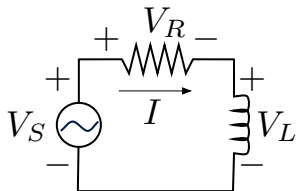


## Example 2: RL Circuit



$$-V_S + V_R + V_L = 0$$

Kirchhoff's voltage law

$$V_R = RI$$

Ohm's law

$$V_L = L\dot{I}$$

Faraday's law

$$-V_S + RI + L\dot{I} = 0$$

$$\dot{I} = -\frac{R}{L}I + \frac{1}{L}V_S \quad (\text{1st-order system})$$

$I$  – state,  $V_S$  – input

**Q:** How should we change the circuit in order to implement a *2nd-order system*? **A:** Add a capacitor.