Network theorems and circuit analysis 1

**NODAL ANALYSIS WITH CURRENT SOURCES**

This provides a general procedure for analysing circuits using node voltages as the circuit variables. Choosing node voltages instead of element voltages as circuit variables is convenient and reduces the number of equations one must solve simultaneously.

To simplify matters, we assume that circuits do not contain voltage sources but has reference nodes.

STEPS

1. Select a node as the reference node or datum node (commonly called ground) and it is assumed to have zero potential.

2. Assign voltages to the remaining nodes. The voltages are referenced with respect to the reference node.

3. Apply KCL to each of the nodereference nodes.

4. Use Ohm’s law to express the branch currents in terms of node voltages

5. Solve the resulting simultaneous equations to obtain the unknown node voltages

Current flows from higher potential to lower potential

When you perform KCL, you have an equation of currents

Use the above equation to form an equation of currents in terms of volts and resistances

**NODAL ANALYSIS WITH VOLTAGE SOURCES**

There are two cases to this

1. Connection between the ground and an idependent node.

2. Connection of a voltage source between two independent nodes

A supernode is formd by enclosing a (dependent or independent) voltage source connected between two nonreference nodes and any elements connected in parallel. The node that contains the voltage source is called the supernode.

Note the following about supernodes

1. The voltage source inside the supernode provides a constraint equation needed to solve for the node voltages

2. A supernode has no voltage of its own

To solve:

1. we join the two nodes that are connected to this voltage source.

2. Identify the branches (not nodes) that were attached to that voltage source.

3. Solve that junction with KCL. That means we look for the current in each branch and the sum of the currents in/out of the junction should be zero.

4. Then we can then say, the difference of the voltages between the two nodes equals the voltage of the voltage source at the supernode

**MESH ANALYSIS**

Here, we use mesh currents.

Mesh analysis is only for planar circuits.

A planar circuit is one that can be drawn on a plane with no branches crossing one another

A Mesh is a loop which does not contain any other loops within it. The current through a mesh is known as mesh current.

We use KVL in mesh analysis.

Steps

1. Assign mesh currents to the n meshes

2. Apply KVL to each of the n meshes. Use ohm’s law to express the voltages in terms of the mesh currents.

3. Solving the resulting n simultaneousl equations to get the mesh currents

MESH ANALYSIS WITH CURRENT SOURCES

1. When a curr