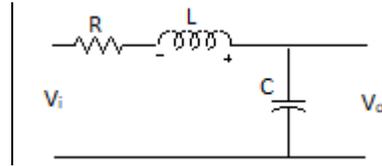


EE 224

Circuit Simulation

$$\frac{V_o}{V_i} = \frac{1/(LC)}{s^2 + \left(\frac{R}{L}\right)s + 1/(LC)}$$



We can use MATLAB[®] to find the frequency response and the step response of this circuit.

To form a transfer function we need to write the numerator and denominator as polynomials:

$$\text{num} = 1/(L*C);$$

$$\text{den} = [1 \ R/L \ 1/(L*C)];$$

Frequency Response

We can get the frequency response from a function called `freqs`

$$H = \text{freqs}(\text{num}, \text{den}, w);$$

The function `freqs` substitutes $j\omega$ for making the numerator and denominator complex polynomials. It then evaluates the complex function at all of the radian frequencies in w .

Suppose we want to plot this for frequencies from 1 to 1000Hz

```
%RLCSimulation.m
```

```
R = 1000; L = 1; C = 10^-6;
```

```
num = 1/(L*C);
```

```
den = [1 (R/L) 1/(L*C)];
```

```
f = 1:1000;
```

```
w = 2*pi*f;
```

```
H = freqs(num, den, w);
```

```
figure(1); clf;
```

```
plot(f, abs(H));
```

You can also use `freqs` with just two arguments as in

$$[H \ w] = \text{freqs}(\text{num}, \text{den});$$

In this case the function will choose appropriate values of w for the function.

Write a function which will accept either three or four arguments and will plot the frequency response of an RLC network as shown in the figure above. You can call the function with either of the following:

```
plotfreq(R, L, C, w);
```

Or

```
plotfreq(R, L, C);
```

Step Response

The step function in MATLAB[®] plots the unit step response of a transfer function. The step function also accept two arguments where the second arguments is a time vector.
`step(tf(num, den));`

or,

```
sys = tf(num, den);  
step(sys);
```

```
[y T] = step(sys);
```

Or

```
y = step(sys, T); %where T is a time vector.
```

Write a primary function which will plot the step function of an RLC network as shown in the figure above. Your function should accept either of the following forms:

```
plotstep(R, L, C);
```

Or

```
plotstep(R, L, C, T); where T is a time vector.
```

Reading and Writing Audio Files

AudioRead

AudioWrite

AudioPlayer

```
%audioExmp.m  
filename = 'rossini.wav';  
[y fs] = audioread(filename);  
T = 1/fs;  
t = 0:T:T*(length(y)-1);  
figure(1);clf;  
plot(t, y);  
xlabel('time in seconds');  
ylabel('voltage');  
title(filename);  
player = audioplayer(y, fs);  
play(player);
```