



Transient Analysis II

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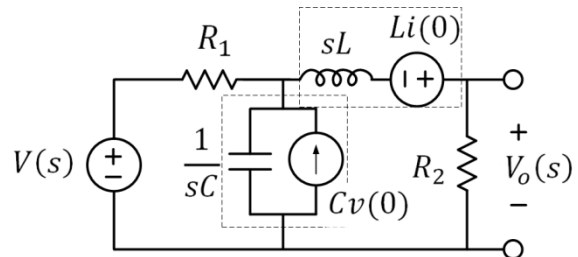
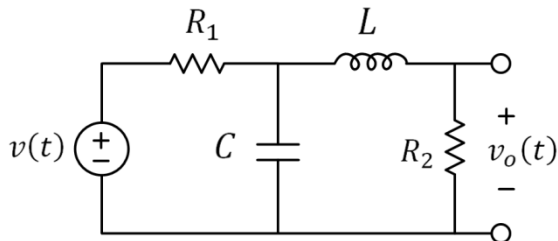
OUTLINE

- Application of the Laplace
 - Use of s -Domain Circuit Models
- Analysis Techniques
 - Superposition
 - Thévenin and Norton Equivalent Circuit
 - Loop and Node Analysis

Applications of the Laplace

Steps in Applying the Laplace Transform

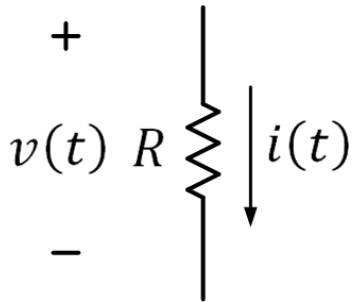
- 1) Transform the circuit from the time domain to the s-domain.



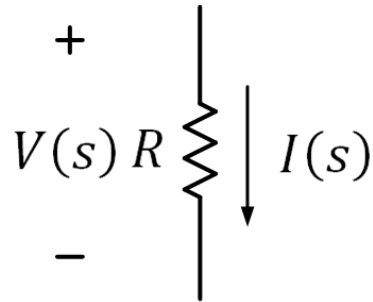
- 2) Solve the circuit using nodal analysis, mesh analysis, source transformation, superposition, or any circuit analysis technique with which we are familiar.
- 3) Take the inverse transform of the solution and thus obtain the solution in the time domain.

