Dr. Stuffle

LEL 216

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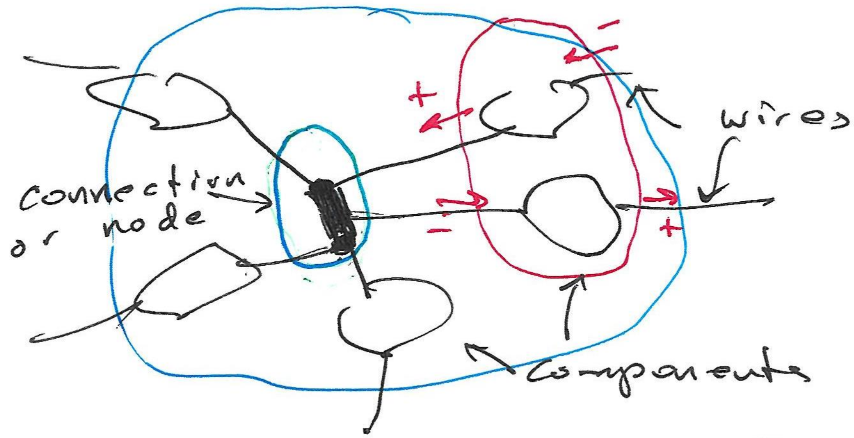
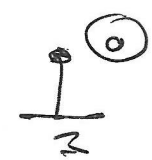
Component Connections

Node - 2 or more connections



Wires are ideal
=> no resistance

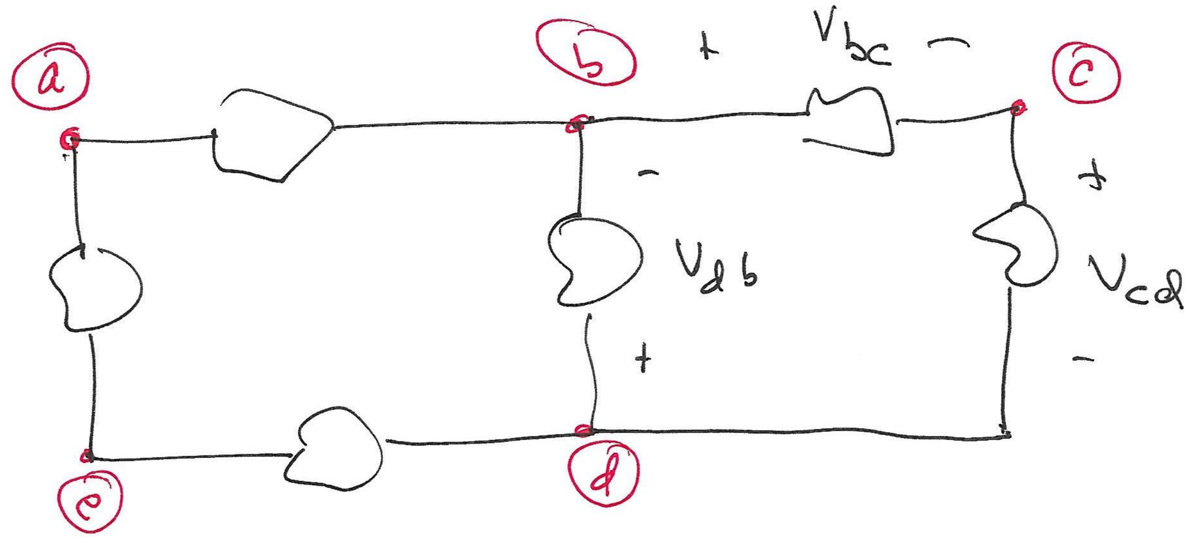


Kirchhoff's Current Law

The algebraic sum of all currents crossing any closed boundary is zero.

Kirchhoff's Voltage Law:

The algebraic sum of all voltages encountered when traversing any closed path is zero.



a, b, d, e, a is a closed path

a, b, c, d, e, a " " " "

b, c, d, b. " " " "

$V_{bc} + V_{cd} + V_{db} = 0$

Nodal Analysis:

1. Write a constraint equation (and create a supernode) for each voltage source.
   [if any supernodes contain the same original node, merge them into a single supernode]
2. Write a KCL equation for each supernode, and for each remaining original node (except the reference node)]
3. Solve.

Mesh Analysis:

[A mesh is a closed loop that contains no other loop]

1. Define mesh currents.
2. Write a constraint equation for each current source, and create a supermesh from the adjacent meshes.
3. Write a KVL equation for each supermesh and for each remaining original mesh. (Expressing resistor voltages in terms of the mesh currents.)
4. Solve for the mesh currents.

Independent voltage source

Independent current source

Resistor (Conductance)

