Electrical sources

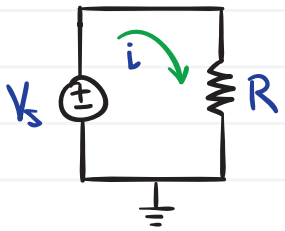
Ideal sources

Ideal electrical sources specify either the current or voltage, and the other variable depends on the circuit.

Ideal voltage sources V_s specify an independent voltage V_s. The current through the source depends on the circuit.

Ideal current sources I_s specify an independent current I_s. The voltage across the source depends on the circuit.

The problem with ideal sources is that they can be unrealistic. Consider the case of a voltage source across a resistor of resistance R.



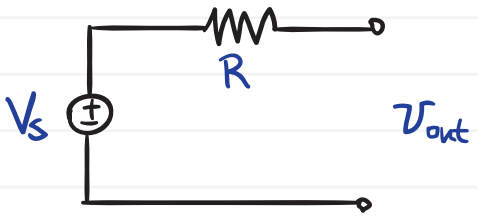
The current through R is $i = \frac{V_s}{R}$. If R is small, the current is large. If $R \to 0$, $i \to \infty$ (short circuit). Real sources can't provide infinite current and finite voltage. (In reality, V_s would become small, because $P = V_s i$, and power is limited.

This means that if we ave to model real sources we need to modify the behavior of pure sources.

Real source modeling

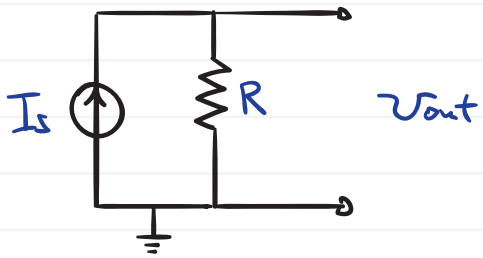
One way to approximate real sources is to use a resistor in parallel or series with the source.

A voltage source can be modeled as a resistor in series with an ideal voltage source.



The resistor limits the current draw. This is called a Thévenin equivalent source.

A current source can be modeled as a resistor in parallel with an ideal current source.



The resistor limits the voltage requirement. This is called a Norton equivalent source.