Resistor-Capacitor circuits

1. Capacitive low-pass filter

```
circuit = Circuit('circuits/passive/c2_rc_low_pass.txt');
circuit.list
```

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

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

```
Symbolic analysis successful (0.249407 sec).
```

Maybe you want expressions for node voltages.

```
circuit.symbolic_node_voltages
```

```
ans =
```

$$\begin{pmatrix} v_1 = \mathrm{Vin} \\ v_2 = \dfrac{\mathrm{Vin}}{C_1 R_1 s + 1} \end{pmatrix}$$

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

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

```
Numerical evaluation successful (0.0399604 sec).
```

```
circuit.numerical_element_currents
```

```
ans =
```

$$\begin{pmatrix} i_{\mathrm{R1}} = \dfrac{s}{2000\left(\frac{s}{10}+1\right)} \\ i_{\mathrm{C1}} = \dfrac{5}{\frac{s}{100000}+\frac{1}{10000}} \end{pmatrix}$$

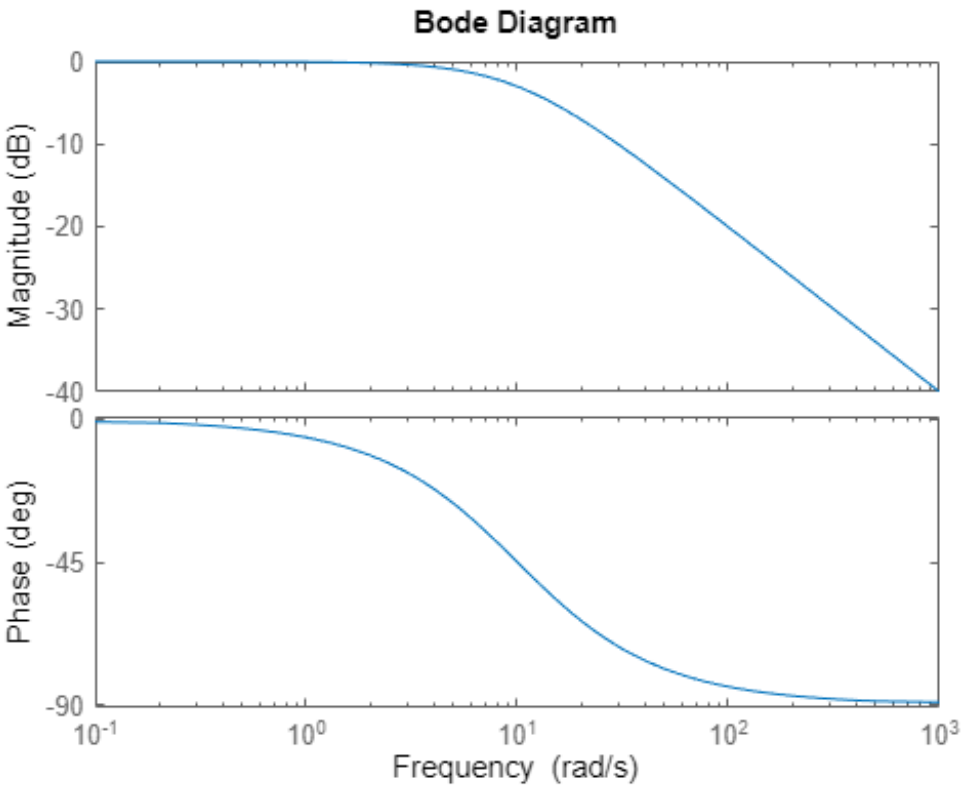
Say we want the numerical transfer function, where the output is the voltage across the capacitor.

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

```
Transfer function object created successfully (1.683160e-02 sec).

TF =

    10
  ------
  s + 10

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 infact a low-pass-filter.

```
bode(TF)
```



2. Capacitive high-pass filter

We can repeat the process with a variation of the circuit, where the capacitor comes before the resistor.

```
circuit = Circuit('circuits/passive/c3_rc_high_pass.txt');
circuit.list
```

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

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

```
Symbolic analysis successful (0.169788 sec).
```

```
circuit.symbolic_node_voltages
```

```
ans =
```

$$\begin{pmatrix} v_1 = \text{Vin} \\ v_2 = \dfrac{C_1 R_1 \,\text{Vin}\, s}{C_1 R_1 s + 1} \end{pmatrix}$$

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

```
Numerically evaluating circuit.

Numerical evaluation successful (0.0411536 sec).
Transfer function object created successfully (7.335670e-02 sec).
```

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

```
bode(TF)
```