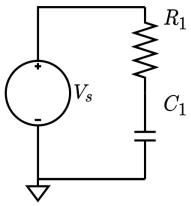
Time-domain analysis

Say, we want not only to examine circuits in the s-domain, but also in the more intuitive time-domain, as is so often the case. ELABorate has built-in functionality for this. Let's start by loading in a simple 1st-order-series-rc-circuit, otherwise known as a low-pass fitler. This has an AC-source.

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

```
ans =
    'Vs 1 0 AC 10-10*exp(-5000*t)
     R1 1 2 10000
     C1 2 0 0.00000001
     '
```



We analyze it as usual to obtain the circuit equations. If evaluate detects that the circuit has not been analyzed, it does it automatically.

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

```
Symbolic analysis successful (0.191636 sec).

Numerical evaluation successful (0.0674139 sec).
```

In this case, we would like to know the voltage across the capacitor. `Evaluate` has saved the results in the circuit object.

```
sd = circuit.numerical_element_voltages(2)
```

```
sd =
```

$$v_{C1} = -\frac{\frac{10}{s+5000} - \frac{10}{s}}{\frac{s}{10000} + 1}$$

We transmute the result into the time-domain. We only need the right-hand-side.

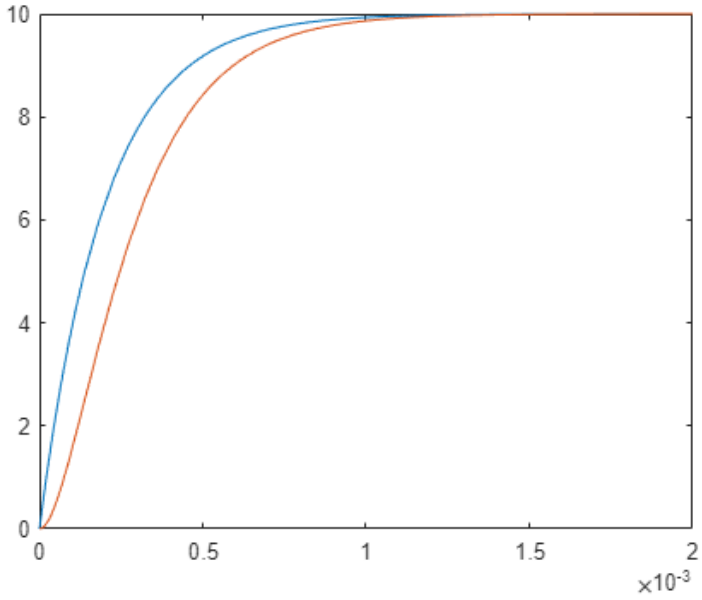
```
td = ELAB.sd2td(rhs(sd))
```

```
td =
```

$$10\,\mathrm{e}^{-10000\,t} - 20\,\mathrm{e}^{-5000\,t} + 10$$

We plot the input voltage (blue) and the voltage across the capacitor (orange).

```
fplot(circuit.Indep_VSs(1).voltage, [0,0.002]); hold on;
fplot(td, [0,0.002]); hold off;
```


10
8
6
4
2
0
0
0.5
1
1.5
2
×10-3