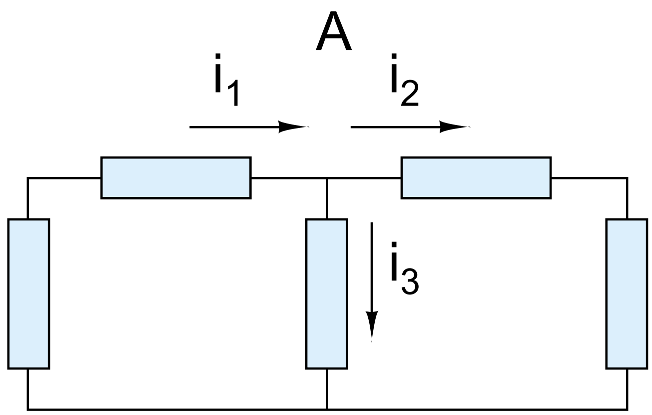
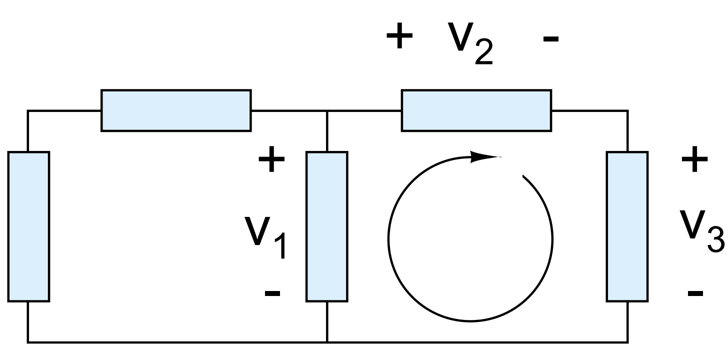
Do not try to get ahead of yourself on the problem sets. Do each little step in detail. It is better to err on the side of too much information rather than too little.

Homework set #3, due 4/16/08
3-2, 3-4, 3-7, 3-9, 3-12, 3-18, 3-19, 3-20

Note: You will have to know how to solve a system of 3 equations and 3 unknowns on the exams- see Appendix B and the discussion section

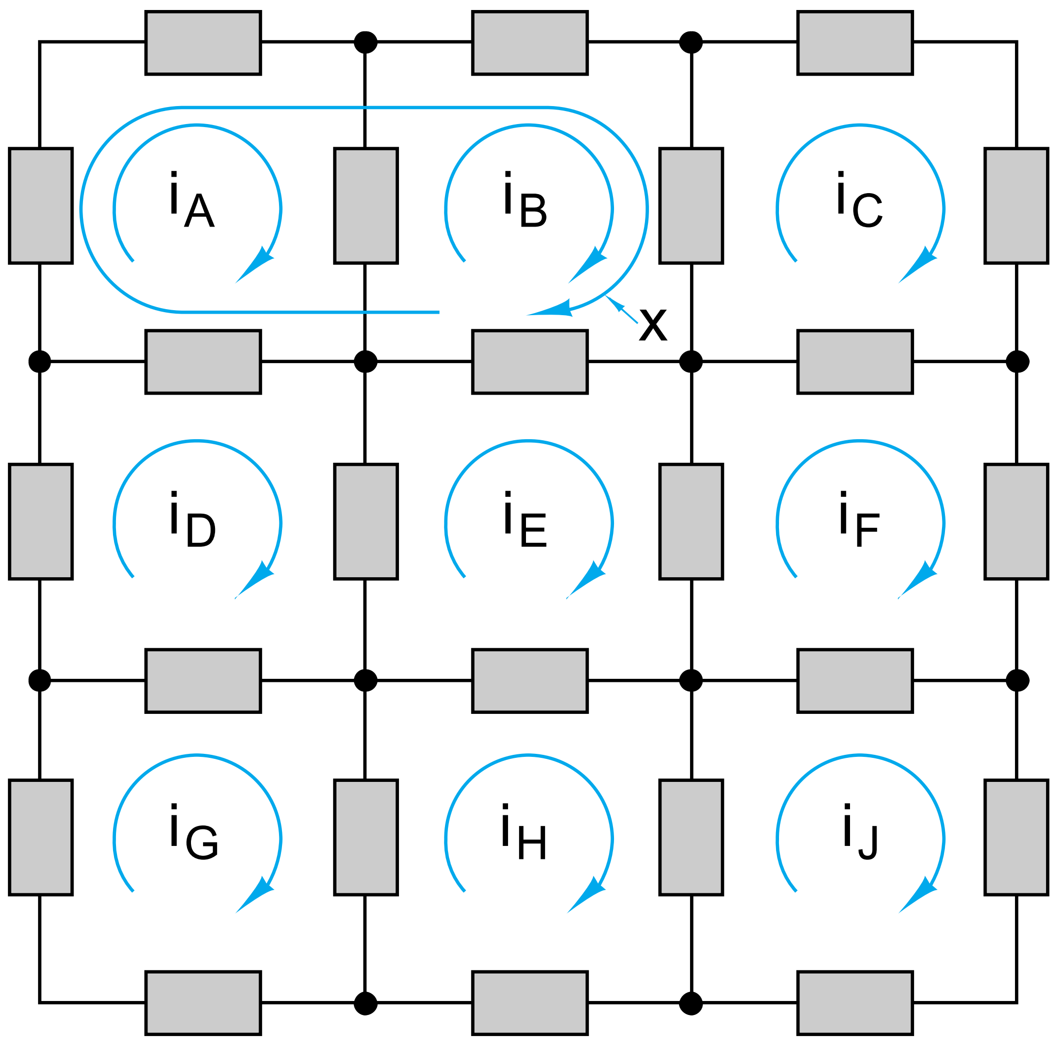
Quick review: KCL, KVL, and algebraic manipulation





