

# Resistor-Inductor circuits

## 1. Inductive low-pass filter

```
circuit = Circuit('circuits/passive/c4_rl_low_pass.txt');  
circuit.list
```

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

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

Symbolic analysis successful (0.189702 sec).

Say, you want expressions for node voltages, for example.

```
circuit.symbolic_node_voltages
```

```
ans =  

$$\begin{pmatrix} v_1 = V_{in} \\ v_2 = \frac{R_1 V_{in}}{R_1 + L_1 s} \end{pmatrix}$$

```

Or the numerical currents for all elements in this particular circuit in relation to the s-domain.

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

Numerical evaluation successful (0.0379307 sec).

```
circuit.numerical_element_currents
```

```
ans =  

$$\begin{pmatrix} i_{R1} = \frac{5}{3s + 1000} \\ i_{L1} = \frac{5s}{3s + 1000} \end{pmatrix}$$

```

Say we want the numerical transfer function, where the output is the voltage across the resistor.

```
TF = ELAB.ec2tf(circuit, 1, 2)
```

Transfer function object created successfully (1.815570e-02 sec).

```
TF =  

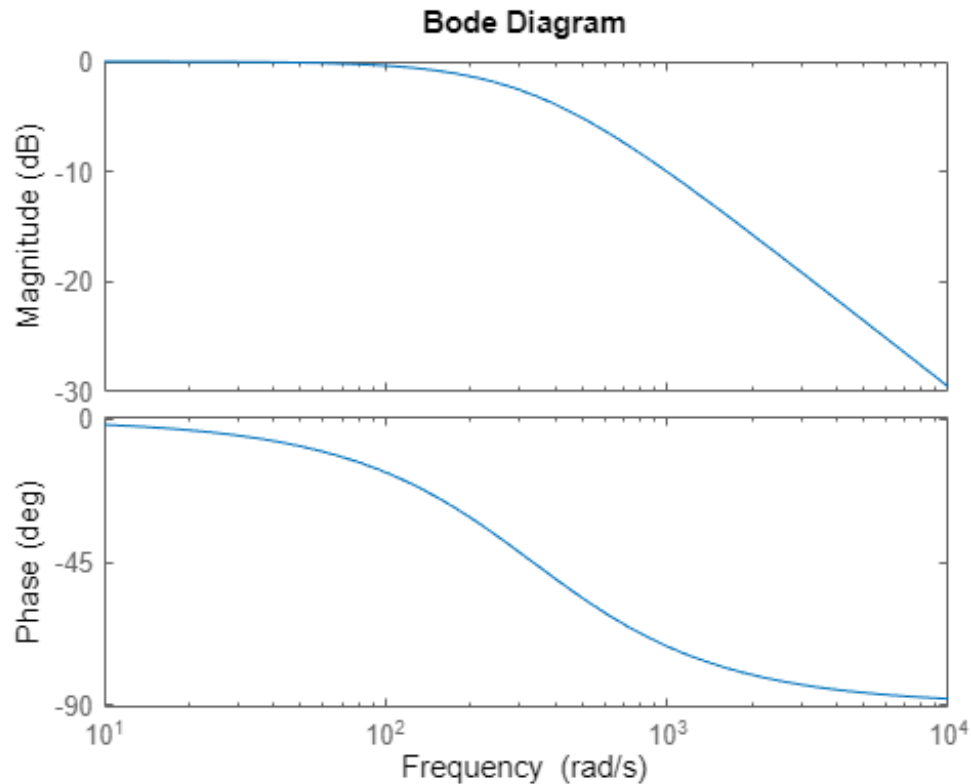
$$\frac{333.3}{s + 333.3}$$

```

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 is also a low-pass-filter, like the previous rc-example.

```
bode(TF)
```



## 2. Inductive high-pass filter

We can repeat the process with a variation of the circuit, where the inductor comes after the resistor.

```
circuit = Circuit('circuits/passive/c5_rl_high_pass.txt');  
circuit.list
```

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

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

Symbolic analysis successful (0.167633 sec).

```
circuit.symbolic_node_voltages
```

```
ans =  

$$\begin{pmatrix} v_1 = V_{in} \\ v_2 = \frac{L_1 V_{in} s}{R_1 + L_1 s} \end{pmatrix}$$

```

```
TF = ELAB.ec2tf(circuit, 1, 2)
```

Numerically evaluating circuit.

Numerical evaluation successful (0.0426367 sec).

Transfer function object created successfully (6.905100e-02 sec).

TF =

$$\frac{s}{s + 333.3}$$

Continuous-time transfer function.

Plotting the Bode diagram, we see that this rl-configuration acts as a high-pass filter.

```
bode(TF)
```

