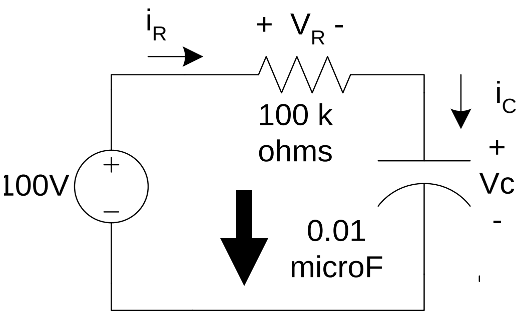
NETWORK ANALYSIS AND SYNTHESIS

Example



Initial condition $Vc(0) = 0$V

$$i_R = i_C$$

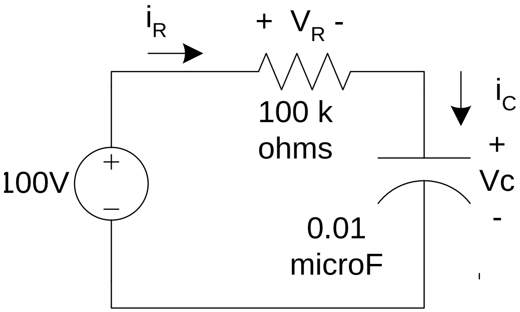
$$i_R = \frac{v_s - v_C}{R}, i_C = C\frac{dv_C}{dt}$$

$$RC\frac{dv_C}{dt} + v_C = v_s$$

$$10^5 \times 0.01 \times 10^{-6}\frac{dv_C}{dt} + v_C = 100$$

$$10^{-3}\frac{dv_C}{dt} + v_C = 100$$

Example



Initial condition *Vc*(0) = 0V

$$10^{-3}\frac{dv_C}{dt}+v_C=100$$

$$\tau\frac{dx(t)}{dt}+x(t)=K_s f(t)$$

and

$$x=x_N(t)+x_F(t)$$
$$=\alpha e^{-t/\tau}+K_S F$$
$$=\alpha e^{-t/\tau}+x(\infty)$$

$$v_c=100+Ae^{-\frac{t}{10^{-3}}}$$

$$As\ \ v_c(0)=0,\ 0=100+A$$

$$A=-100$$

$$v_c=100-100e^{-\frac{t}{10^{-3}}}$$

Energy stored in capacitor

$$p = vi = Cv\frac{dv}{dt}$$

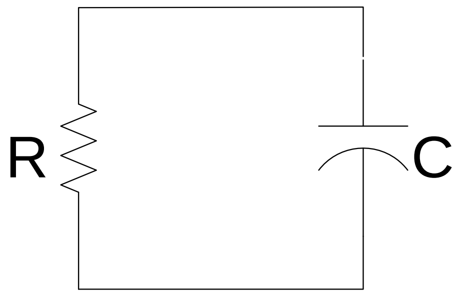
$$\int_{t_o}^{t} p\,dt = \int_{t_o}^{t} Cv\frac{dv}{dt}\,dt = C\int_{t_o}^{t} v\,dv$$

$$= \frac{1}{2}C\left\{[v(t)]^2 - [v(t_o)]^2\right\}$$

If the zero-energy reference is selected at t_o, implying that the capacitor voltage is also zero at that instant, then

$$w_C(t) = \frac{1}{2}Cv^2$$

RC CIRCUIT



Power dissipation in the resistor is:

$p_R = V^2/R = (V_o{}^2/R)\, e^{-2t/RC}$

Total energy turned into heat in the resistor

$$W_R = \int_0^\infty p_R dt = \frac{V_o^2 \int_0^\infty e^{-2t/RC} dt}{R}$$

$$= V_o^2 R(-\frac{1}{2RC})e^{-2t/RC} |_0^\infty$$

$$= \frac{1}{2} C V_o^2$$

THANKS….

Queries Please…