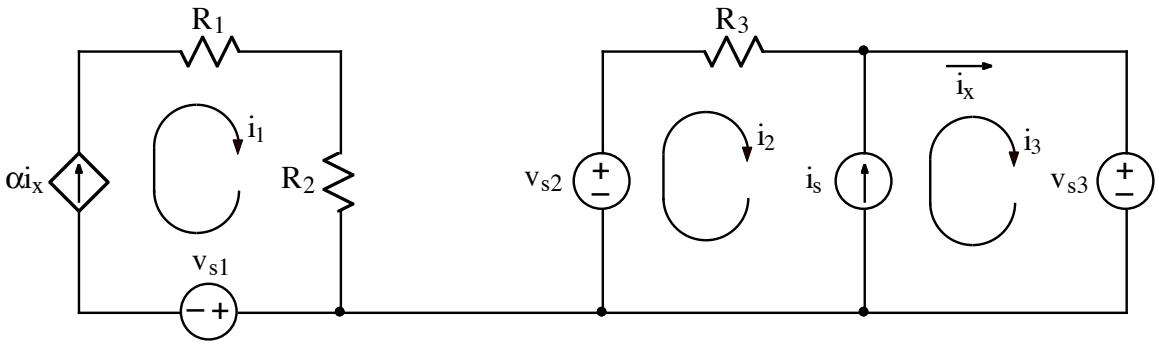
EX:



For the circuit shown, write three independent equations for the three mesh currents i_1, i_2, and i_3. The quantity i_x must not appear in the equations.

sol'n: First, we express i_x in terms of mesh currents. Since i_x is on the outer edge of the circuit, it is equal to the mesh current i_3:

$$i_x = i_3$$

Second, we examine the i_1 loop and find that the dependent source is on the outside edge. Thus, $\alpha i_x = i_1$. Substituting for i_x gives an equation for i_1:

(1) $i_1 = i_3$

Third, we examine the i_2 loop and find that the current source, i_s, between the i_2 and i_3 loops means we have an i_2, i_3 super mesh.

The v-loop for the i_2, i_3 super mesh is

(2) $v_{s2} - i_2 R_3 - v_{s3} = 0V$

Note: The problem asks only for circuit eq'ns, but we could easily solve for i_2:

$$i_2 = \frac{v_{s2} - v_{s3}}{R_3}$$

Fourth, we write an eq'n for the i_s source between the i_2 and i_3 loops.

(3) $$i_s = i_3 - i_2$$

Note that i_3 flows in the same direction as i_s and i_2 flows opposite the direction of the arrow for i_s.

The eq'ns numbered (1), (2), and (3) are independent, (meaning we could solve them to find i_1, i_2, and i_3.