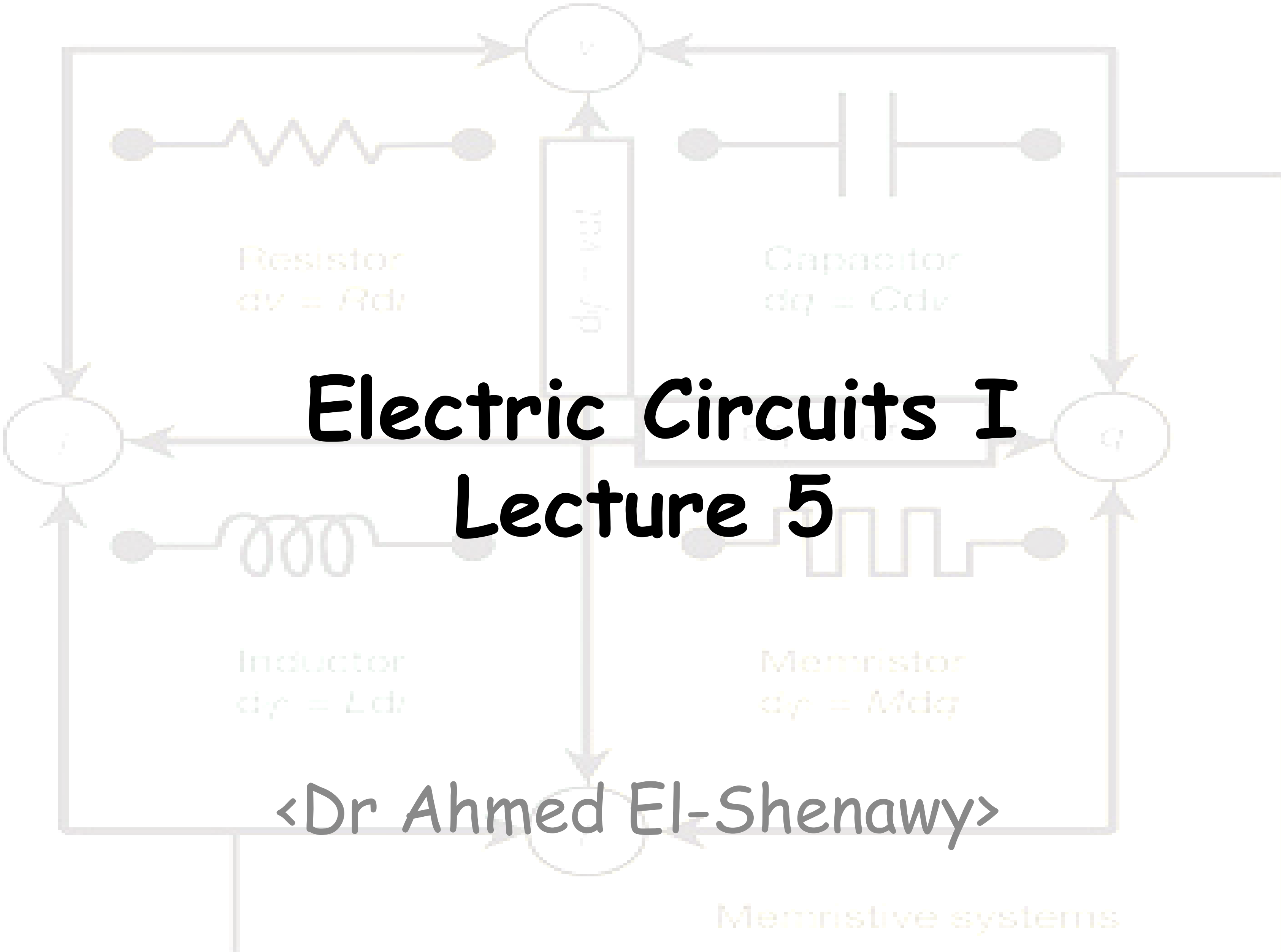

Electric Circuits I
Lecture 5

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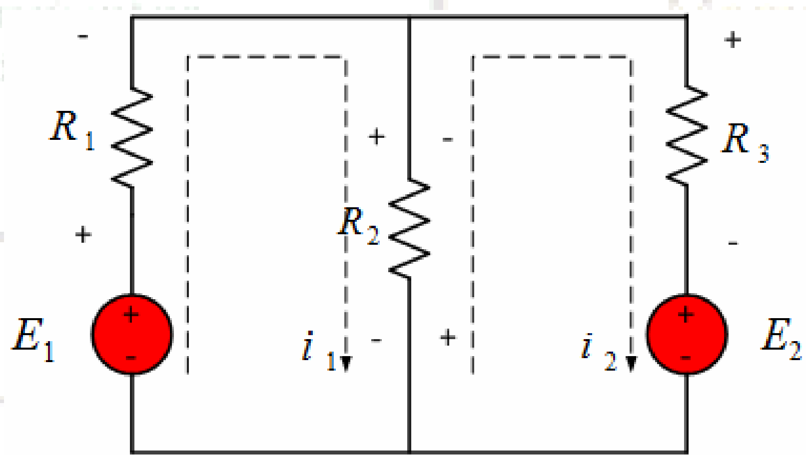
Mesh Analysis

1-Assign a distinct current in the clockwise direction to each independent closed loop (mesh) of the circuit. It is not absolutely necessary to choose the clockwise direction for each loop current. However, it eliminates the need to have to choose a direction for each application. Any direction can be chosen for each loop current with no loss in accuracy as long as the remaining steps are followed properly.

Note:A mesh is a loop which does not contain any other loops within it.

2- Indicate the polarities within each loop for each resistance as determined by the assumed direction of loop current for that loop.



3- Apply KVL around each closed loop in the clockwise direction. Again, clockwise direction was chosen to establish uniformity and prepare us for the format approach to follow:

a- If an resistance has two or more assumed currents through it, the total current through the resistance is the assumed current of the loop in which KVL is being applied, plus the assumed currents of the other loops passing through in the same direction, minus the assumed currents passing through in the opposite direction

b-The polarity of a voltage source is unaffected by the direction of the assigned loop currents.

4- Solve the resulting simultaneous linear equations for the assumed loop currents

