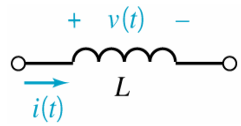
Inductors



$$v(t) = L\frac{d}{dt}i(t) \quad \text{and} \quad i(t) = \frac{1}{L}\int_{-\infty}^{t} v(\tau)\,d\tau = i(0) + \frac{1}{L}\int_{0}^{t} v(\tau)\,d\tau$$

These equations describe a voltage and current that adhere to the passive convention.

All of the currents and voltages are constant in a dc circuit. When the inductor current is constant, the inductor voltage is zero.

Inductors act like short circuits in dc circuits.

Suppose the inductor current is discontinuous, for example

$$i(t) = \begin{cases} 4.3 & t < 2.5 \\ 4.4 & t > 2.5 \end{cases}$$

That is, the current changes from 4.3 A to 4.4 A abruptly at time $t = 2.5$ s . At $t = 2.5$ s , the derivative of the inductor current is

$$\frac{d\,i}{d\,t} = \lim_{\Delta t \to 0} \frac{i(t+\Delta t) - i(t-\Delta t)}{(t+\Delta t) - (t-\Delta t)} = \lim_{\Delta t \to 0} \frac{4.4 - 4.3}{2\,\Delta t} = \infty$$

Consequently, discontinuous inductor currents require infinite inductor voltages. Infinite voltages are physically impossible, so discontinuous inductor currents are physically impossible.

In the absence of infinite voltages, inductor currents must be continuous.