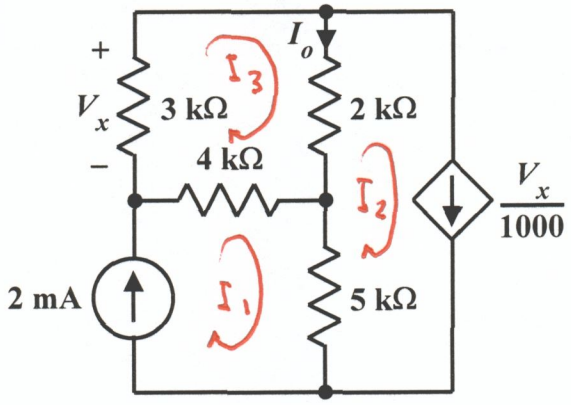
EE 2240

Problem #11

Use mesh analysis to find I_o.



$I_1 = 2\text{mA}$ (constraint)

$I_2 = \frac{V_x}{1000}$ (constraint)

$3000\,I_3 + 2000(I_3 - I_2) + 4000(I_3 - I_1) = 0$ (mesh 3)

$V_x = -3000\,I_3$ (definition)

In matrix form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & -0.001 \\ -4000 & -2000 & 9000 & 0 \\ 0 & 0 & 3000 & 1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ V_x \end{bmatrix} = \begin{bmatrix} 0.002 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

Solving yields: $I_2 = -1.6\,\text{mA}$ and $I_3 = \frac{8}{15}\,\text{mA}$

Then $I_o = I_3 - I_2 = \frac{32}{15}\,\text{mA}$