Mesh currents:

A mesh is a loop, but a loop is not necessarily a mesh

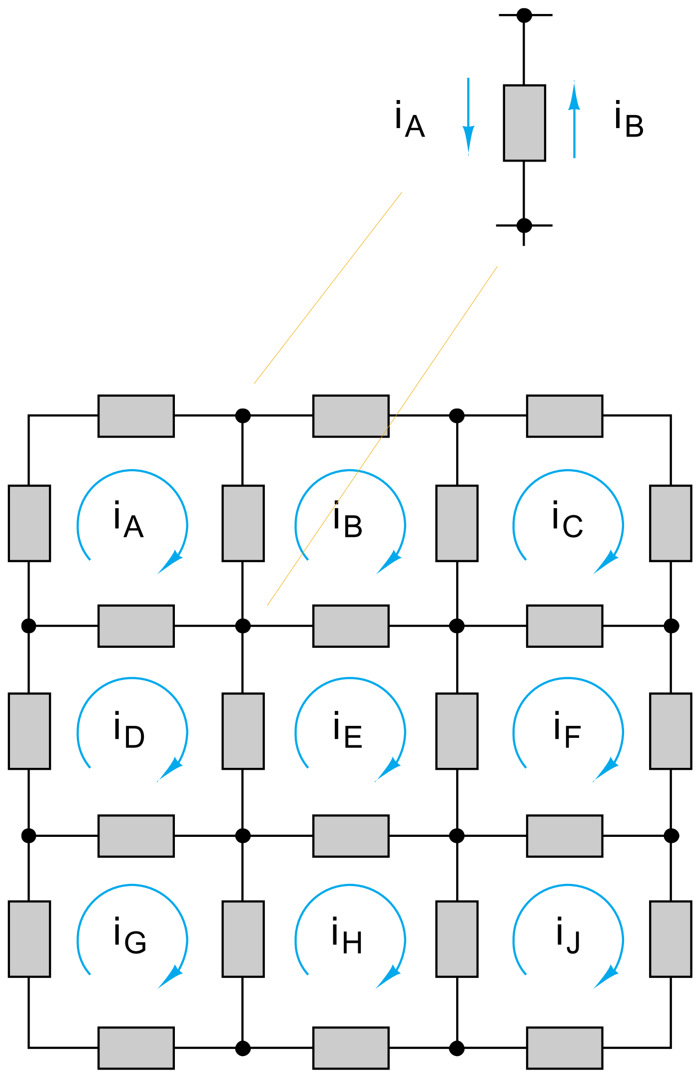


Note: Mesh current analysis is restricted to planar circuits

If the Kth two-terminal element is ~~connected between nodes~~ contained in meshes X and Y, then the element ~~voltage~~ current can be expressed in terms of the two ~~node voltages~~ mesh currents as

$$i_k=i_x-i_y$$

where X is the mesh whose reference direction agrees with the reference direction of i_k

