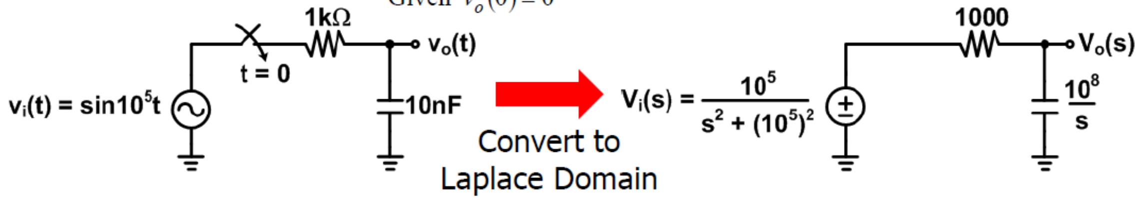
Given $v_o(0)=0$



$$H(s)=\frac{V_o(s)}{V_{in}(s)}=\frac{1}{1+sRC}=\frac{1}{1+\frac{s}{10^5}}=\frac{10^5}{s+10^5}$$

$$V_o(s)=H(s)V_i(s)=\left(\frac{10^5}{s+10^5}\right)\left(\frac{10^5}{s^2+\left(10^5\right)^2}\right)$$

with partial fraction expansion

$$V_o(s)=\frac{\frac{1}{2}}{s+10^5}-\frac{\frac{1}{2}s}{s^2+\left(10^5\right)^2}+\frac{\frac{1}{2}\left(10^5\right)}{s^2+\left(10^5\right)^2}$$

with inverse Laplace Transform

$$\mathrm{v_o}(t)=\frac{1}{2}e^{-10^5 t}-\frac{1}{2}\cos 10^5 t+\frac{1}{2}\sin 10^5 t=\frac{1}{2}e^{-10^5 t}+\frac{1}{\sqrt{2}}\sin\left(10^5 t-45^\circ\right)$$

We can decompose the output into it's transient and steady - state response

$$\mathrm{v_o}(t)=\frac{1}{2}e^{-10^5 t}+\frac{1}{\sqrt{2}}\sin\left(10^5 t-45^\circ\right)=v_{tr}(t)+\mathrm{v_{ss}}(t)$$

$$\mathrm{v_{tr}}(t)=\frac{1}{2}e^{-10^5 t}$$

$$\mathrm{v_{ss}}(t)=\frac{1}{\sqrt{2}}\sin\left(10^5 t-45^\circ\right)$$