

MATLAB Programming for Engineers | (5th Edition)

Step-by-step solution



Step 1 of 8

Refer to Figure 2.19 in the text book for the simplified version of the front end of an AM radio receiver.

Write the formula for the rms voltage across the resistive load in the figure.

$$V_R = \frac{R}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}} V_o$$

Here,

$$\omega = 2\pi f$$

f is the frequency in hertz

(a)

Write the MATLAB code to plot the rms voltage as a function of frequency.

```
% Variables Used :
% L    -- inductance
% C    -- capacitance
% R    -- resistance
% f    -- frequency
% Vr   -- rms voltage
% Set the value of inductance, capacitance, resistance and V0
L=0.25E-3;
C=0.10E-9;
R=50;
V0=10E-3;
% Create an array of frequency
f=1:1:15E5;
w=2.*pi.*f;
% Calculate rms voltage
V=(R./ (sqrt ((R.^2)+(w.*L-(1./ (w.*C))) .^2))) .*V0;
% Plot the height versus velocity
plot(f,V);
title('Plot of rms voltage versus frequency');
ylabel('RMS Voltage V');
xlabel('Frequency Hz');
[Vmax,n]=max(V)
f0=f(n)
```

Comment

Step 2 of 8

Obtain the MATLAB output for the maximum voltage and resonant frequency.

Comment

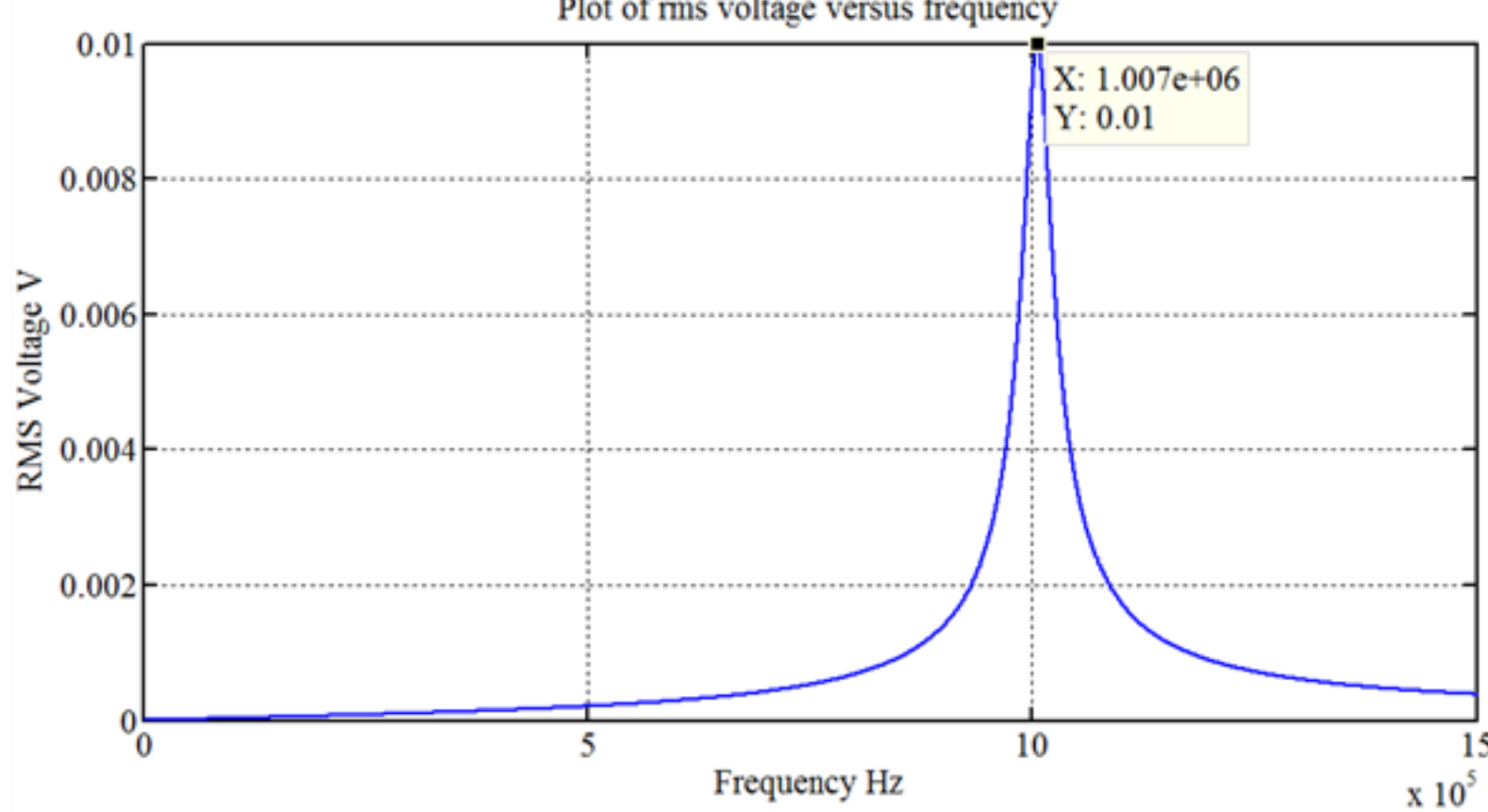
Step 3 of 8

```
Vmax =
    0.0100
n =
    1006584
f0 =
    1006584
```

