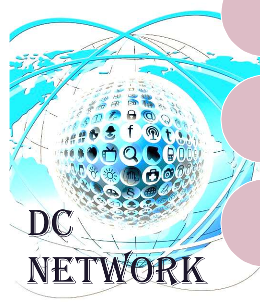
Professional Communication Project

-Presentation



- Mesh Analysis
- Thevenin's Theorem
- Norton's Theorem

DC NETWORK

Electrical circuits are mainly divided into two namely AC and DC. Therefore, circuit analysis also can be made by these two: -AC & DC. Here I have done DC circuit analysis using simple methods such as KVL ,KCL , mesh analysis , nodal analysis & by using certain theorems.

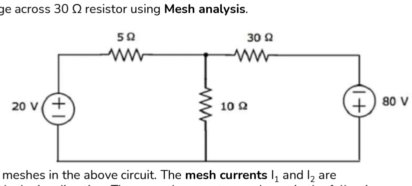
- A DC circuit essentially consists of a source of DC power; and the conductors are used to carry current and the load.

Mesh Analysis

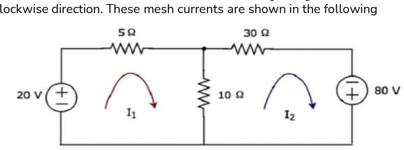
- Mesh analysis is defined as *the method in which the current flowing through a planar circuit is calculated.*
- A planar circuit is defined as the circuits that are drawn on the plane surface in which there are no wires crossing each other. Therefore, a mesh analysis can also be known as loop analysis or mesh-current method.

Example

Find the voltage across 30 Ω resistor using **Mesh analysis**.



There are two meshes in the above circuit. The **mesh currents** I_1 and I_2 are considered in clockwise direction. These mesh currents are shown in the following figure.



The **mesh equation** of first mesh is

$20-5I_1-10(I_1-I_2)=0$

4I2=6I1 -8

Equation 1

he **mesh equation** of second mesh is

$-10(I_2-I_1)-30I_2+80=0$

$4I_2=I_1+8$

Equation 2

So, we got the mesh currents I_1 and I_2 as 16/5 A and 14/5A respectively

The following steps are to be followed while solving the given electrical network using mesh analysis:

Step 1:
To identify the meshes and label these mesh currents in either clockwise or counterclockwise direction.

Step 2:
To observe the amount of current that flows through each element in terms of mesh current.

Step 3:
Writing the mesh equations to all meshes using Kirchhoff's voltage law and then Ohm's law.

Step 4:
The mesh currents are obtained by following Step 3 in which the mesh equations are solved.

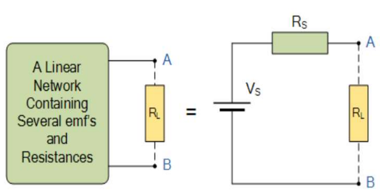
Hence, for a given electrical circuit the current flowing through any element and the voltage across any element can be determined using the node voltages.

Thevenin's Theorem

Thevenin's Theorem states that "*Any linear circuit containing several voltages and resistances can be replaced by just one single voltage in series with a single resistance connected across the load*". In other words, it is possible to simplify any electrical circuit, no matter how complex, to an equivalent two-terminal circuit with just a single constant voltage source in series with a resistance (or impedance) connected to a load as shown below.

Thevenin's Theorem is especially useful in the circuit analysis of power or battery systems and other interconnected resistive circuits where it will have an effect on the adjoining part of the circuit.

Thevenin's Theorem Equivalent Circuit



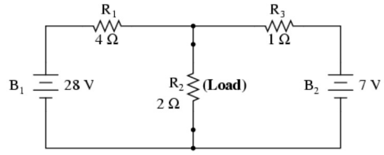
$$I_L = \frac{V_{Th}}{R_{Th}+R_L}$$

Norton's Theorem

Norton's Theorem states that it is possible to simplify any linear circuit, no matter how complex, to an equivalent circuit with just a single current source and parallel resistance connected to a load. Just as with Thevenin's Theorem, the qualification of "linear" is identical to that found in the Superposition Theorem: all underlying equations must be linear (no exponents or roots).

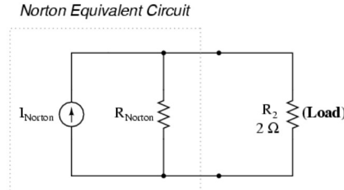
Simplifying Linear Circuits

Contrasting our original example circuit against the Norton equivalent: it looks something like this:



After Norton conversion . . .

Norton Equivalent Circuit



$I_L = I_N R_N/(R_N+R_L)$ Here $R_2 = R_L$

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BTECH 1ST YEAR

CSE 2

P2