Mesh 1

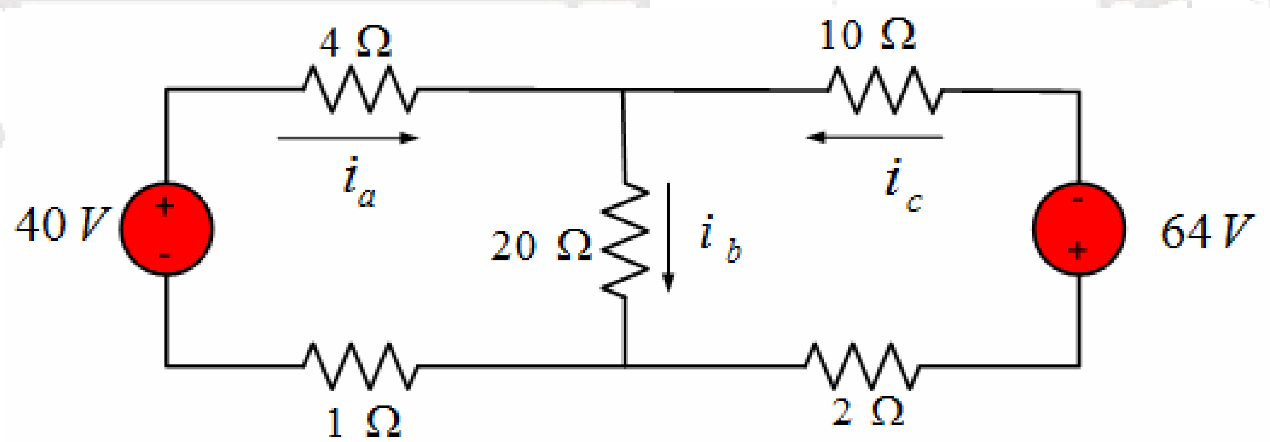
$$+E_1 - i_1R_1 - R_2(i_1 - i_2) = 0$$

Mesh 2

$$-R_2(i_2 - i_1) - i_2R_3 - E_2 = 0$$

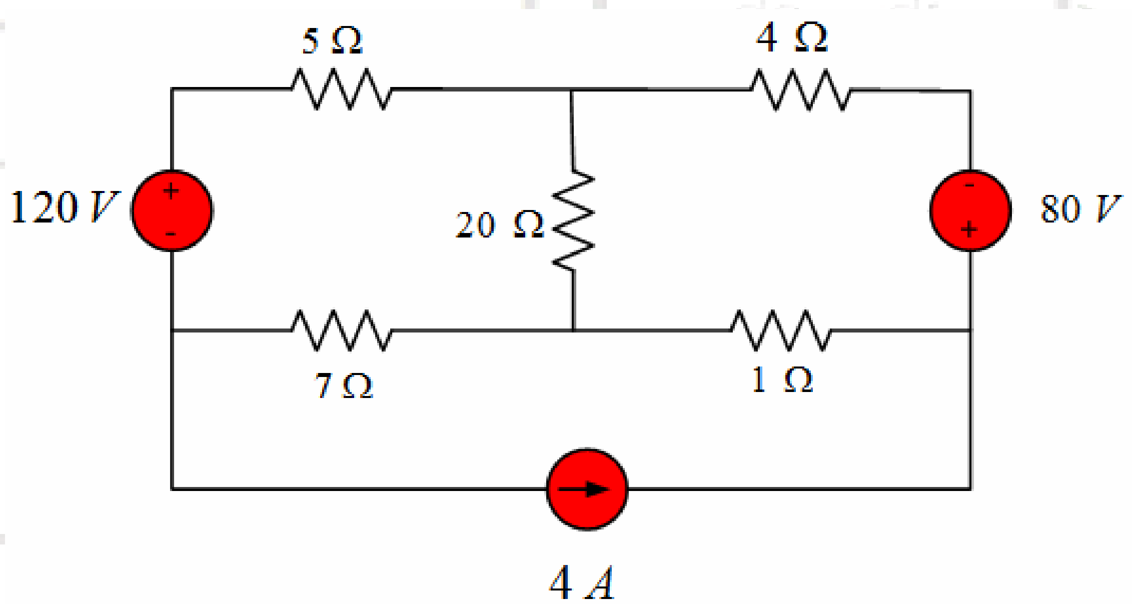
Example

Use the mesh-current method to find the branch currents i_a, i_b, i_c in the circuit shown in the figure below

