EEE201
Circuit Analysis II

Ankara University

Faculty of Engineering

Electrical and Electronics Engineering Department

The Laplace Transform in Circuit Analysis

EEE201 Circuit Analysis II

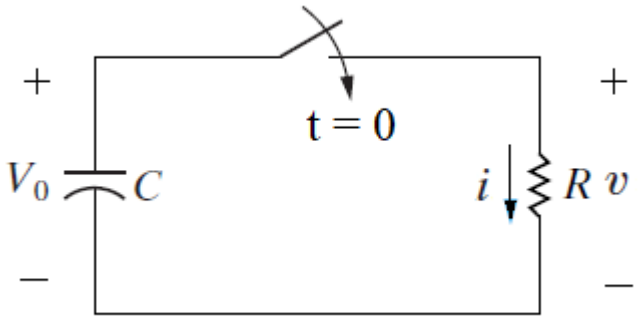
Lecture 12

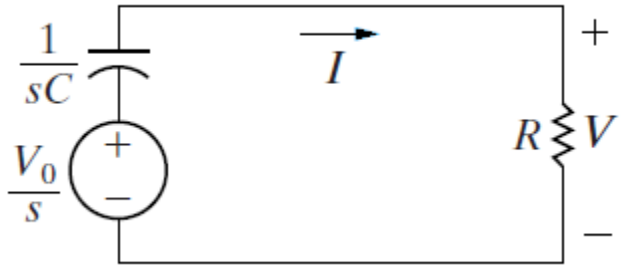
Agenda

- Applications: The Natural Response of an RC Circuit
- Transfer Function

Applications: The Natural Response of an RC Circuit

Capacitor discharge circuit:



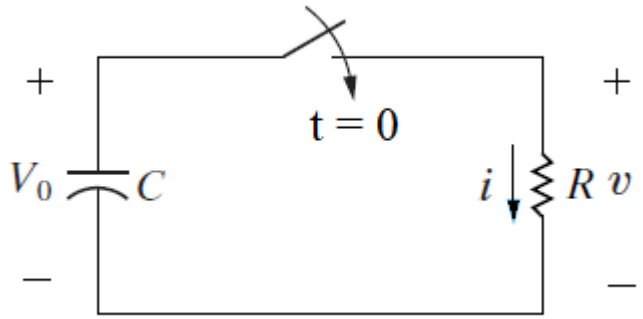


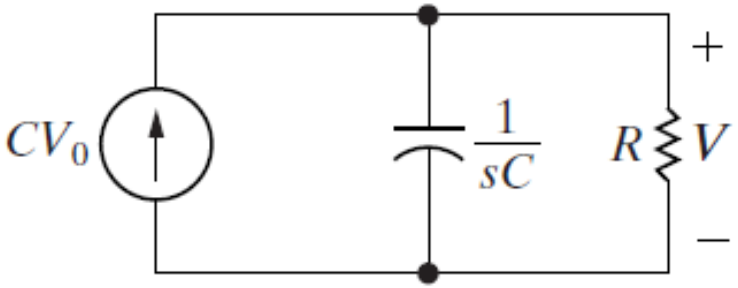
$$\frac{V_0}{s} = \frac{1}{sC} I + RI \implies I = \frac{V_0/R}{s+\left(\frac{1}{RC}\right)} \quad \longrightarrow \quad i = \frac{V_0}{R} e^{-t/(RC)} u(t)$$

$$v = Ri = V_0 e^{-t/(RC)} u(t)$$

Application: The Natural Response of an RC Circuit

Capacitor discharge circuit:





$$\frac{V}{R} + sCV = CV_0 \implies V = \frac{V_0}{s + \left(\frac{1}{RC}\right)} \quad \rightarrow \quad v = V_0 e^{-t/(RC)} u(t)$$

Transfer Function

$$H(s) = \frac{Y(s)}{X(s)}$$

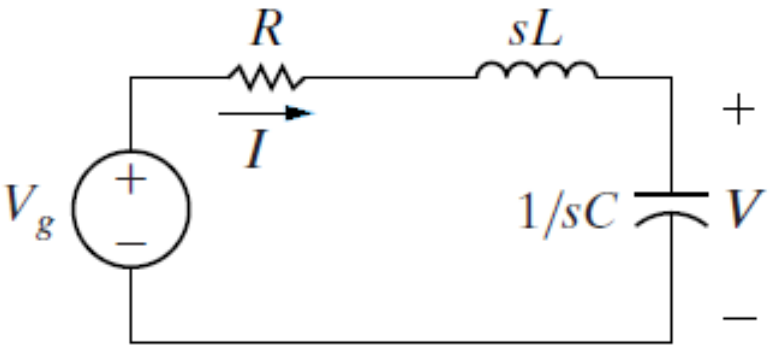
$Y(s)$: Laplace transform of the output signal

$X(s)$: Laplace transform of the input signal

Transfer Function

$$H(s) = \frac{I}{V_g} = \frac{1}{R + sL + \frac{1}{sC}} = \frac{sC}{s^2LC + RCs + 1}$$

$$H(s) = \frac{V}{V_g} = \frac{\frac{1}{sc}}{R + sL + \frac{1}{sC}} = \frac{1}{s^2LC + RCs + 1}$$



Reference

- Electric Circuits, Tenth Edition, James W. Nilsson, Susan A. Riedel Pearson, 2015