EE2703 END SEM

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1 INTORDUCTION

This code involves a lot of vectors and arrays. All such operations should be vectorized. This is a problem to find the antenna currents in a half-wave dipole antenna.A long wire carries a current I(z) in a dipole antenna with half length of 50cm - so the antenna is a metre long, and has a wavelength of 2 metres. We want to determine the currents in the two wires of the antenna. The standard analysis assumes that the antenna current is given by I

This is then used to compute the radiated field. The problem is to determine if this is a good assumption. The parameters of this problem are as follows: l=0.5 metres (quarter wavelength) c=2.9979e8 m/sec,(speed of light), mu0=4e-7*pi(permeability of free space) N=100 (Number of sections in each half section of the antenna). . Im=1.0(current injected into the antenna). a=0.01metres,(radius of wire). Dependent Parameters lamda=l*4.0metres, (wavelength) f=c/lamda Hz, (frequency) k=2*pi/lamda wave number dz=l/N spacing of current samples.

1.1 Matrices Obtained

```
Vector z :
    [-0.5   -0.38  -0.25  -0.12   0.      0.12   0.25   0.38   0.5]
Vector u :
    [-0.38  -0.25  -0.12   0.12   0.25   0.38]
```

2 Question2

From Ampere's Law:

1. We have $H = M * J$.We will compute H at $r = a$
2. We will construct matrix M by using "*identity*" command to get unit matrix of size $(2N-2, 2N-2)$

2.1 Matrices Obtained

```
Matrix M:
    [[15.92   0.      0.      0.      0.      0.   ]
      [ 0.    15.92   0.      0.      0.      0.   ]
      [ 0.     0.    15.92   0.      0.      0.   ]
      [ 0.     0.     0.    15.92   0.      0.   ]
      [ 0.     0.     0.     0.    15.92   0.   ]
      [ 0.     0.     0.     0.     0.    15.92]]
```

3 Question3

```
Matrix Rz :
[[0.01+0.j 0.13+0.j 0.25+0.j 0.38+0.j 0.5 +0.j 0.63+0.j
0.75+0.j 0.88+0.j 1.  +0.j]

 [0.13+0.j 0.01+0.j 0.13+0.j 0.25+0.j 0.38+0.j 0.5 +0.j
 0.63+0.j 0.75+0.j 0.88+0.j]

 [0.25+0.j 0.13+0.j 0.01+0.j 0.13+0.j 0.25+0.j 0.38+0.j
 0.5 +0.j 0.63+0.j 0.75+0.j]

 [0.38+0.j 0.25+0.j 0.13+0.j 0.01+0.j 0.13+0.j 0.25+0.j
 0.38+0.j 0.5 +0.j 0.63+0.j]

 [0.5 +0.j 0.38+0.j 0.25+0.j 0.13+0.j 0.01+0.j 0.13+0.j
 0.25+0.j 0.38+0.j 0.5 +0.j]

 [0.63+0.j 0.5 +0.j 0.38+0.j 0.25+0.j 0.13+0.j 0.01+0.j
 0.13+0.j 0.25+0.j 0.38+0.j]

 [0.75+0.j 0.63+0.j 0.5 +0.j 0.38+0.j 0.25+0.j 0.13+0.j
 0.01+0.j 0.13+0.j 0.25+0.j]

 [0.88+0.j 0.75+0.j 0.63+0.j 0.5 +0.j 0.38+0.j 0.25+0.j
 0.13+0.j 0.01+0.j 0.13+0.j]

 [1.  +0.j 0.88+0.j 0.75+0.j 0.63+0.j 0.5 +0.j 0.38+0.j
 0.25+0.j 0.13+0.j 0.01+0.j]]

Matrix Ru :
    [[0.01+0.j 0.13+0.j 0.25+0.j 0.5 +0.j 0.63+0.j 0.75+0.j]
     [0.13+0.j 0.01+0.j 0.13+0.j 0.38+0.j 0.5 +0.j 0.63+0.j]
     [0.25+0.j 0.13+0.j 0.01+0.j 0.25+0.j 0.38+0.j 0.5 +0.j]
     [0.5 +0.j 0.38+0.j 0.25+0.j 0.01+0.j 0.13+0.j 0.25+0.j]
     [0.63+0.j 0.5 +0.j 0.38+0.j 0.13+0.j 0.01+0.j 0.13+0.j]
     [0.75+0.j 0.63+0.j 0.5 +0.j 0.25+0.j 0.13+0.j 0.01+0.j]]

Vector RN :
    [0.38+0.j 0.25+0.j 0.13+0.j 0.13+0.j 0.25+0.j 0.38+0.j]

Matrix P*1e8 :
[[124.94-3.93j    9.2 -3.83j    3.53-3.53j   -0.   -2.5j
```

```
-0.77-1.85j  -1.18-1.18j]

 [   9.2  -3.83j  124.94-3.93j     9.2  -3.83j     1.27-3.08j
 -0.   -2.5j  -0.77-1.85j]

 [   3.53-3.53j     9.2  -3.83j  124.94-3.93j     3.53-3.53j
 1.27-3.08j  -0.   -2.5j  ]

 [  -0.   -2.5j      1.27-3.08j     3.53-3.53j  124.94-3.93j
 9.2  -3.83j  3.53-3.53j]

 [  -0.77-1.85j    -0.   -2.5j      1.27-3.08j     9.2  -3.83j
 124.94-3.93j  9.2  -3.83j]

 [  -1.18-1.18j    -0.77-1.85j    -0.   -2.5j      3.53-3.53j
 9.2  -3.83j  124.94-3.93j]]

Vector P_B*1e8:
    [1.27-3.08j  3.53-3.53j  9.2  -3.83j  9.2  -3.83j  3.53-3.53j  1.27-3.08j]
```

