MT360_UR7_2_2_3 Wave and Input Impedance

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Description

Two half-wave dipole antennas, each with an impedance of 75 ohms, are connected in parallel through a pair of transmission lines, and the combination is connected to feed a transmission line, as shown in Fig. P2.33 in your book, pg 127. Assume that all lines are 50 ohms and lossless.

Exercises

1. Create a function.m that will calculate the impedance anywhere on the transmission-line given the parameters Z_L, Z_0, and β_d where

Z_L = The equivalent load impedance at the end of the line.

Z_0 = The characteristic impedance of the line.

β = The Propagation Constant for a lossless line.

d = The distance on the line away from the load.

β_d = The multiplication of β and d.

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Look in the *Useful Information* section for the equation and in the
 *Provided Code* section for help in creating the function.m.
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2. Using the created function, calculate Z_{in_1} and Z_{in_2}, the input impedance of the antenna-terminated lines, at the parallel juncture.

3. Combine Z_{in_1} and Z_{in_2} in parallel to obtain Z'_L, the effective load impedance of the feedline.

4. Calculate Z_{in} of the feedline.

Questions

None

Useful Information

The impedance shown anywhere on a line is shown below.

Z_L = The equivalent load impedance at the end of the line.

Z_0 = The characteristic impedance of the line.

β = The Propagation Constant for a lossless line.

d = The distance on the line away from the load.

Z_{in} = The impedance of the line looking in at a certain distance.

$$Z_{\text{in}} = Z_0 \frac{Z_L + jZ_0 \tan(\beta d)}{Z_0 + jZ_L \tan(\beta d)}$$

$$\beta = \frac{2\pi}{\lambda}$$

Provided Code

```
% The following should be contained in the function file.

%  1)
% The function returns the impedance seen on the T-Line at a certain
% distance from an equivalent load impedance.
% Z_0 = the characteristic impedance of the T-Line.
% Z_L = the equivalent load impedance.
% beta = The propagation constant for a lossless line.
% d = distance away from the load.
% beta_d = beta * d.
%
function [Z] = Z_d(Z_0,Z_L, beta_d)
  Z = % INSERT CODE HERE
end

% The following should be contained in the script file.
%
Z_L = 75;         % The Load impedance of the two antennas.
Z_0 = 50;         % The characteristic impedance of the T-Line.
```

```
d_1 = 0.2;       % The distance in wavelengths between the juncture
 and the
               % antennas.
d_2 = 0.3;       % The distance in wavelengths between the juncture
 and
               % beginning of the T-Line.
beta_d_1 = 2*pi*d_1; % Beta*d1
beta_d_2 = 2*pi*d_2; % Beta*d2
%
% The values that will be calculated
% Z_in1,Z_in2     % the input impedance of the antenna-terminated
 line, at
                % the parallel juncture.
% Z_L_prime       % Z_in1 in parallel with Z_in2.
% Z_in            % The input impedance of the T-line.

%   2)
Z_in1 = % INSERT CODE HERE    % Calculate Z_in1
Z_in2 = % INSERT CODE HERE    % Calculate Z_in2

%   3)
Z_L_prime = % INSERT CODE HERE % Calculate Z_L_prime

%   4)
Z_in = % INSERT CODE HERE      % Calculate Z_in
```

Solution

Answers
Z_in1 = 35.2008-8.6210i Ohms
Z_in2 = 35.2008-8.6210i Ohms
Z_L_prime = 17.6004-4.3105i Ohms
Z_in = 107.5700-56.7012i Ohms

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