EEE104
Circuit Analysis I

Ankara University

Faculty of Engineering

Electrical and Electronics Engineering Department

Response of First Order RL Circuits

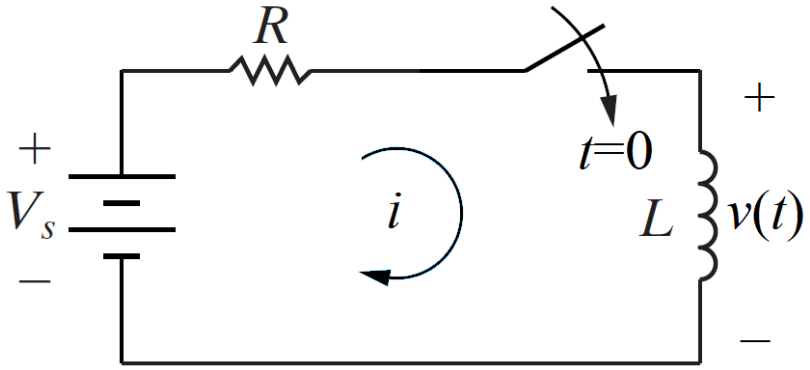
EEE104 Circuit Analysis I

Lecture 11

Agenda

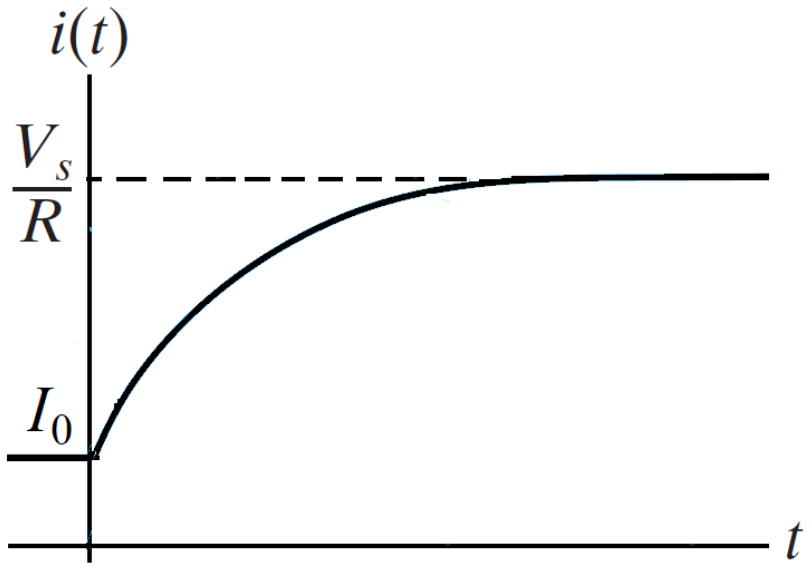
- Step Response of an RL Circuit
- Step Response of an RC Circuit

- Step Response of an RL Circuit



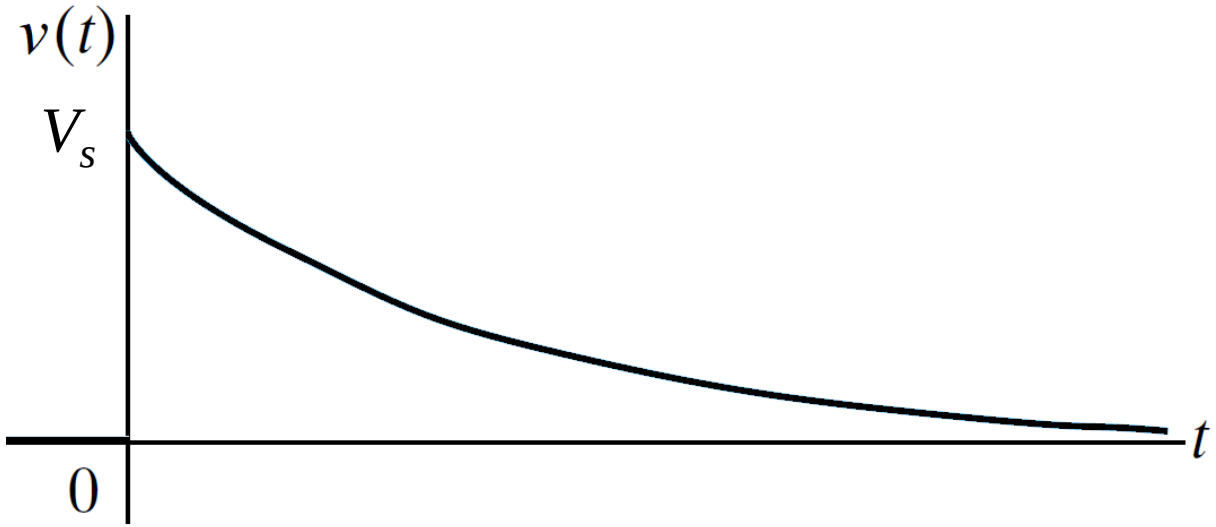
$$i(t) = \frac{V_s}{R} + \left(I_0 - \frac{V_s}{R}\right) e^{-\frac{t}{\tau}}, \qquad t \geq 0$$

