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 11

Agenda

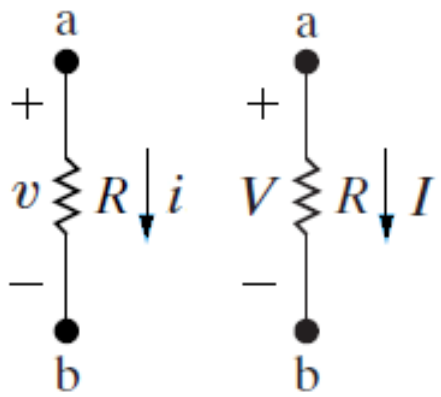
- Circuit Elements in the s Domain
- Circuit Analysis in the s Domain

Circuit Elements in the s Domain

Resistor:

$$v = Ri$$

$$\mathcal{L}\{v\} = \mathcal{L}\{Ri\} \Longrightarrow V = RI$$



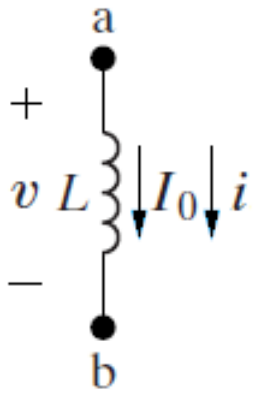
Circuit Elements in the s Domain

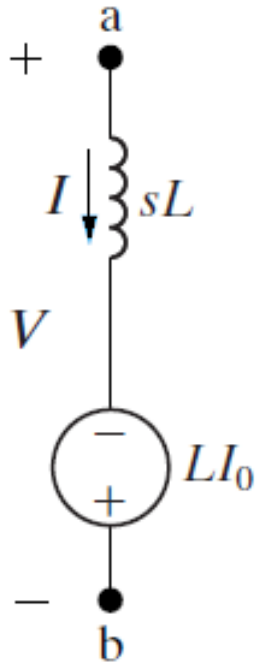
Inductor:

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

$$\mathcal{L}\{v\} = \mathcal{L}\left\{L\frac{di}{dt}\right\} \Longrightarrow V = L[sI - i(0^-)]$$

$$V = sLI - LI_0$$

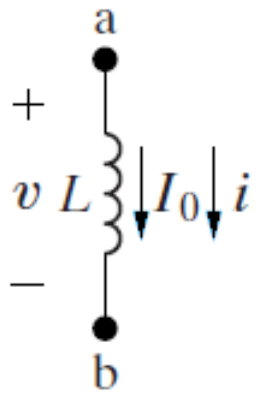


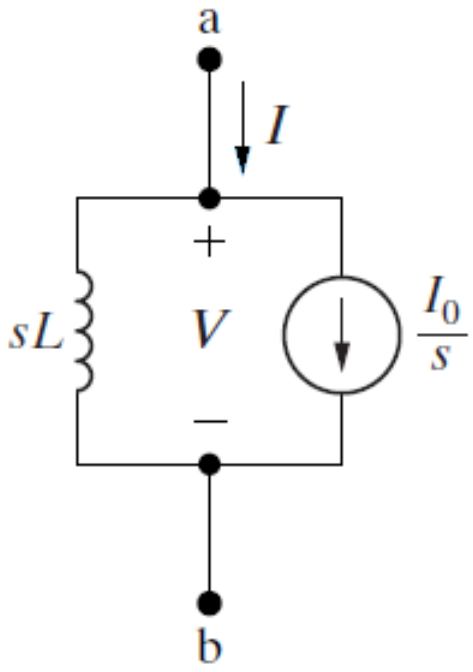


Circuit Elements in the s Domain

Inductor:

$$V = sLI - LI_0 \Longrightarrow I = \frac{V}{sL} + \frac{I_0}{s}$$





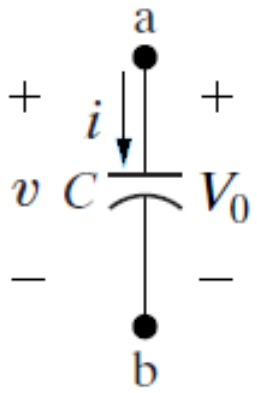
Circuit Elements in the s Domain

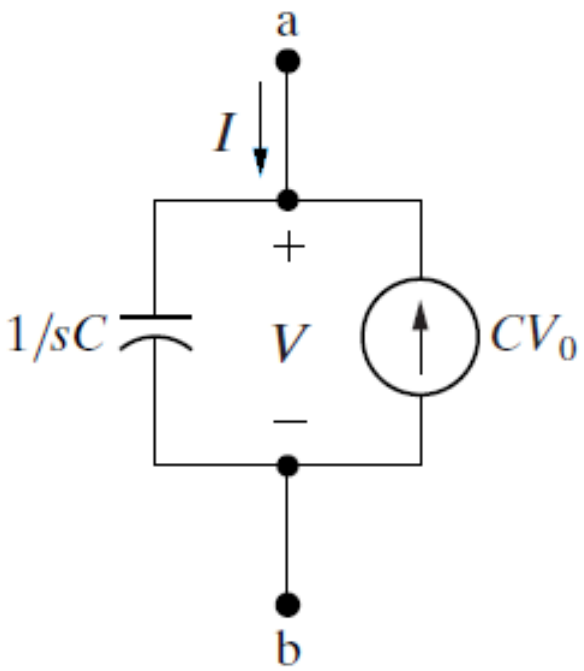
Capacitor:

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

$$\mathcal{L}\{i\} = \mathcal{L}\left\{C\frac{dv}{dt}\right\} \Longrightarrow I = C[sV - v(0^-)]$$

$$I = sCV - CV_0$$

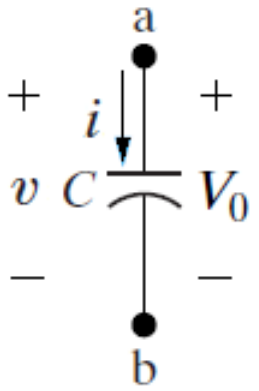


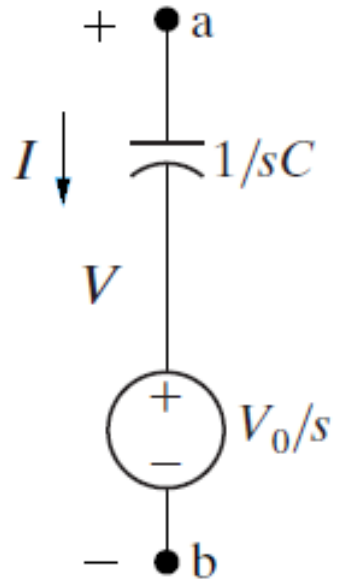


Circuit Elements in the s Domain

Capacitor:

$$I = sCV - CV_0 \Longrightarrow V = \left(\frac{1}{sC}\right) I + \frac{V_0}{s}$$





Circuit Analysis in the s Domain

Relationship between the terminal voltage and current:

$$V = ZI$$

Kirchhoff's Laws: $\sum I = 0$ and $\sum V = 0$

Reference

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