691-82 Applied EM- FDTD Method, Spring 2012
Friday, February 17, 2012

1) Assuming no spatial variations in the *y*-direction, find the relevant differential equations for the transverse electric (TE_y) and transverse magnetic (TM_y) cases. Start with equations (3.9) and (3.10) in the text.
2) Using the results of part 1), find the update equations for the electric and magnetic fields for the transverse electric (TE_y) case. Sketch and label the FDTD mesh(es) used for this 2D case. Hint: consider 3D Yee unit cell.
3) Using the results of part 2), determine the update equations for the electric and magnetic fields for the transverse electric (TE_y) case in a medium described by material parameters $\varepsilon_r = 4$, $\mu_r = 1$, $\sigma = 10^{-3}$ S/m, and $\sigma^* = 0$. Assume a time-step of 1 ns, spatial step sizes of 0.2 m, and no sources.
4) Using the results of part 1), find the update equations for the electric and magnetic fields for the transverse electric (TM_y) case. Sketch and label the FDTD mesh(es) used for this 2D case. Hint: consider 3D Yee unit cell.
5) Using the results of part 4), determine the update equations for the electric and magnetic fields for the transverse magnetic (TM_y) case in a medium described by material parameters $\varepsilon_r = 9$, $\mu_r = 90$, $\sigma = 10^{-2}$ S/m, and $\sigma^* = 1\ \Omega$/m. Assume a time-step of 1 ns, spatial step sizes of 0.1 m, and no sources.
6) 3.12

Show **all** work for full credit.

Due Friday, February 24, 2012