EE40
Lecture 6
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Reading: Chap. 2

Nodal Analysis, Mesh analysis

Nodal Analysis: no voltage sources

1. **Choose a reference node** (“ground”)

   Look for the one with the most connections! Set its voltage to zero.

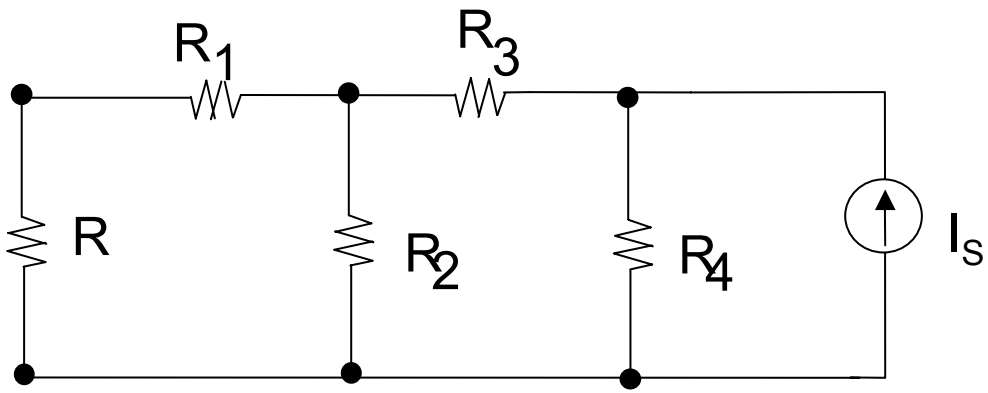
2. **Define unknown node voltages**
   (*the number of these will be one less than the total number of nodes).*

3. **Write KCL at each unknown node**,
   (after expressing link currents in terms of the node voltages by using the I-V relationships of the circuit elements)

4. **Solve the set of independent equations**

   n-1 equations for n-1 unknown node voltages where n is the total number of nodes.

Nodal Analysis: Example #1



1. Choose a reference node. Set its voltage to zero.
2. Name the other node voltages (three variables here)
3. Apply KCL at the nodes other than the reference node (three equations here).
4. Solve for the unknown node voltages.

Nodal Analysis: all voltage sources connected to ground directly or through voltage sources

1. **Choose a reference node** ("ground")

   Look for the one with the most connections! All voltage sources must connect to it directly or through voltage sources. Set its voltage to zero.

2. **Define unknown node voltages**

   (those which are not the reference and not fixed by the voltage sources)

3. **Write KCL at each unknown node**

   (after expressing the current through each link in terms of the node voltages using the I-V relationships of the link elements)

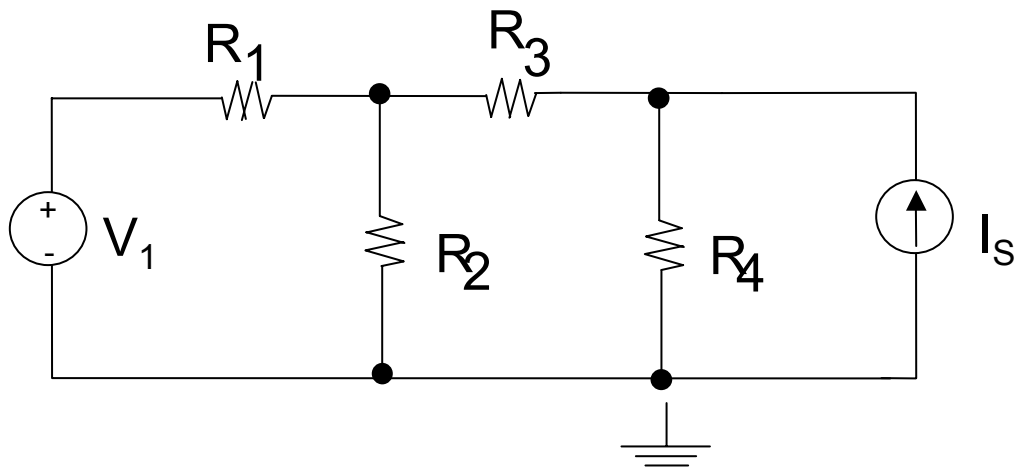
4. **Solve the set of independent equations**

   n-1 – (#voltage sources) equations for n-1 – (#voltage sources) unknown node voltages where n is the number of nodes.

