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# MT240\_NR\_1\_6\_1\_T Power Template

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## Title

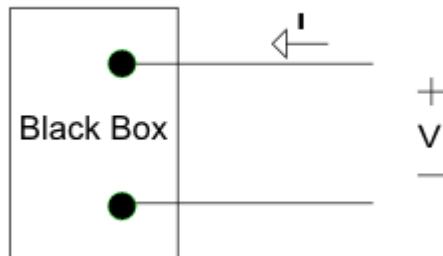
Last Updated: 1/1/2016

## Description

The voltage and current at the terminals of a circuit, see image below, are 0 for  $t < 0$  and for  $t \geq 0$ , they are:

$$V = 200e^{\frac{-t}{\tau}} * \sin(500t)$$

$$I = 10e^{\frac{-t}{\tau}} * \sin(500t)$$



## Exercise

1. Create an array to represent time. The time array should start at  $t = 0$ s, have a time step of 0.0001s, and end at  $t = 0.05$ s.

2. Use the created time array to calculate the voltage and current as a function of time. Assume that

$$\tau = \frac{1}{100} \text{ s.}$$

3. Calculate the power of the circuit using your calculated voltage and current.

4. Plot the calculated power as a function of time. Be sure to include a label for each axis, and a title.

## Questions

1. Looking at the generated plot, approximate the value of power at  $t = 0.01$  seconds.

## Useful Information

To create an array in MATLAB that has a specific beginning, step size, and end, use the colon operator to create it. An example is shown below.

```
t = beg:step:end
```

MATLAB makes array operations easy. You can easily multiply every element in an array by a constant. An example is shown below using the array 't' created above.

`500*t`  $\Rightarrow$  Every element in t will be scaled by 500.

When an array is inside of a MATLAB function, i.e. sin, the output of the operation will be an array whose contents are composed of the function evaluated at every value of the original array. An example is shown below using the array 't' created above.

If `x = 500*t`, x is an array. To evaluate the function sin at every value of x, the command would be.

```
y = sin(x)
```

y is an array composed of the function sin evaluated at every value of x.

When you have two arrays that you want to multiply together element wise, i.e. the first element of one array multiplied by the first element of the second array and the second element of the first array multiplied by the second element of the second array and so on, you can use the dot operator to accomplish this instead of using a for-loop. An example is shown below.

Let x and y be two arrays of the **same length**, they must be the same length.

```
x = [1, 2, 3]
y = [4, 5, 6]
```

If we want to multiply them element wise it would look like the following.

```
z = x.*y  $\Rightarrow$  [1*4, 2*5, 3*6] = [4, 10, 18]
```

The equation for power is

$$P = IV$$

## Provided Code

```
% 1)
% creation of the time array.
```

```
t_beg = 0; % beginning of the time array, s
t_step = 0.0001; % time step, s
t_end = 0.05; % end of the time array, s
t = % INSERT CODE HERE % time array, s

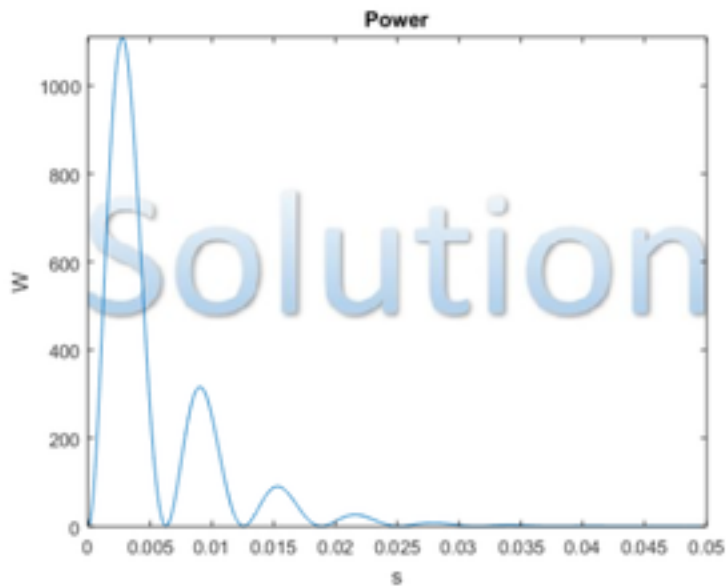
% 2)
tau = 1/100; % parameter tau, s
V = 200*exp(-t/tau).*sin(500*t); % calculates the voltage of the
    circuit of duration t, V
I = % INSERT CODE HERE % calculates the current of the
    circuit % of duration t, A

% 3)
P = % INSERT CODE HERE; % Calculate the power, w

% 4)
figure(1),clf; %specifies the figure to be used
plot(t, P); %plots the power vs time
title('Power'); %gives the graph a title
ylabel('W'); %labels the y axis
xlabel('s'); %labels the x axis
```

## Solution

*Plot*



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