4 Question4

4.1 Matrices Obtained

```
Matrix Q :
[[9.952e+01-0.j 5.000e-02-0.j 1.000e-02-0.j 0.000e+00-0.j 0.000e+00-0.j
  0.000e+00-0.j]
 [5.000e-02-0.j 9.952e+01-0.j 5.000e-02-0.j 0.000e+00-0.j 0.000e+00-0.j
  0.000e+00-0.j]
 [1.000e-02-0.j 5.000e-02-0.j 9.952e+01-0.j 1.000e-02-0.j 0.000e+00-0.j
  0.000e+00-0.j]
 [0.000e+00-0.j 0.000e+00-0.j 1.000e-02-0.j 9.952e+01-0.j 5.000e-02-0.j
  1.000e-02-0.j]
 [0.000e+00-0.j 0.000e+00-0.j 0.000e+00-0.j 5.000e-02-0.j 9.952e+01-0.j
  5.000e-02-0.j]
 [0.000e+00-0.j 0.000e+00-0.j 0.000e+00-0.j 1.000e-02-0.j 5.000e-02-0.j
  9.952e+01-0.j]]

Matrix Q_B :
[0.  -0.j 0.01-0.j 0.05-0.j 0.05-0.j 0.01-0.j 0.  -0.j]
```

5 Question5

5.1 Matrices Obtained

```
Icalculated :
[0. 0. 0. 0. 1. 0. 0. 0. 0.]

Iassumed :
[0.   0.38 0.71 0.92 1.   0.92 0.71 0.38 0.   ]
```

5.2 Plots

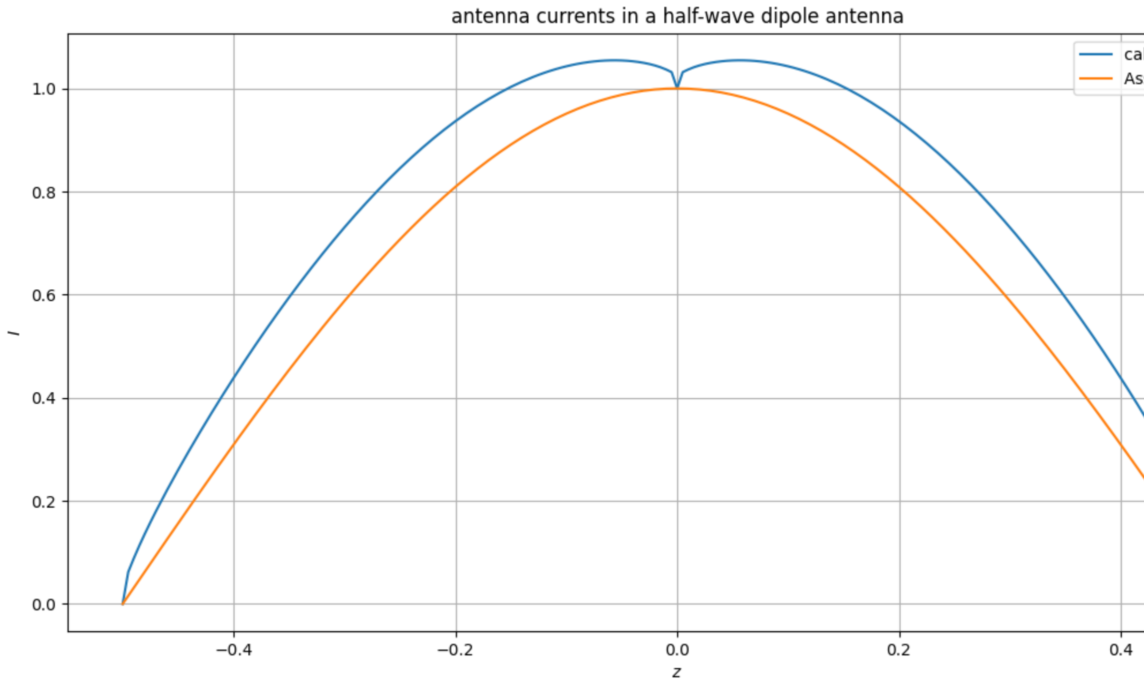

Figure 1: Antenna currents in a half-wave dipole antenna at N=100

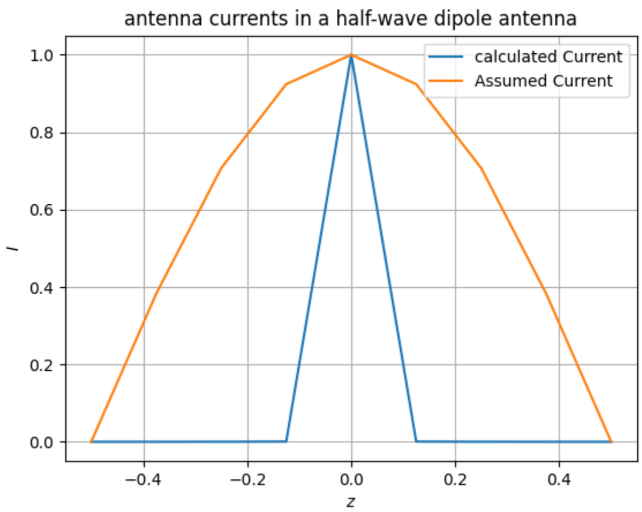

Figure 2: Antenna currents in a half-wave dipole antenna at N=4