5. **Find the currents through the voltage sources**

   using KCL at the remaining nodes that are not the reference node. There will be (#voltage sources) such equations.

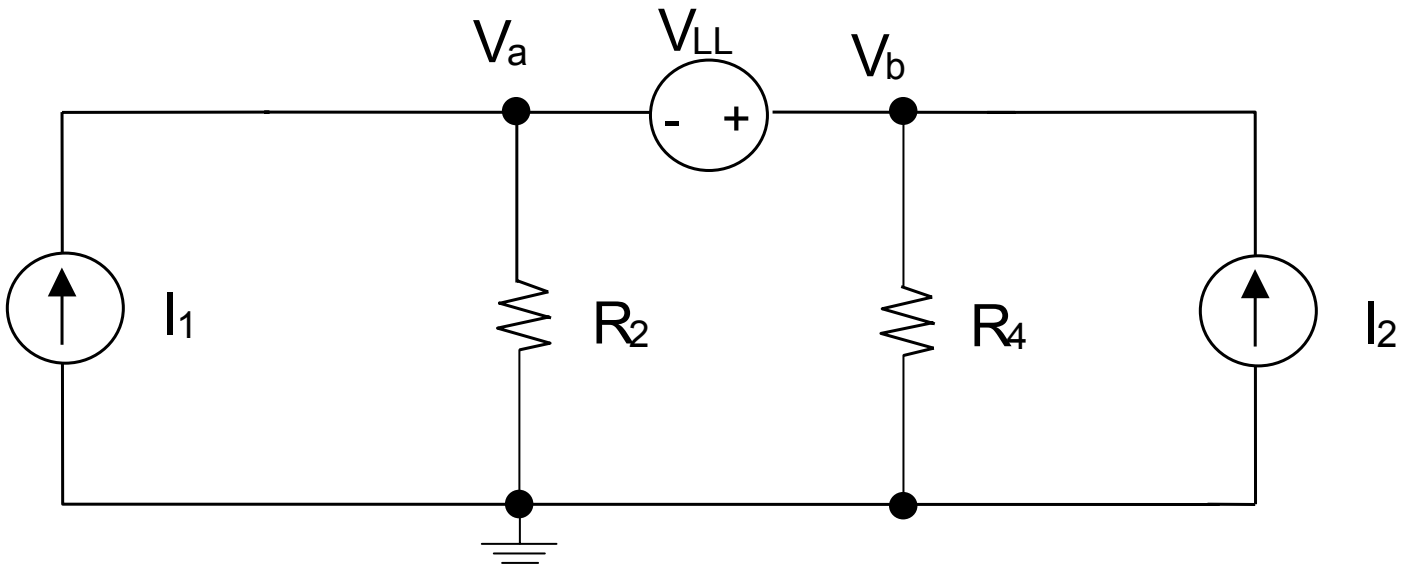
Nodal Analysis: Example #2



1. Choose a reference node (as indicated in the figure). Note that the voltage source connects to it. Set the voltage of the reference node to zero.
2. Define the unknown node voltages (except the reference node and the one set by the voltage source). There are two such voltages.
3. Apply KCL at the nodes with unknown voltages. This gives two equations.
4. Solve for the unknown node voltages.
5. Find the current through the voltage source by using the remaining KCL equation at the remaining node that is not the reference node.

Nodal Analysis w/ "Floating Voltage Source"

A "floating" voltage source is one for which neither terminal is connected to the reference node through voltage sources, e.g. V_{LL} in this circuit with the chosen reference (which was stupidly chosen):



Observation: Since Va is determined by Vb and vice versa we need only one variable to work with to handle both these nodes. We will treat this pair of nodes as a "supernode". We will write KCL for this supernode. In this circuit we get one equation in one variable, which we solve. Later we can figure out the current through the voltage source by using KCL at either the Va node or the Vb node.