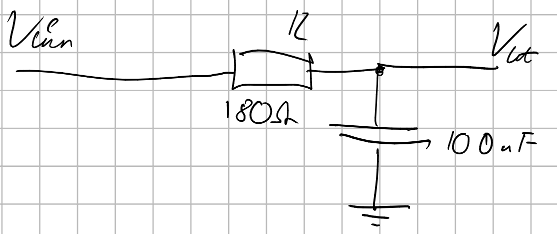
Motorlab

1.1)



a) $I = i_{V_{ut}} + i_c$

$V_{inn} = V_{ut} + V_c$

$V_{inn} = V_{ut} + RC \frac{d}{dt} V_{ut}$

$$\underline{\underline{\frac{d}{dt} V_{ut} = \frac{1}{RC} V_{inn} - \frac{1}{RC} V_{ut}}}$$

b) $R = 180\,\Omega \quad C = 100\,nF$

$\dot{v} = -\frac{1}{RC} V_{ut} + \frac{1}{RC} V_{inn}$

$T = -\frac{1}{a} = -\frac{1}{-\frac{1}{RC}} = \underline{\underline{RC}} = \underline{1{,}8 \cdot 10^{-5}\,s}$

c) $\frac{d}{dt} V_{ut} = -\frac{1}{RC} V_{ut} + \frac{1}{RC} V_{inn}$

$\frac{d}{dt} V_{ut} + \frac{1}{RC} V_{ut} = \frac{1}{RC} V_{inn} \qquad \frac{1}{RC} = \lambda$

$\frac{d}{dt} V_{ut} + \lambda V_{ut} = \lambda V_{inn}$

$\frac{d}{dt}(V_{ut} e^{\lambda t}) = \lambda V_{inn} e^{\lambda t} \quad \Big| \cdot \int dt$

$V_{ut} e^{\lambda t} = V_{inn} e^{\lambda t} + A \quad \Big| \cdot e^{-\lambda t}$

$V_{ut} = V_{inn} + A e^{-\lambda t}$

$V_{ut}(t) = V_{inn} + A e^{-\frac{1}{RC} t} \qquad V_{ut}(0) = 0$

$V_{inn} + A = 0$

$A = -V_{inn}$

$V_{out}(t) = V_{in}(1 - e^{-\frac{1}{RC}t})$ $V_{in} = 1V$

$V_{out}(t) = 1 - e^{-\frac{1}{RC}t}$