Comment

Step 4 of 8

Execute the code to obtain the MATLAB output for the plot. Mark the point on the plot where the voltage is maximum.



Thus, the frequency at which the voltage is at its peak is 1.007×10^6 Hz.

The voltage at the resonant frequency is 0.01.

Comment

Step 5 of 8

(b)

Write the MATLAB code to obtain the voltage at frequency 10% greater than the resonant frequency.

```
% Set the value of inductance, capacitance, resistance and V0
L=0.25E-3;
C=0.10E-9;
R=50;
V0=10E-3;
% Create an array of frequency
f=1:1:15E5;
w=2.*pi.*f;
% Calculate rms voltage
V=(R./ (sqrt ((R.^2)+(w.*L-(1./ (w.*C))) .^2))) .*V0;
% Plot the height versus velocity
[Vmax,n]=max(V);
f0=f(n);
f=f0+0.1*f0;
w=2.*pi.*f;
% Calculate rms voltage
V10=(R./ (sqrt ((R.^2)+(w.*L-(1./ (w.*C))) .^2))) .*V0;
```

Comment

Step 6 of 8

Execute the MATLAB code to obtain the voltage value.

```
>> V10
```

```
V10 =
    0.0016
```

Thus, the voltage at frequency 10% greater than the resonant frequency is 0.0016.

If the frequency is reduced to 10% greater than the resonant frequency, the voltage is decreased to a much lower value.

Comment

Step 7 of 8

(c)

