Resistor-Inductor-Capacitor circuits

1. Series RLC

```
circuit = Circuit('circuits/passive/c6_rlc_series.txt');
circuit.list
```

```
ans =
    'Vin 1 0 DC 5
     R1 3 0 1000
     L1 1 2 1
     C1 2 3 0.0001
     '
```

```
ELAB.analyze(circuit)
```

```
Symbolic analysis successful (0.272047 sec).
```

Say, you want expressions for node voltages.

```
circuit.symbolic_node_voltages
```

ans =

$$\begin{pmatrix} v_1 = \mathrm{Vin} \\ v_2 = \dfrac{\mathrm{Vin}\ (C_1 R_1 s + 1)}{C_1 L_1 s^2 + C_1 R_1 s + 1} \\ v_3 = \dfrac{C_1 R_1 \mathrm{Vin}\ s}{C_1 L_1 s^2 + C_1 R_1 s + 1} \end{pmatrix}$$

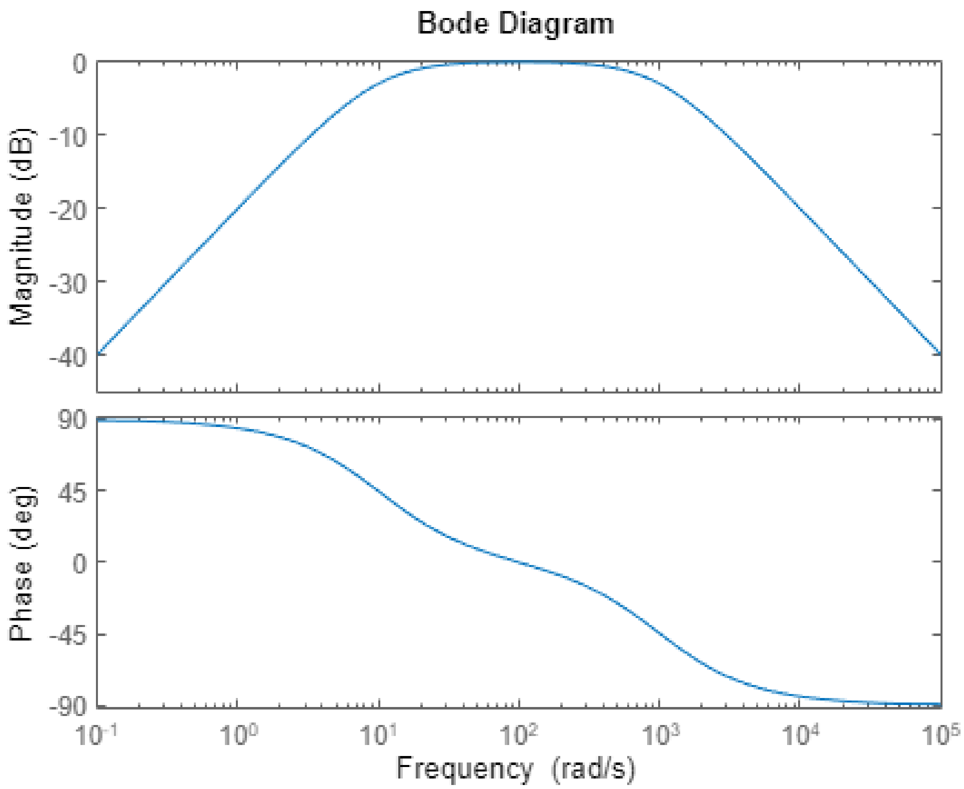
From the circuit, you can easily create a transfer function object, only giving the input and output nodes.

```
TF = ELAB.ec2tf(circuit, 1, 3)
```

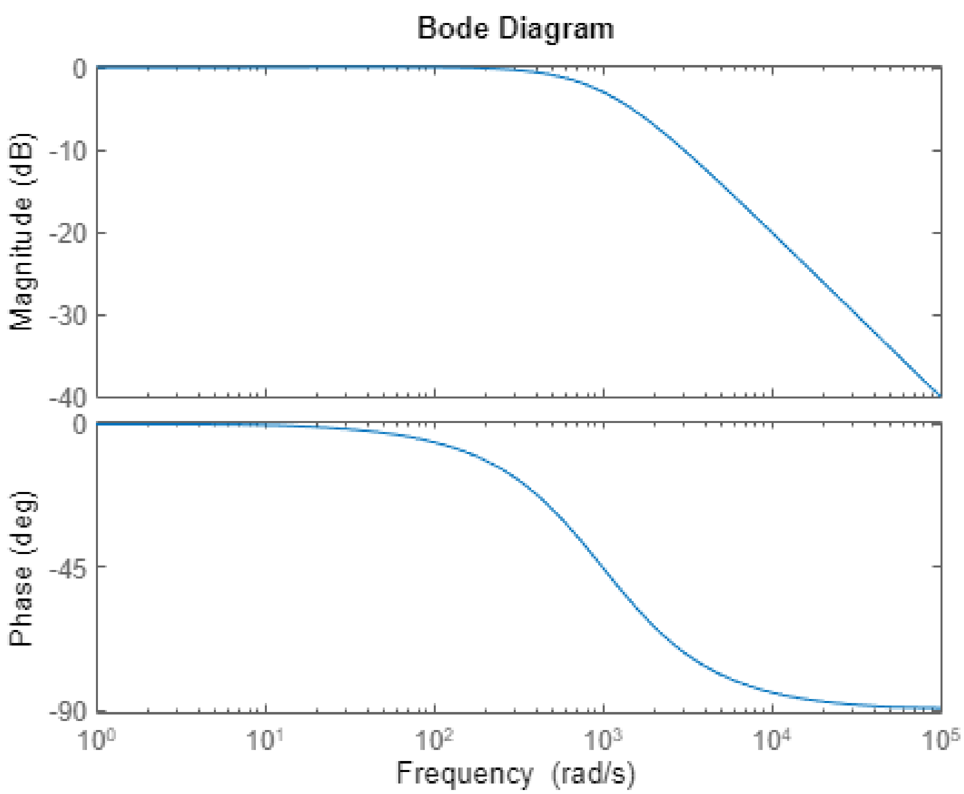
```
Numerically evaluating circuit.

Numerical evaluation successful (0.0690117 sec).
Transfer function object created successfully (1.002254e-01 sec).

TF =

         1000 s
  --------------------
  s^2 + 1000 s + 10000

Continuous-time transfer function.
```

