FDTDusingPython

May 16, 2022

1D FDTD Simulation in free space

[ ]:
```
import numpy as np
from math import exp
from matplotlib import pyplot as plt

ke = 200
ex = np.zeros(ke)
hy = np.zeros(ke)

# Pulse parameters
kc = int(ke/2)
t0 = 40
spread = 12
nsteps = 100

# Main FDTD Loop
for time_step in range(1,nsteps+1):
    # Calculate the Ex field
    for k in range(1,ke):
        ex[k] = ex[k]+0.5*(hy[k-1]-hy[k])

    # Put a Gaussian pulse in the middle
    pulse = exp(-0.5*((t0-time_step)/spread)**2)
    ex[kc] = pulse

    # Calculate the Hy field
    for k in range(ke-1):
        hy[k] = hy[k]+0.5*(ex[k]-ex[k+1])

# Plot the outputs as shown in Fig.1.2
plt.rcParams['font.size'] = 12
plt.figure(figsize=(8,3.5))

plt.subplot(211)
plt.plot(ex,color='k',linewidth=1)
plt.ylabel('E$_x$',fontsize='14')
plt.xticks(np.arange(0,201,step=20))
```

```
plt.xlim(0,200)
plt.yticks(np.arange(-1,1.2,step=1))
plt.ylim(-1.2,1.2)
plt.text(100,0.5,'T={}'.format(time_step),horizontalalignment='center')

plt.subplot(212)
plt.plot(hy,color='k',linewidth=1)
plt.ylabel('H$_y$',fontsize='14')
plt.xlabel('FDTD cells')
plt.xticks(np.arange(0,201,step=20))
plt.xlim(0,200)
plt.yticks(np.arange(-1,1.2,step=1))
plt.ylim(-1.2,1.2)

plt.subplots_adjust(bottom=0.2,hspace=0.45)
plt.show()
```