INTRODUCTION

The transient scattering properties of wideband antennas are studied. The response was calculated numerically by solving the electric field integral equation (EFIE) in the frequency domain. The time domain signal was generated using the IFFT.

As a test case, a circular loop strip is examined first. The result agrees well with previous efforts. The transient scattering response of spiral antennas is then presented.

APPROACH

The electric field integral equation (EFIE)
\[ \mathbf{E}_{\text{tangential}} = (j \omega \mathbf{A} + \nabla \Phi)_{\text{tangential}} \]

Is solved numerically with Moment Method (MoM) technique.

The current on S is approximated as
\[ \mathbf{J} \approx \sum_n \mathbf{f}_n (\mathbf{r}) \]

where \( \mathbf{f}_n (\mathbf{r}) \) is chosen as RWG modes.

These expansion functions are also employed as testing functions and the current on the surface is obtained by solving the matrix equation
\[ \langle \mathbf{E}^i, \mathbf{f}_m \rangle = j \omega \langle \mathbf{A}, \mathbf{f}_m \rangle + \langle \nabla \Phi, \mathbf{f}_m \rangle \]

The far field is thus evaluated and transient response is obtained by taking inverse Fourier transformation.

TEST CASE – a circular loop strip

Radius : \( R = 1/(2\pi) \) m
Strip width : \( w = 13.5 \) mm
Incident Plane Wave (Broad-side)
\[ e(t) = \frac{d}{dt} \left[ \exp \left( -a \left( t - t_0 \right) \right) \right] \]

Here, \( t_0 = 1.667 \) ns

The curves are given as
\[ \rho_1 = k e^{ia} \]
\[ \rho_2 = k e^{i(\phi - a)} \]
\[ \rho_3 = k e^{i(\phi - \pi)} \]
\[ \rho_4 = k e^{i(\phi - \pi - a)} \]

where \( k = 5 \) mm
\( a = 0.25 \)
\( \phi = \pi / 3 \)

and \( \rho, \phi \) are the variables in cylindrical coordinate system.

TRANSIENT RESPONSE FROM W/B ANTEENA – a spiral strip (I)

The incident wave is band-limited impulse (broad-side).

To reduce the side-lobe levels in time domain, Hanning window is used in the transition band.

The incident wave is polarized in x-orientation and both co-polar scattering and cross-polar scattered electric fields are examined 1 km away from the spiral in the broad-side direction. While each are normalized to their respective maximal values, the cross-pol ratio is also given below.

The co-polar component roughly shows the time derivative behavior of the incident pulse. More analysis is being conducted.