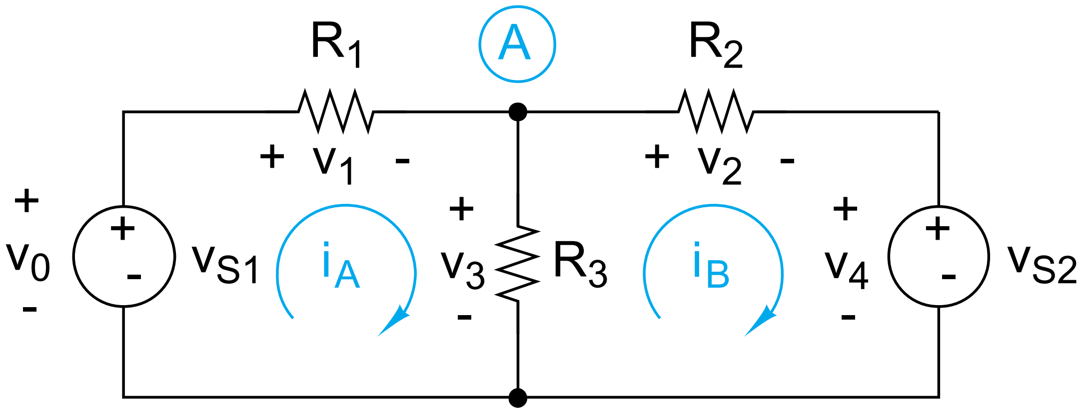


What if the element is contained in only one mesh?

Mesh current analysis

1) identify a mesh current with every mesh and a voltage across every circuit element.
2) write KVL connection constrains in terms of the element voltages around every mesh.
3) use KCL and the i-v relationships of the elements to express the element voltages in terms of the mesh currents
4) combine steps 2 & 3 to eliminate (non-source) element voltages. In the process, reorder node equations to put all dependent values on LHS and independent values on RHS
5) solve for mesh currents using linear algebra (you should know how to do this, see appendix B for a refresher)

Did somebody say example?



Making things quicker...

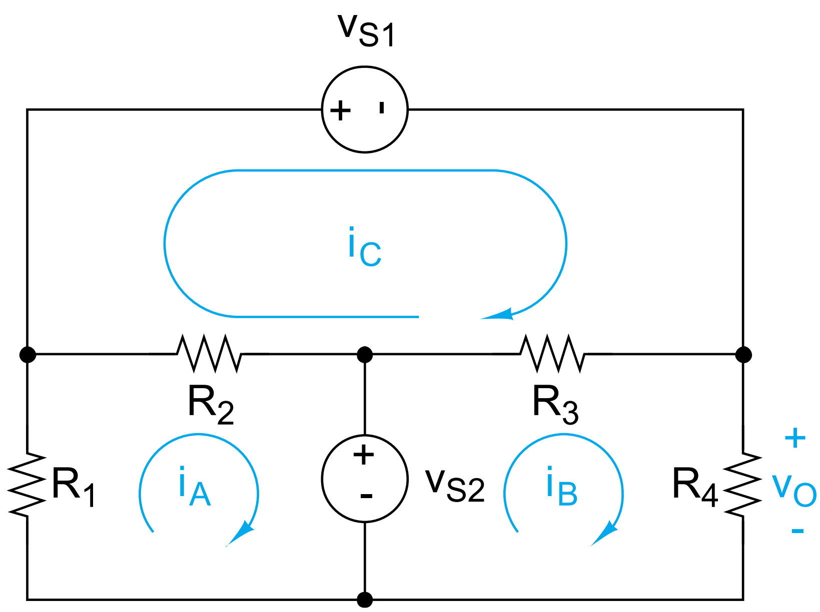
Replace steps 2-4 with modified step 2:

i_X•(sum of all resistances in mesh X) - Σ(resistance k common to mesh X)•i_k + other currents = 0

where i_k is the adjacent mesh current of the k-th resistor in mesh X

- Look familiar? It should
- Note, until you feel comfortable with the basic methodology, do not worry about mastering this simplification.

