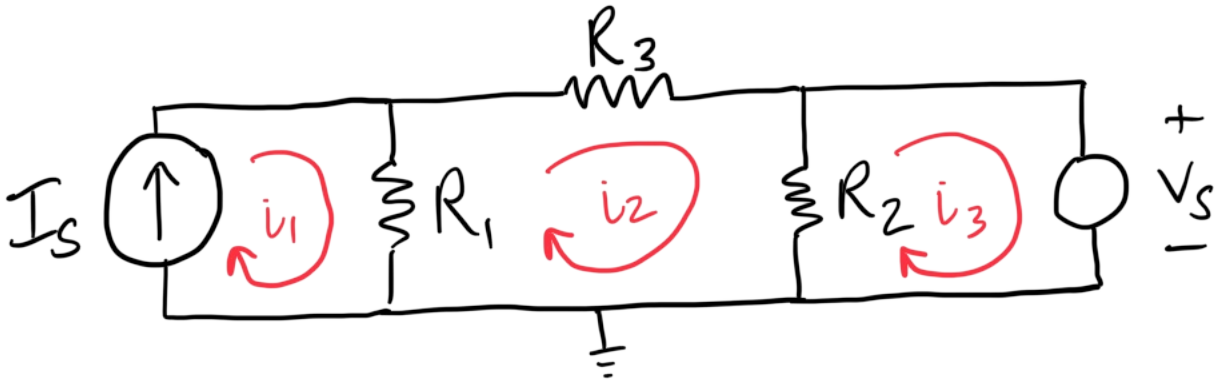


mesh analysis:

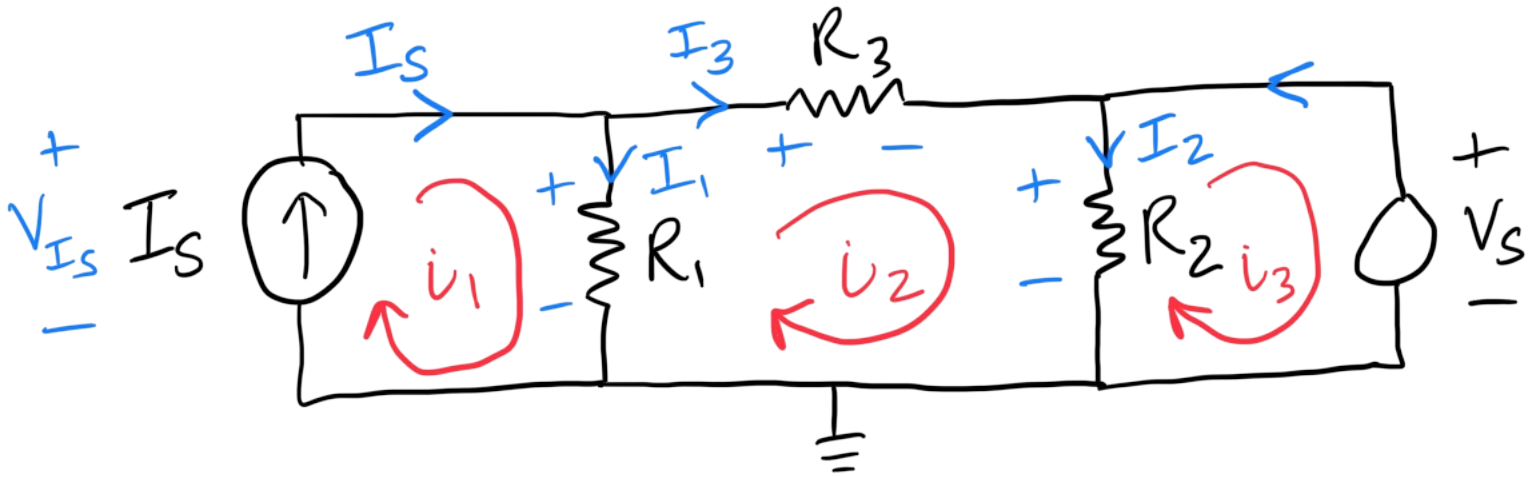
unknowns: (1) mesh currents

(2) voltage across current sources

known: (1) sources

equations to use:

- KVL represented using mesh currents
- current sources



unknowns: i_1, i_2, i_3, V_{I_S}

KVL on meshes:

mesh 1: $-V_{I_S} + V_{R_1} = 0$

ohm's law: $\boxed{-V_{I_S} + R_1 (i_1 - i_2) = 0}$

this is the correct equation; check for yourselves! :)

$R_1 i_1 - R_1 i_2 - V_{I_S} = 0$

known

mesh 2 : $-V_{R_1} + V_{R_3} + V_{R_2} = 0$

ohm's law : $-R_1(i_1 - i_2) + R_3 i_2 + R_2(i_2 - i_3) = 0$

$-R_1 i_1 + (R_1 + R_2 + R_3) i_2 - R_2 i_3 = 0$ known

mesh 3 : $-V_{R_2} + V_S = 0$

ohm's law : $-R_2(i_2 - i_3) + V_S = 0$

$-R_2 i_2 + R_2 i_3 = -V_S$ known

current source : $I_S = i_1$

together:

originally incorrectly written in lecture; this is correct

$$\begin{bmatrix} R_1 & -R_1 & 0 & -1 \\ -R_1 & R_1+R_2+R_3 & -R_2 & 0 \\ 0 & -R_2 & R_2 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \\ V_{I_S} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -V_S \\ I_S \end{bmatrix}$$

A $\quad$ x $\quad$ b

$$Ax = b \implies x = A^{-1}b$$

Let's add numbers!

$V_S = 3\,V$

$R_1 = 300\,\Omega$

$R_2 = 1\,K\Omega$

$R_3 = 100\,\Omega$

$I_S = 0\,A$

what is V_{R_3} ?