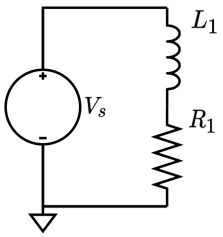
# Resistor-Inductor circuits

## 1. Inductive low-pass filter

```
circuit = Circuit('circuits/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 (0.193818 sec).
```

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

```
circuit.symbolic_node_voltages
```

```
ans =
```

$$\begin{pmatrix} v_1 = \mathrm{Vin} \\ v_2 = \dfrac{R_1\,\mathrm{Vin}}{R_1 + L_1\,s} \end{pmatrix}$$

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

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

```
Numerical evaluation successful (0.0783564 sec).
```

```
circuit.numerical_element_currents
```

```
ans =
```

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

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

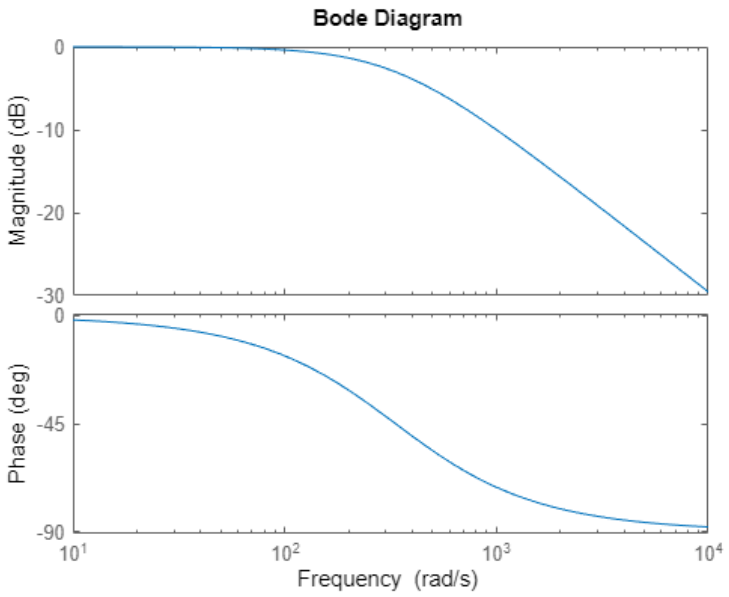
```
TF = ELAB.ec2tf(circuit, 1, 2)
```

```
Transfer function object created successfully (5.883160e-02 sec).

TF =
```

```
    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)
```

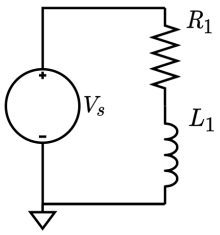



## 2. Inductive high-pass filter

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

```
circuit = Circuit('circuits/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 (0.183581 sec).
```

```
circuit.symbolic_node_voltages
```

```
ans =
```

$$\begin{pmatrix} v_1 = \mathrm{Vin} \\ v_2 = \dfrac{L_1\,\mathrm{Vin}\,s}{R_1 + L_1\,s} \end{pmatrix}$$

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

```
Numerical evaluation successful (0.0405401 sec).
Transfer function object created successfully (7.102560e-02 sec).

TF =

      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)
```