Oh what I'd give for an example...



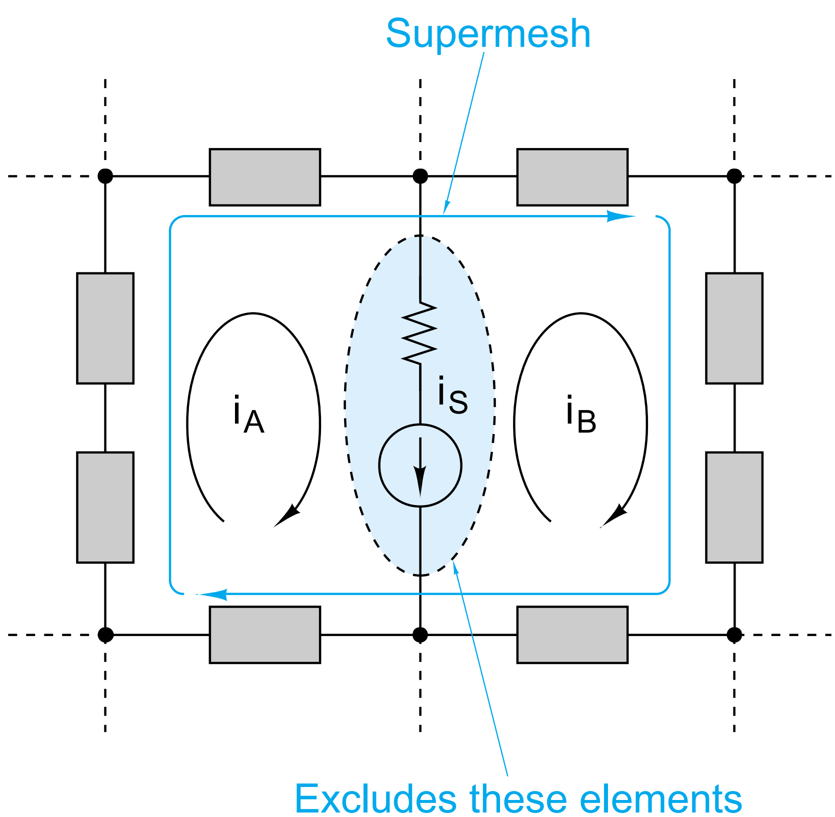
R_1=R_4=2kΩ; R_2=R_3=4kΩ; find v_o

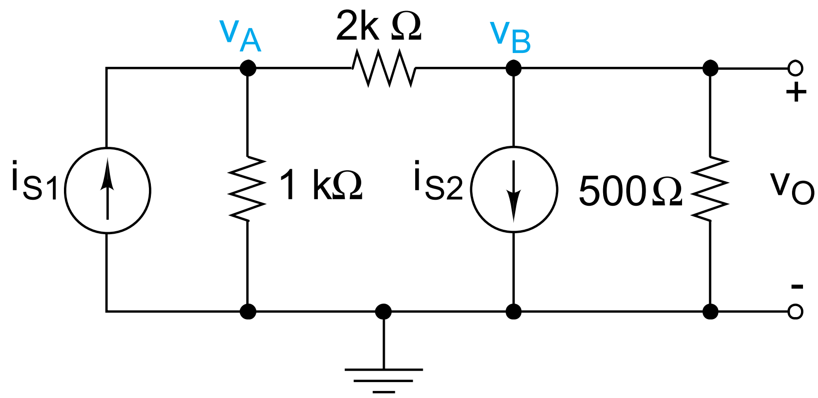
But what about current sources?

method 1: convert to voltage source

method 2: If current source is contained in only one mesh, than that mesh current is determined by the source.

method 3: Super mesh: apply KVL around the loop just outside of the element and note that $i_A - i_B = i_S$





v_A
2k Ω
v_B
+
i_{S1}
1 kΩ
i_{S2}
500Ω
v_O
-