V-code: ???

Energy Storage Elements (2): Inductors

Lecture 11
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Outline

Textbook: 9.1, 9.2 (Inductors), 9.3.4

- **Constitutive Laws**
- **Series and Parallel Connections**

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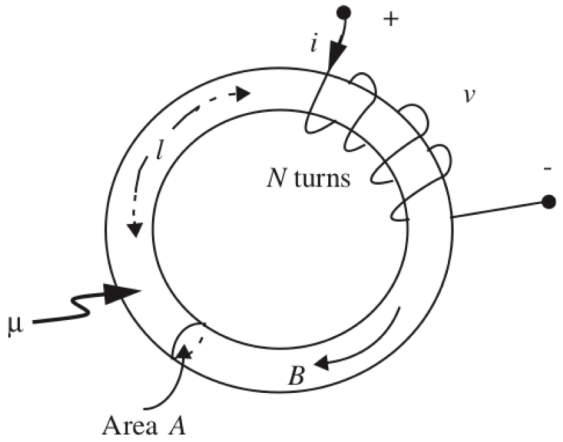
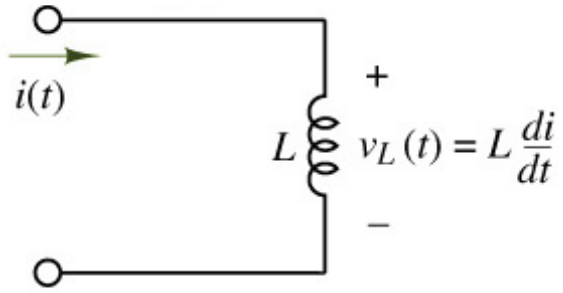
Inductance and Practical Inductors

- **Toroidal inductor and circuit symbol**





V = L di/dt
where
L=μN²A/l [Henry]

i(t) =

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Observations from v = L di/dt

- For DC current: inductor is a short circuit
- For *v* to be finite, *i(t)* must be continuous
- Typical units: mH ~ H

Inductor circuit is dual to Capacitor circuit

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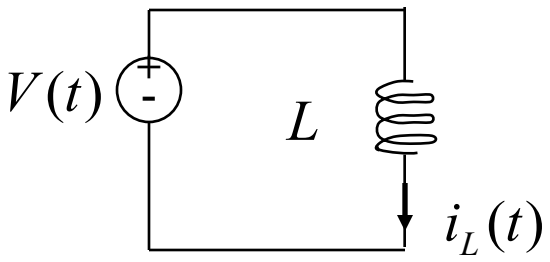
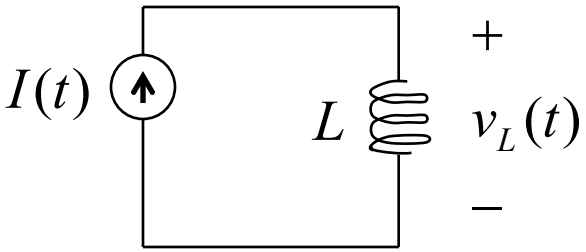
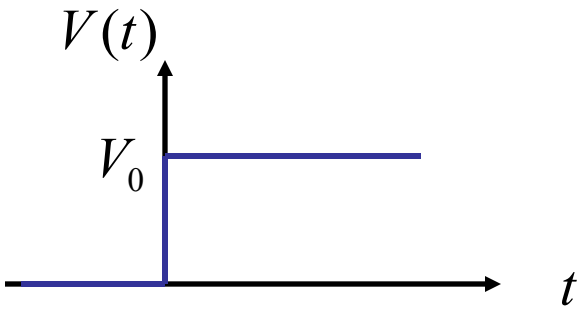
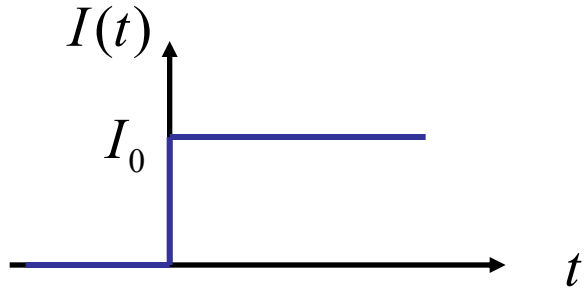
Voltage/Current Source and Inductor







