EEE104
Circuit Analysis I

Ankara University

Faculty of Engineering

Electrical and Electronics Engineering Department

Natural and Step Responses of RLC Circuits

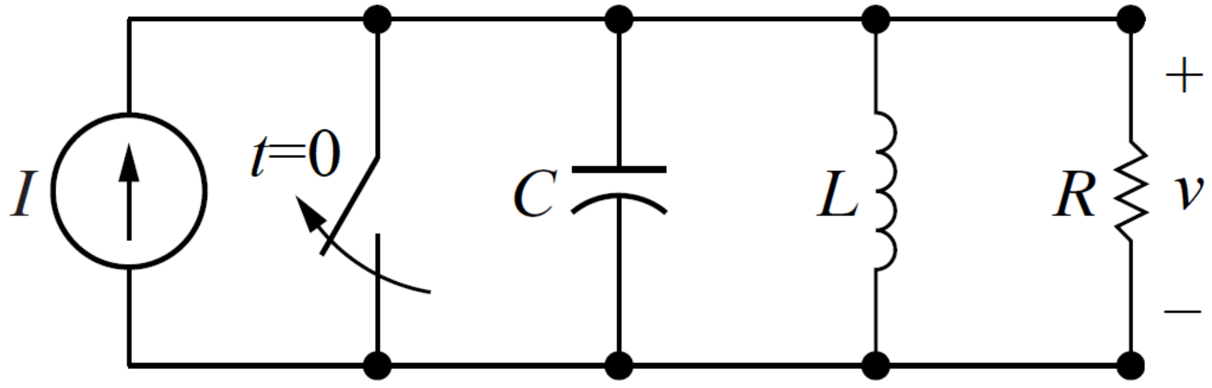
EEE104 Circuit Analysis I

Lecture 13

Agenda

- Step Response of a Parallel RLC Circuit

- Step Response of a Parallel RLC Circuit



- Step Response of a Parallel RLC Circuit

$$i_L + i_R + i_C = I$$

$$i_L + \frac{v}{R} + C\frac{dv}{dt} = I$$

$$\frac{d^2 i_L}{dt^2} + \frac{1}{RC}\frac{di_L}{dt} + \frac{i_L}{LC} = \frac{I}{LC}$$

- Step Response of a Parallel RLC Circuit

$$\frac{1}{L}\int_0^t v\,d\tau + \frac{v}{R} + C\frac{dv}{dt} = I$$

$$\frac{v}{L} + \frac{1}{R}\frac{dv}{dt} + C\frac{d^2v}{dt^2} = 0$$

$$\frac{d^2v}{dt^2} + \frac{1}{RC}\frac{dv}{dt} + \frac{v}{LC} = 0$$

- Step Response of a Parallel RLC Circuit

$$v = A_1 e^{s_1 t} + A_2 e^{s_2 t}$$

$$v = B_1 e^{-\alpha t} \cos \omega_d t + B_2 e^{-\alpha t} \sin \omega_d t$$

$$v = D_1 t e^{-\alpha t} + D_2 e^{-\alpha t}$$

★ $$i_L = I + A'_1 e^{s_1 t} + A'_2 e^{s_2 t}$$

★ $$i_L = I + B'_1 e^{-\alpha t} \cos \omega_d t + B'_2 e^{-\alpha t} \sin \omega_d t$$

★ $$i_L = I + D'_1 t e^{-\alpha t} + D'_2 e^{-\alpha t}$$

Reference

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