Circuit Element Models

Resistor Model



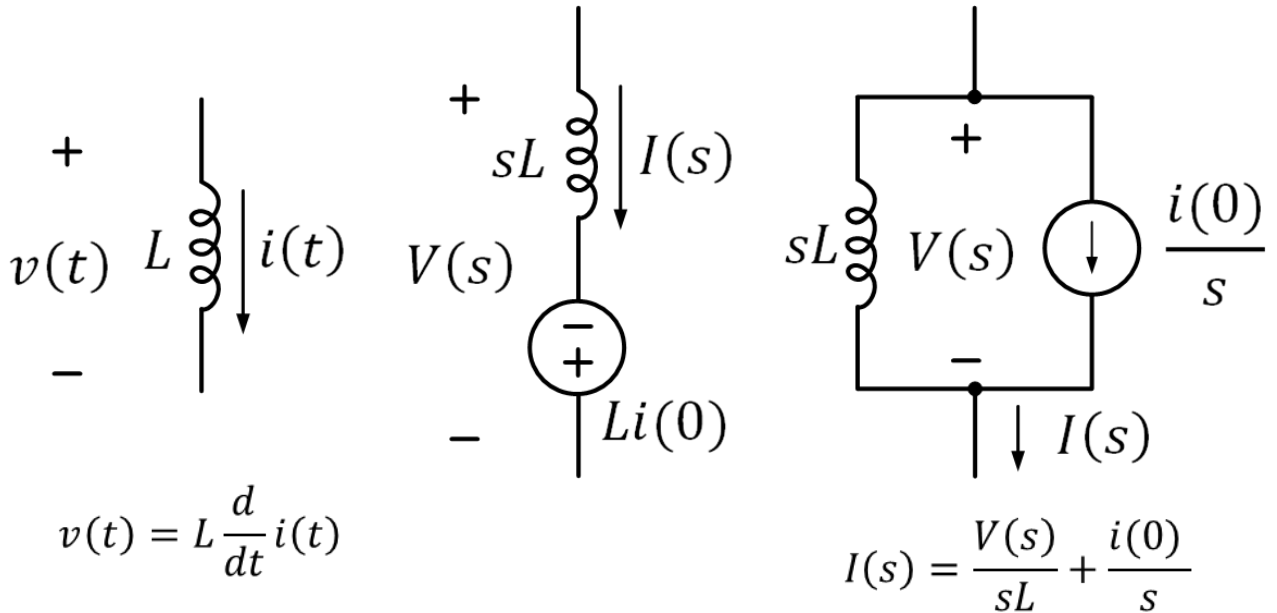
$$v(t) = R \times i(t)$$



$$V(s) = R \times I(s)$$

Circuit Element Models

Inductor Model



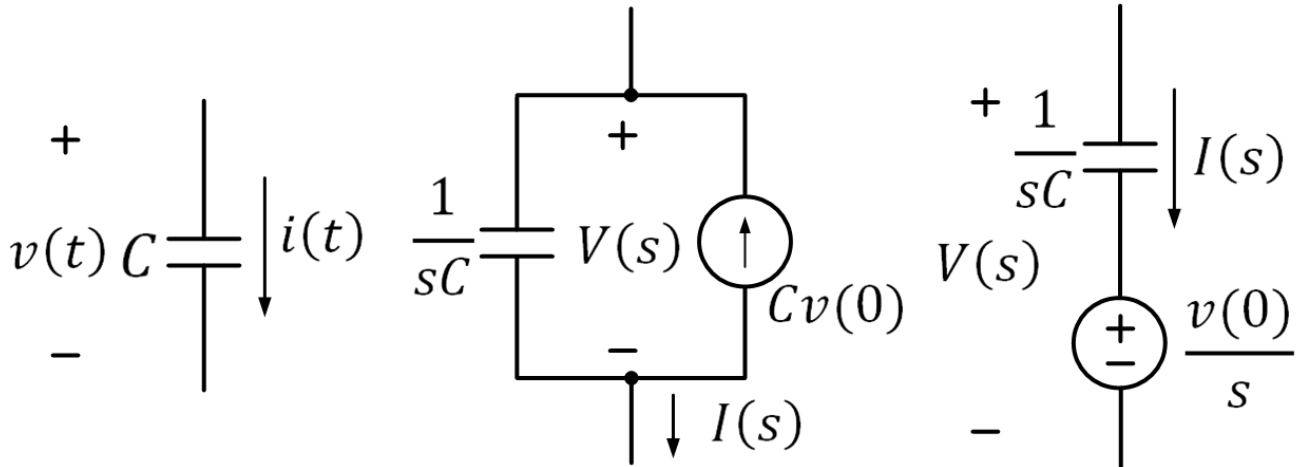
$$v(t) = L \frac{d}{dt} i(t)$$

$$I(s) = \frac{V(s)}{sL} + \frac{i(0)}{s}$$

$$\begin{aligned} V(s) &= L(sI(s) - i(0)) \\ &= sLI(s) - Li(0) \end{aligned}$$

Circuit Element Models

Capacitor Model



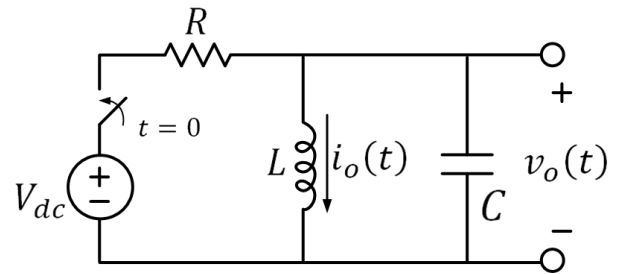
$$i(t) = C \frac{d}{dt} v(t)$$

$$\begin{aligned} I(s) &= C(sV(s) - v(0)) \\ &= sCV(s) - Cv(0) \end{aligned}$$

Applications of the Laplace

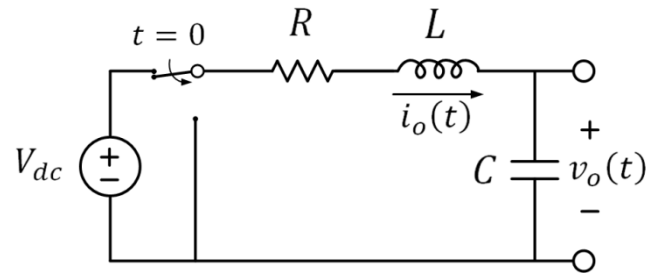
Example (1)

- Assume zero initial condition
 $i_L(0) = 0$ and $v_C(0) = 0$



Applications of the Laplace

Example (2)



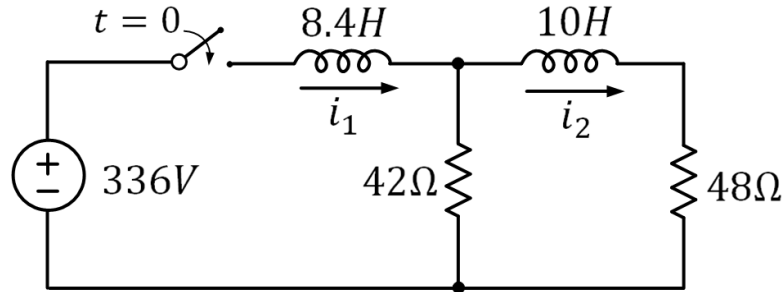
Applications of the Laplace

Analysis Techniques

- Loop and Node Analysis
- Superposition
- Thévenin and Norton Equivalent Circuit

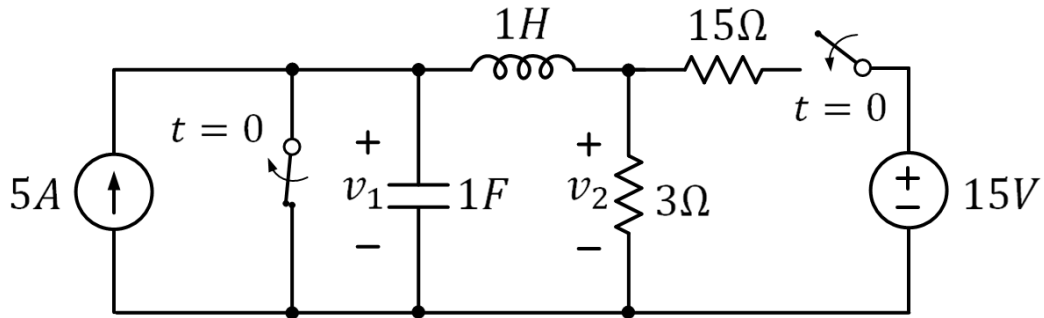
Applications of the Laplace

Example (3): Loop Analysis



Applications of the Laplace

Example (3): Superposition



Applications of the Laplace

Example (4): Thévenin Equivalent