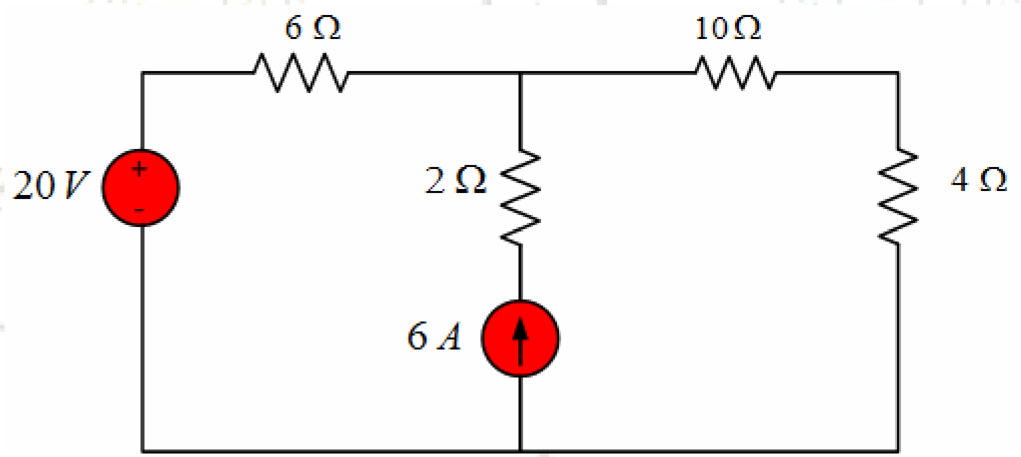


Example

Use the mesh-current method to find how much power the 4-A current source delivers to the circuit shown in the figure below

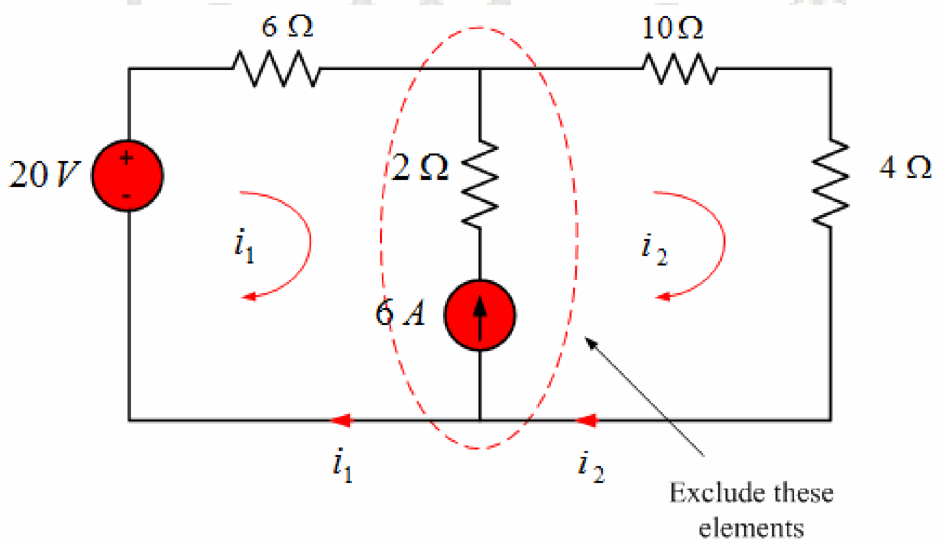


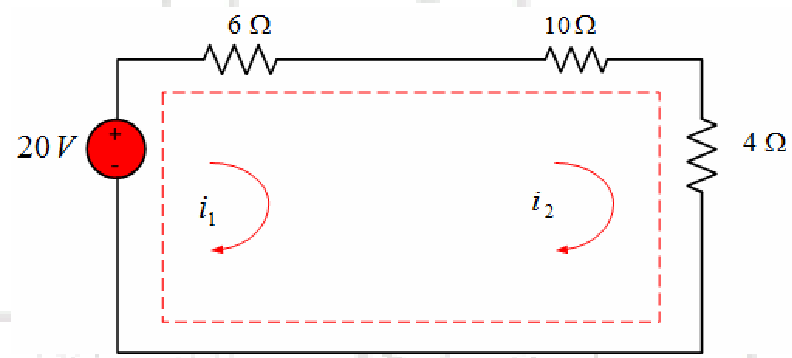
Supermesh: when a current source exists between two meshes



Procedure:

1. Open the current source. That is form a single mesh for the two mesh sharing the current source.





2. Write the constraint equation for the currents (Apply KCL).

$$i_2 - i_1 = 6$$

3. Write the standard mesh equation for the supermesh (Apply KVL).

$$i_1 6 + i_2(10 + 4) = 20$$

Example

Use the mesh-current method to find the current i_1 in the circuit shown in the figure below