- Step Response of an RL Circuit



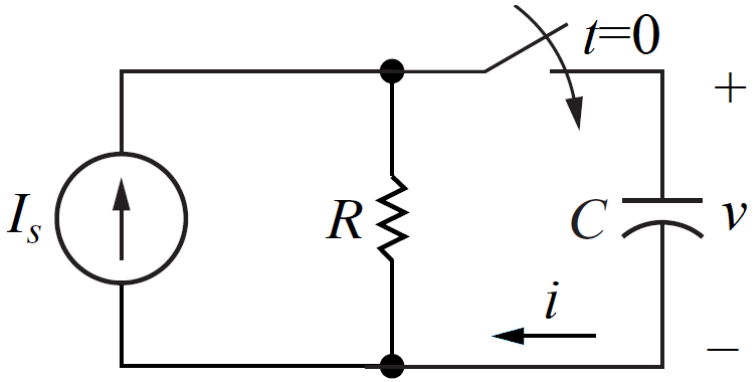
Step current response of RL circuit

- Step Response of an RL Circuit



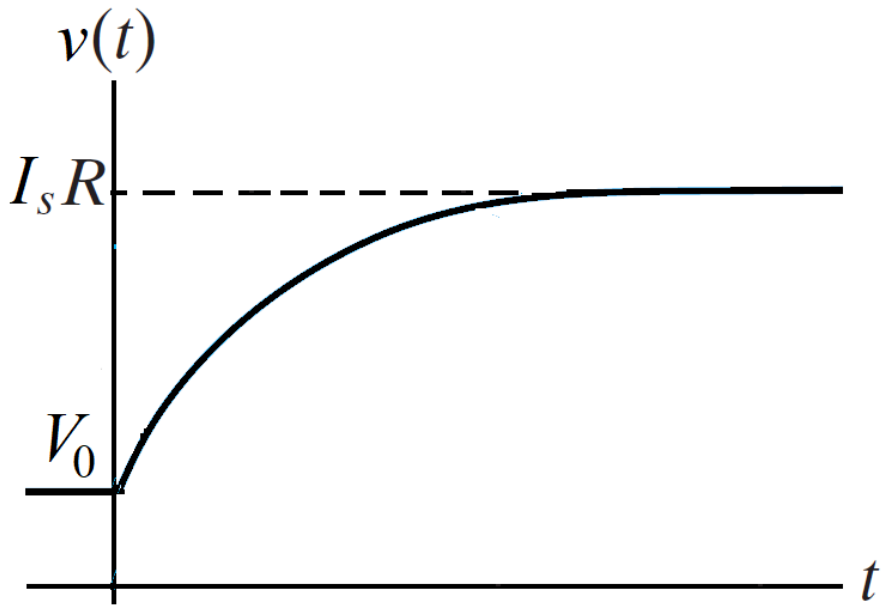
Step voltage response of RL circuit

- Step Response of an RC Circuit



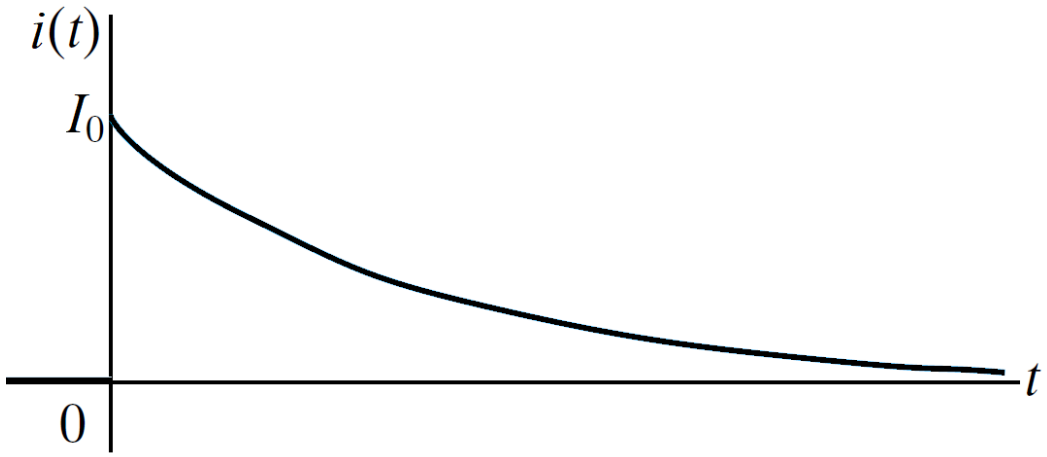
$$v(t) = I_s R + (V_0 - I_s R)e^{-\frac{t}{\tau}}, \qquad t \geq 0$$

- Step Response of an RC Circuit



Step voltage response of RL circuit

- Step Response of an RC Circuit



Step current response of RL circuit

General Solution for Natural and Step Responses

$$x(t) = x_f - [x(t_0) - x_f]e^{\frac{t-t_0}{\tau}}$$

The unknown variable as a function of time=the final value of the variable+(the initial value of the variable-the final value of the variable)$e^{-(\text{t-time of switching})/\text{time constant}}$

Reference

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