Matlab can then be used to visualize the circuit behavior as with any other system. Plotting the Bode diagram, we see that this circuit acts as a band-pass-filter.

```
bode(TF)
```




```
Transfer function object created successfully (2.338730e-02 sec).
```



2. Parallel RLC

We can repeat the process to look at RLC in parallel.

```
circuit = Circuit('circuits/passive/c7_rlc_parallel.txt');
circuit.list
```

```
ans =
    'Iin 1 0 DC 2
     R1 1 0 1000
     L1 1 0 1
     C1 1 0 0.0001
     '
```

```
ELAB.analyze(circuit)
```

```
Symbolic analysis successful (0.166269 sec).
```

```
ELAB.evaluate(circuit)
```

```
Numerical evaluation successful (0.0415356 sec).
```

In this case, because there is only one node besides ground, the transfer function is just the voltage at node 1.

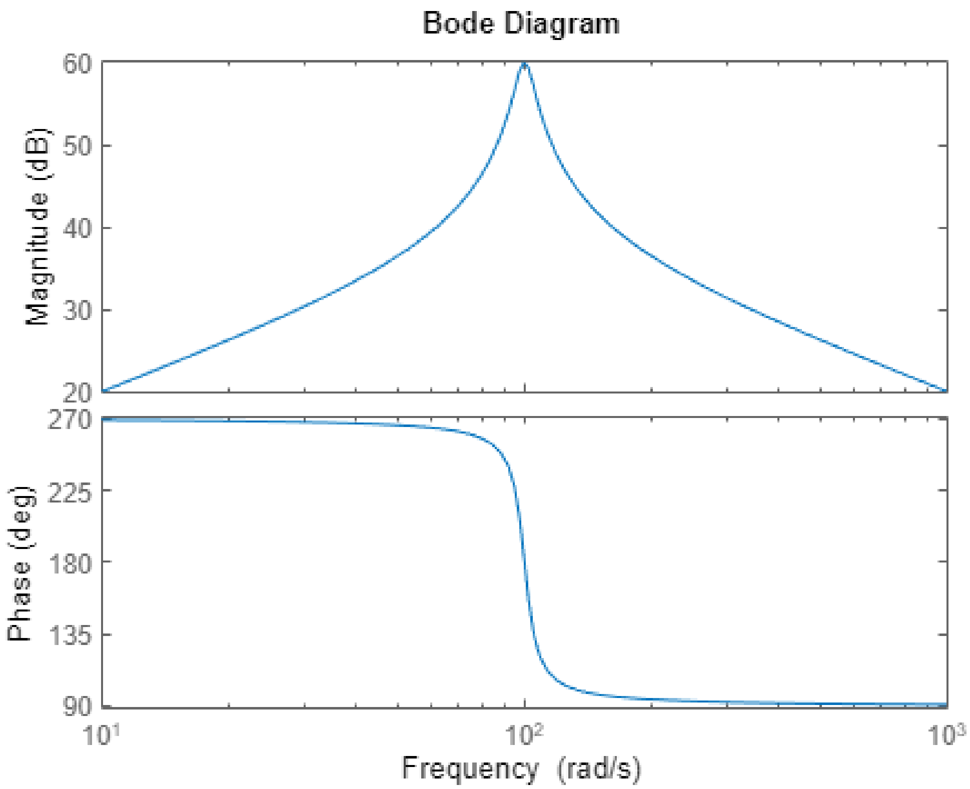
```
circuit.numerical_node_voltages(1)
```

ans =

$$v_1 = -\frac{2000\,s}{\frac{s^2}{10} + s + 1000}$$

You can of course input the equation directly into Matlab's transfer function. Plotting the Bode diagram show that this is another kind of band-pass-filter.

```
s = tf('s');
TF = -(1000*s)/(s^2/10 + s + 1000);
bode(TF)
```



Feel free to try any combination of resistors, capacitors and inductors.