EEE104
Circuit Analysis I

Ankara University

Faculty of Engineering

Electrical and Electronics Engineering Department

Inductors and Capacitors

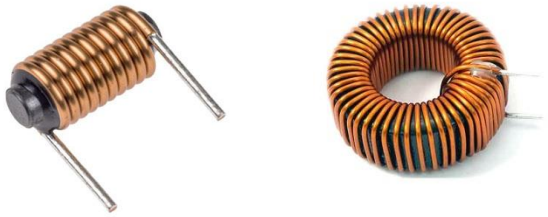
EEE104 Circuit Analysis I

Lecture 8

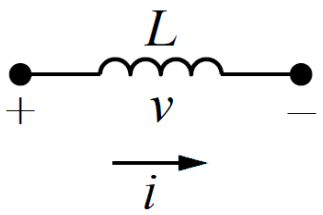
Agenda

- Inductance
- Capacitance
- Series and Parallel Combinations of Inductance and Capacitance

- Inductance



Inductor



$$v = L\frac{di}{dt}$$

- Inductance

$$i(t) = \frac{1}{L}\int_{t_0}^{t} v\, d\tau + i(t_0)$$

If $t_0 = 0$

$$i(t) = \frac{1}{L}\int_{0}^{t} v\, d\tau + i(0)$$

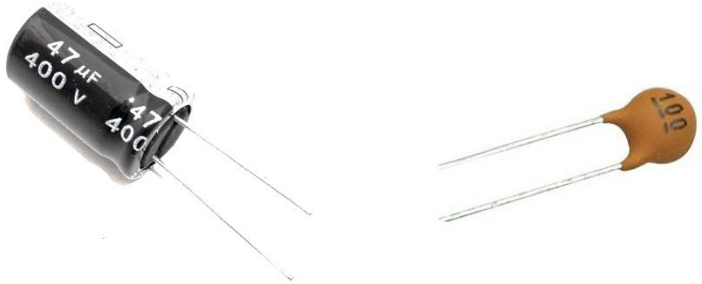
- Inductance

Power and Energy

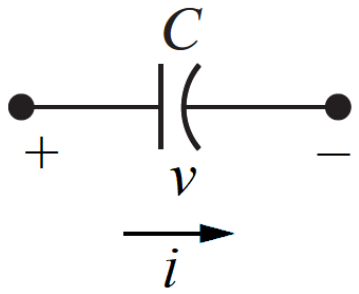
$$p = Li\frac{di}{dt}$$

$$w = \frac{1}{2}Li^2$$

- Capacitance



Capacitor



$$i = C\frac{dv}{dt}$$

- Capacitance

$$v(t) = \frac{1}{C}\int_{t_0}^{t} i\, d\tau + v(t_0)$$

If $t_0 = 0$

$$v(t) = \frac{1}{C}\int_{0}^{t} i\, d\tau + v(0)$$

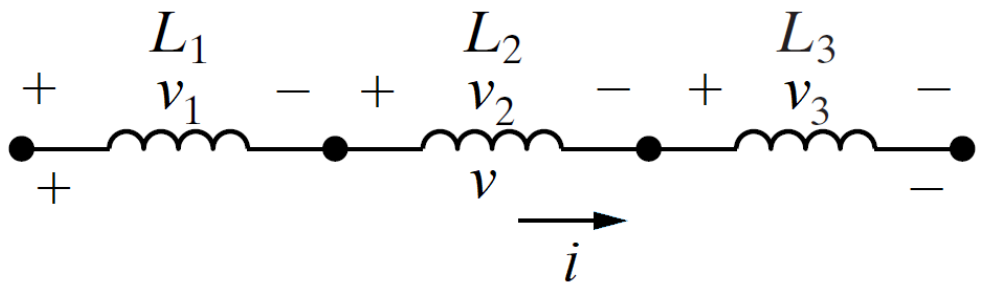
- Capacitance

Power and Energy

$$p = Cv\frac{dv}{dt}$$

$$w = \frac{1}{2}Cv^2$$

- Series Combinations of Inductors



$$v_1 = L_1\frac{di}{dt} \qquad v_2 = L_2\frac{di}{dt} \qquad v_3 = L_3\frac{di}{dt}$$

