

Lecture 13, Tuesday, February 8, 2022

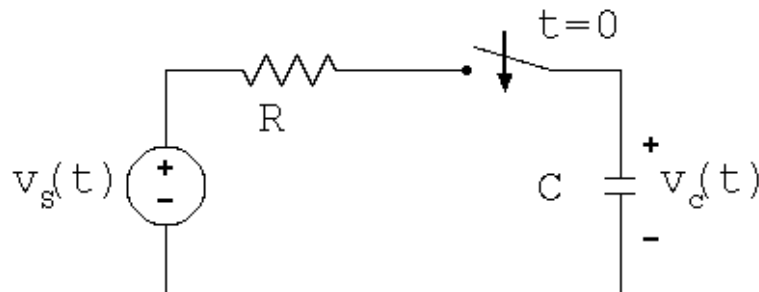
- *Time-invariance*: delayed inputs cause equally delayed outputs for zero initial state and any delay $\mathbf{t_d}$. So, if

$$\mathbf{f_1(t)} \rightarrow \boxed{\text{time-invariant}} \rightarrow \mathbf{y_1(t)}, \text{ then}$$

$$\mathbf{f_2(t) = f_1(t - t_d)} \rightarrow \boxed{\text{time-invariant}} \rightarrow \mathbf{y_2(t) = y_1(t - t_d)},$$

- Basically, the output shouldn't change significantly if you turn on your input earlier/later, you should see the same output, just earlier/later.
- A shift in the input creates the same shift in the output

- First order RC circuits



- For $t > 0$

$$\Rightarrow \frac{v_s(t)}{RC} = \frac{dv_c(t)}{dt} + \frac{1}{RC}v_c(t)$$

- First order ordinary differential equation (ODE) with constant coefficients

- First order ODE with constant coefficients and constant input:

$$K = \frac{dy(t)}{dt} + ay(t) \quad \text{for } t > 0$$