Capacitor

Inductor

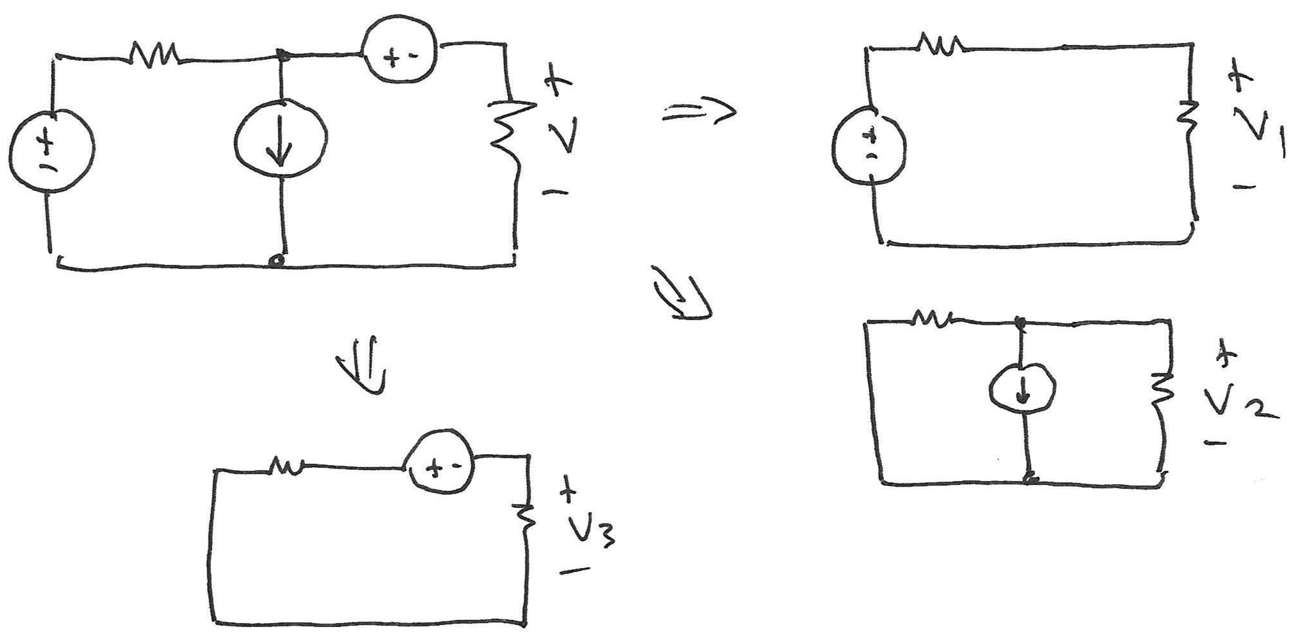
controlled or dependent sources:

- VCVS
- VCCS
- CCVS
- CCCS

Superposition:

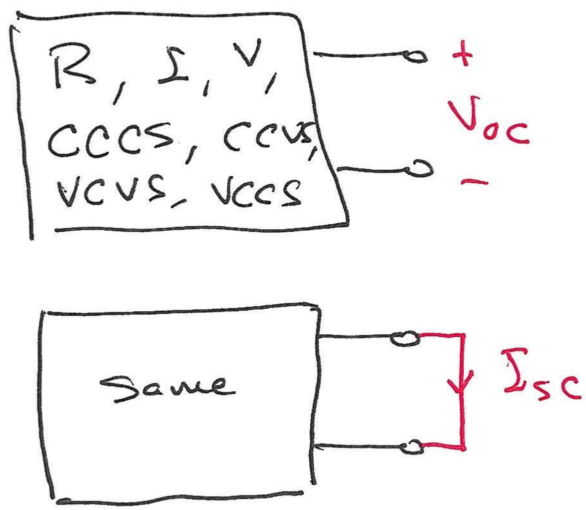
1. Consider one independent source at a time.
2. Solve for the contribution to the voltage or current you want.
3. Add all contributions to get the final value of the variable of interest.

[All circuits are linear.]



$$V = V_1 + V_2 + V_3$$

Thevenin Equivalent



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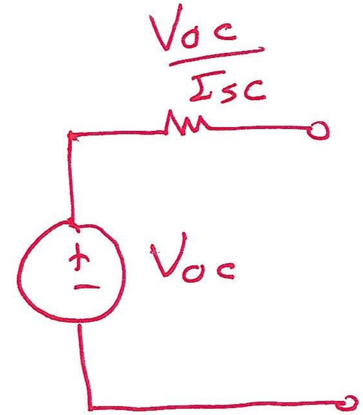
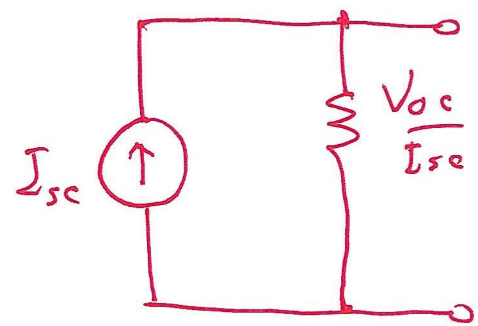
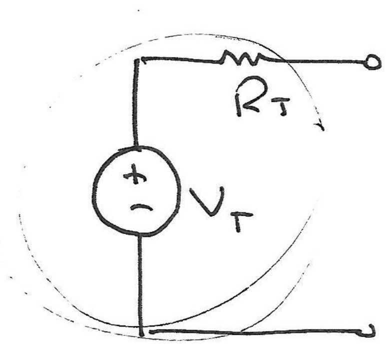


Norton Equivalent

same measurements ⇒



Source Transformation



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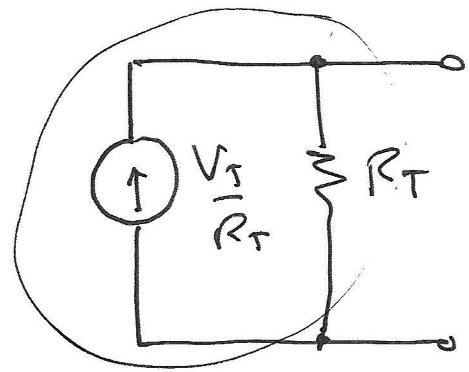

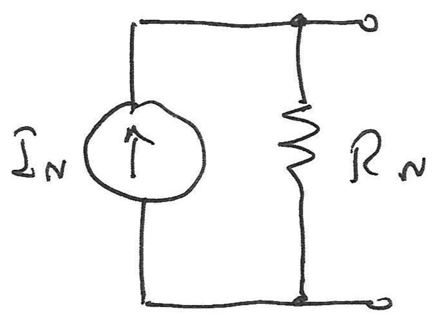

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