Step input



Step input

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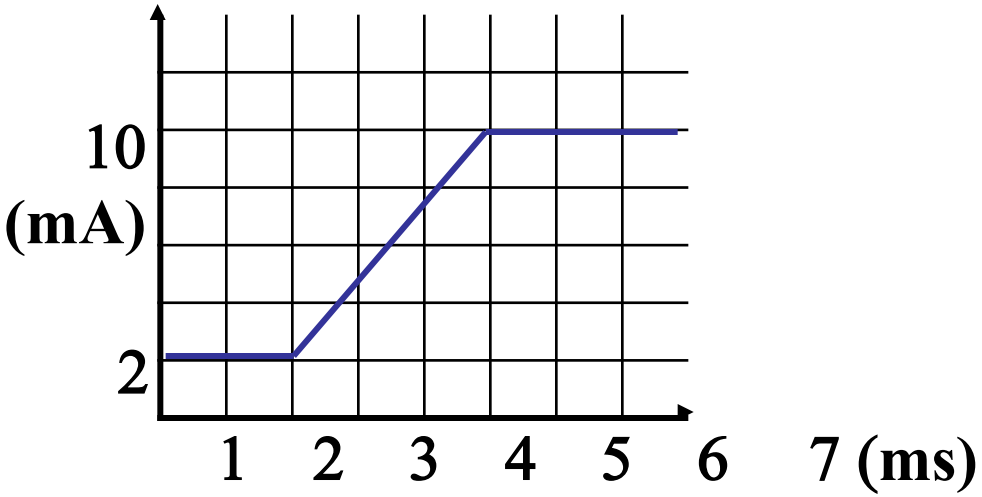
Energy Storage in Inductor

$$W_L = \frac{1}{2} L i_L^2$$



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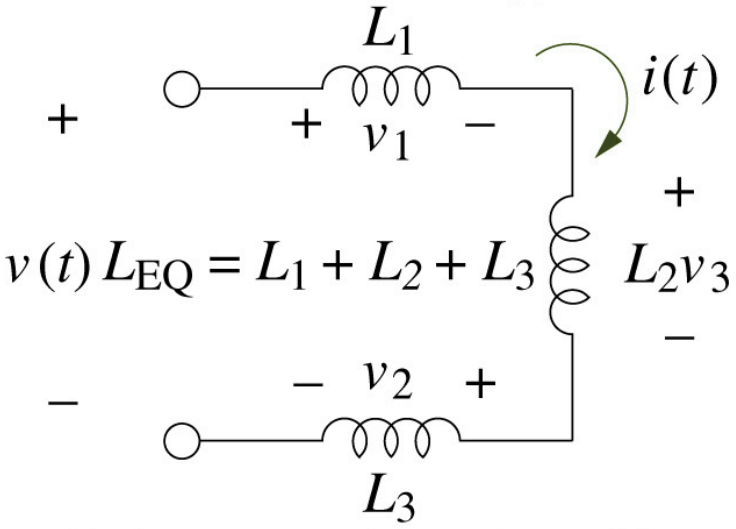
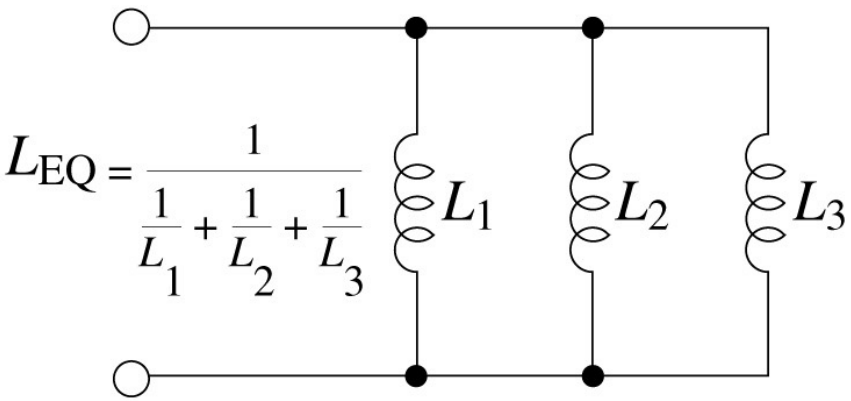
Combining Inductors in a Circuit



Inductances in series add



Inductances in parallel combine like resistors in parallel

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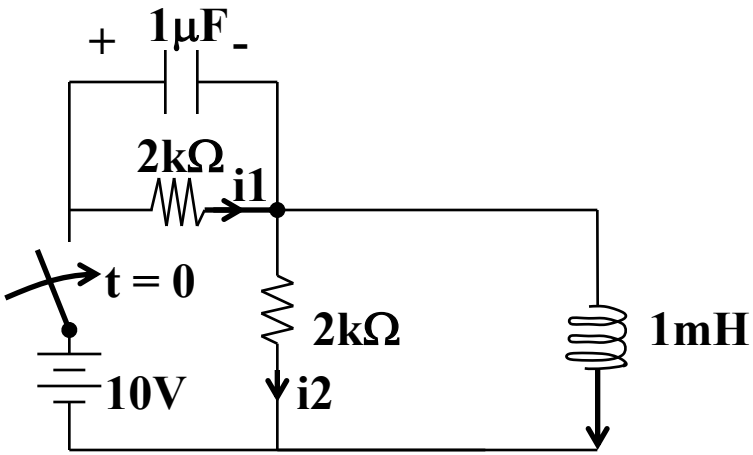
Exercise

Switch is closed at t = 0. Find the following:

$$i_2(0+), \quad \frac{dv_C}{dt}(0+), \quad \frac{di_2}{dt}(0+)$$



$v_c(0^-) = 5V, \; i_L(0^-) = 5mA$