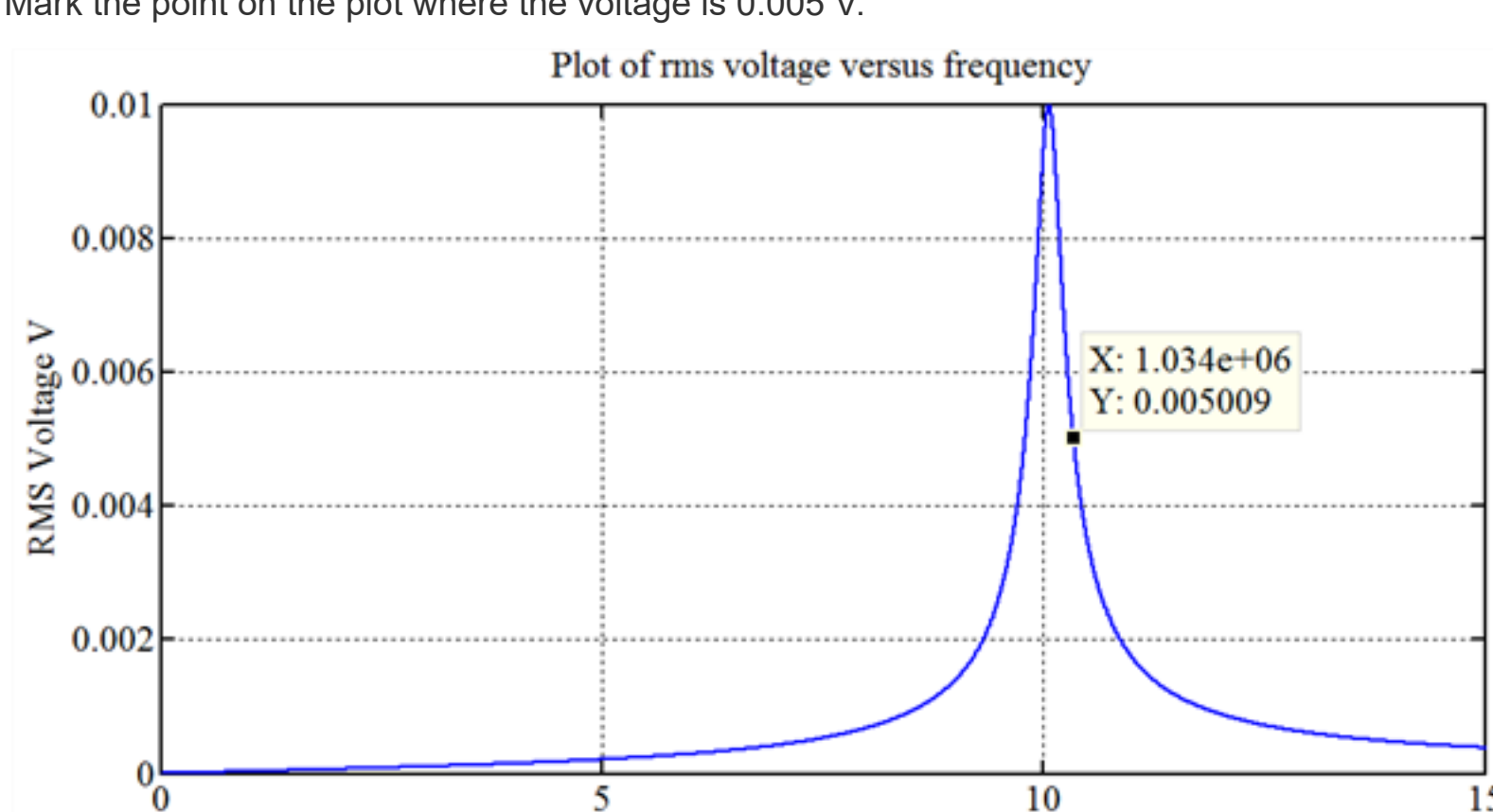
Write the MATLAB code to determine the frequency at half the peak voltage.

```
% Variables Used :
% L    -- inductance
% C    -- capacitance
% R    -- resistance
% f    -- frequency
% Vr   -- rms voltage
% Set the value of inductance, capacitance, resistance and V0
L=0.25E-3;
C=0.10E-9;
R=50;
V0=10E-3;
% Create an array of frequency
f=1:1:15E5;
w=2.*pi.*f;
% Calculate rms voltage
V=(R./ (sqrt ((R.^2)+(w.*L-(1./ (w.*C))) .^2))) .*V0;
% Plot the height versus velocity
plot(f,V);
title('Plot of rms voltage versus frequency');
ylabel('RMS Voltage V');
xlabel('Frequency Hz');
Vmax=max(V);
vc=Vmax/2
vc =
    0.0050
```

Comment

Step 8 of 8

Mark the point on the plot where the voltage is 0.005 V.



Thus, the frequency at which the voltage is half that at resonant frequency is 1.034×10^6 Hz.

Comment

Was this solution helpful?

0

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Recommended solutions for you in Chapter 2

Chapter 2, Solution 13E

Consider the following data: The equation for the ratio of two power measurements in decibels, Where, The power level being measured The reference power level (1 milliwatt is assumed).

[See solution](#)

Chapter 2, Solution 15E

Type the following MATLAB code to convert rectangular coordinates to spherical coordinates. x = input('Enter the value of rectangular coordinate, x: '); y = input('Enter the value of rectangular coordinate, y: '); z =...

[See solution](#)

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