RBE 1001: Introduction to Robotics
C-Term 2019-20
HW 3.2: Solutions

Last modification: February 6, 2020

Solutions

Sayood – Exercise 3.12

To find the voltage, V_o, across the 2k resistor, we can first find the current through it and then use Ohm's Law to get the voltage.

To find the current, we need to first find the current through the whole circuit. But this can be calculated by hand, because the right hand side is just two 6kΩ (equivalent) resistors in parallel, or 3kΩ. So the current through the circuit is

$$I_s = \frac{V_s}{9k\Omega + 3k\Omega} = 1mA$$

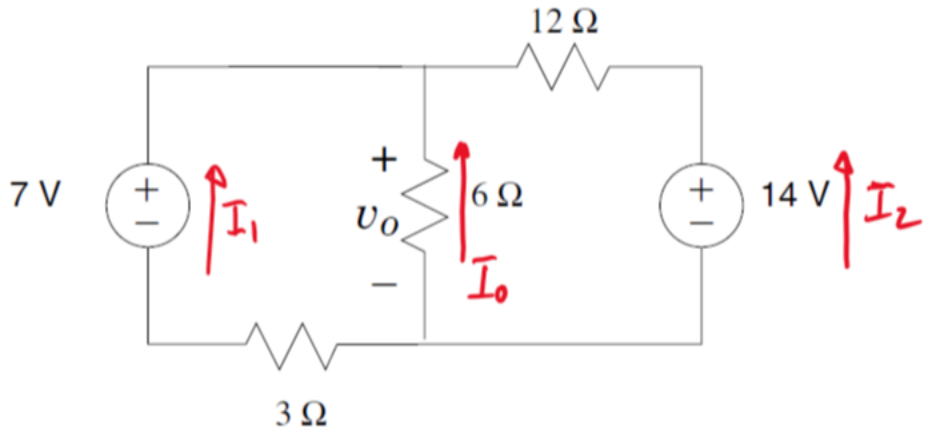
for $V_s = 12V$.

Since each leg of the right hand side is 6kΩ (equivalent), the current is split equally across them, and then

$$\boxed{V_o = 0.5mA \cdot 2k\Omega = 1V}$$

Sayood – Exercise 3.16

With the currents defined as shown, $I_0 = -I_1 - I_2$



Applying KVL in the left loop:

$$7 + 6I_0 - 3I_1 = 7 - 9I_1 - 6I_2 = 0$$

Applying KVL in the right loop:

$$14 - 12I_2 + 6I_0 = 14 - 6I_1 - 18I_2 = 0$$

The linear system becomes:

$$\begin{cases} 9I_1 + 6I_2 = 7 \\ 6I_1 + 18I_2 = 14 \end{cases} \implies \begin{cases} I_1 = 1/3\text{A} \\ I_2 = 2/3\text{A} \end{cases}$$

So that $I_0 = -1A$, which leads to $\boxed{v_0 = 6V}$