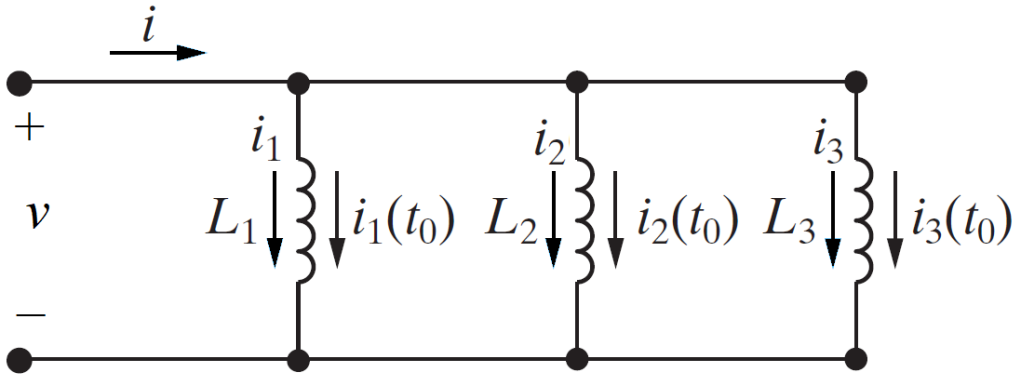
$$v = v_1 + v_2 + v_3 = (L_1 + L_2 + L_3)\frac{di}{dt}$$

$$L_{eq} = L_1 + L_2 + L_3$$

IN GENERAL

$$L_{eq} = \sum_i L_i$$

- Parallel Combinations of Inductors

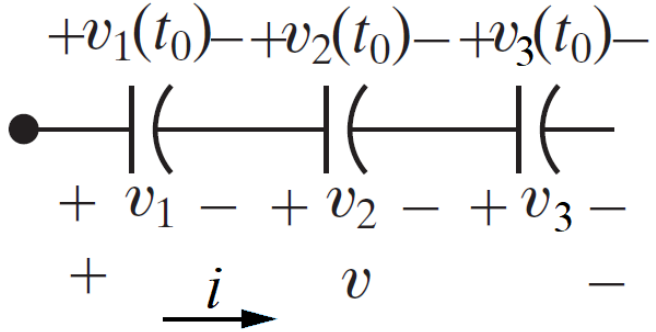


$$\frac{1}{L_{\text{eq}}} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

IN GENERAL

$$\frac{1}{L_{eq}} = \sum_i \frac{1}{L_i}$$

- Series Combinations of Capacitors

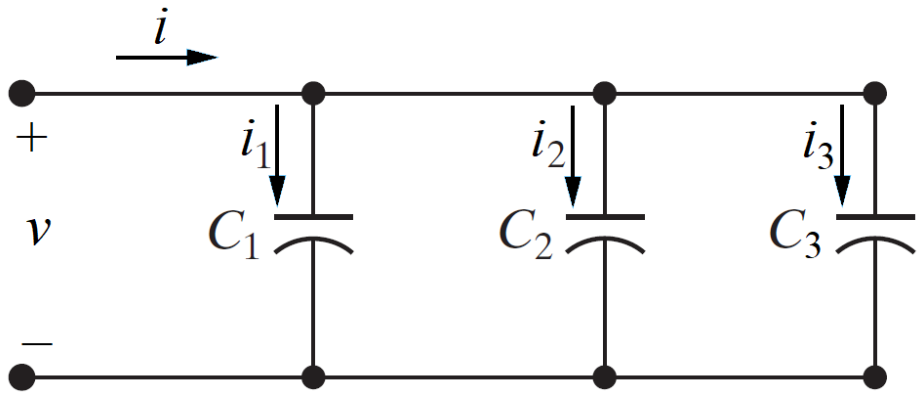


$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

IN GENERAL

$$\frac{1}{C_{eq}} = \sum_i \frac{1}{C_i}$$

- Parallel Combinations of Capacitors



$$C_{eq} = C_1 + C_2 + C_3$$

IN GENERAL

$$C_{eq} = \sum_i C_i$$

Reference

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