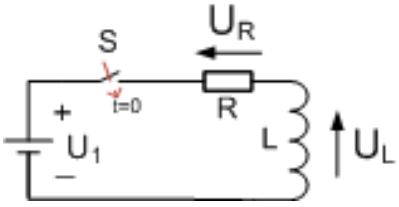


Step respons på en spole L

Vi ønsker å finne strømmen i kretsen, i(t), like etter at bryteren S slås på. Den slås på når t=0

$$u_1 = u_L + u_R = L \cdot \frac{di}{dt} + R \cdot i$$

$$L \cdot \frac{di}{dt} = u_1 - R \cdot i = -R \cdot \left(i - \frac{u_1}{R} \right)$$

$$\frac{di}{dt} = -\frac{R}{L} \cdot \left(i - \frac{u_1}{R} \right)$$

$$\frac{di}{\left(i - \frac{u_1}{R} \right)} = -\frac{R}{L} \cdot dt$$

$$\int_{i_0}^{i(t)} \frac{di}{\left(i - \frac{u_1}{R} \right)} = \int_0^t \left(-\frac{R}{L} \right) \cdot dt$$

$$\ln\left(i(t) - \frac{u_1}{R} \right) - \ln\left(i_0 - \frac{u_1}{R} \right) = -\frac{R}{L} \cdot t$$

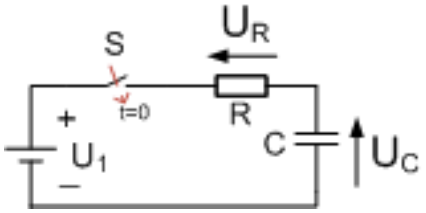
$$\ln\left(\frac{\left(i(t) - \frac{u_1}{R} \right)}{\left(i_0 - \frac{u_1}{R} \right)} \right) = -\frac{R}{L} \cdot t$$

$$\left(i(t) - \frac{u_1}{R} \right) = e^{-\frac{R}{L} \cdot t} \cdot \left(i_0 - \frac{u_1}{R} \right)$$

$$i(t) = \frac{u_1}{R} + e^{-\frac{R}{L} \cdot t} \cdot \left(i_0 - \frac{u_1}{R} \right)$$

i_0=0 (fordi bryteren er åpen når t<0)

$$\underline{\underline{i(t) = \frac{u_1}{R} \left(1 - e^{-\frac{R}{L} \cdot t} \right)}}$$



Step respons på en kondensator C

Vi ønsker å finne spenningen over kondensatoren, $u_C(t)$, like etter at bryteren S slås på. Den slås på når t=0

$$i = \frac{u_R}{R} = \frac{u_1 - u_C}{R} = C \cdot \frac{du_C}{dt}$$

$$u_1 - u_C = R \cdot C \cdot \frac{du_C}{dt}$$

$$dt = R \cdot C \cdot \frac{du_C}{(u_1 - u_C)}$$

$$\int_0^t dt = R \cdot C \cdot \int_{u_0}^{u_C(t)} \frac{du_C}{(u_1 - u_C)}$$

$$t - 0 = -R \cdot C \cdot \left(\ln(u_1 - u_C(t)) - \ln(u_1 - u_0)\right)$$

$$t = -R \cdot C \cdot \ln\left(\frac{(u_1 - u_C(t))}{(u_1 - u_0)}\right)$$

$$-\frac{t}{RC} = \ln\left(\frac{(u_1 - u_C(t))}{(u_1 - u_0)}\right)$$

$$e^{-\frac{t}{RC}} = \left(\frac{(u_1 - u_C(t))}{(u_1 - u_0)}\right)$$

$u_1 \cdot e^{-\frac{t}{RC}} = u_1 - u_C(t)$ u_0=0 (fordi bryteren er åpen når t<0)

$$\underline{\underline{u_C(t) = u_1 \cdot \left(1 - e^{-\frac{t}{RC}}\right)}}$$