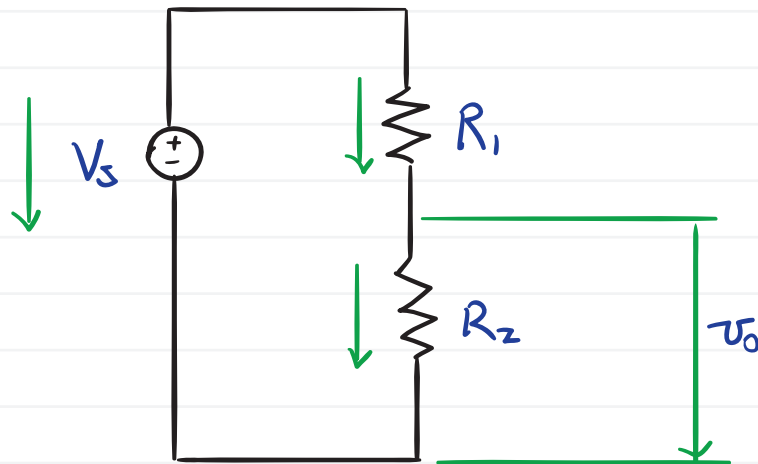


Voltage dividers

Voltage dividers are circuits that are ubiquitous. They're usually used to produce a desired output voltage from a given, higher input voltage. We typically characterize voltage dividers by solving for $v_o(v_s)$.



Analysis

1. Assign sign convention.

2. Elemental equations: $v_{R_1} = i_{R_1} R_1$ (1)
 $v_{R_2} = i_{R_2} R_2 = v_o$ (2)

3. KCL: $i_{R_1} - i_{R_2} = 0 \Rightarrow i = i_{R_1} = i_{R_2}$ (3)

4. KVL: $v_s - v_{R_1} - v_{R_2} = 0 \Rightarrow v_{R_1} = v_s - v_{R_2}$ (4)

5. Solve for $v_o(v_s)$.
From (1), (3), + (4),

$i = \frac{1}{R_1} (v_s - v_o)$. Combining this with (1),

$$v_o = \frac{R_2}{R_1} (v_s - v_o) \Rightarrow \boxed{v_o = \frac{R_2}{R_1 + R_2} v_s}$$