Report on basic circuit analysis

Politics



Abstract

The voltage drop across sections of a circuit and the current can be determined using Kirchoff's laws. For currents and voltages, the algebraic sum at any node should be zero. Using this basic principle, any circuit can be analyzed for current and voltage. This paper will present and experiment performed to validate Kirchoff's laws. According to Thevenin, a complex circuit can be simplified into an equivalent circuit to obtain voltage and current. By Superposition theorem, effect of sources in a circuit can be considered singly and then summed up. It was determined that the laws are true.

Objective

The aim of the experiments was to verify Kirchoff's current law, principle of superposition, Thevenin theorem and maximum power using a simple DC circuit.

Theory

Kirchoff's current law

According to the current law, total current into a node is equal to the total current out of that node.

Superposition principle

Voltage across a branch or current through a branch in a network is can be obtained by summing contributions from indipedent sources. One source is considered first while other sources are replaced by their internal resistance.

Thevenin theorem

A circuit can be simplified by replacing elements as an impedance in series with a source. The whole circuit can be simplified or portions of the circuit can be simplified.

Maximum power transfer theorem

A source delivers maximum power when load is equal to the internal impedance of the source.

Procedure: Kirchoff's current law

Figure 1. 0: Resistors in parallel

The source voltage was 10V. The resistance values were measured and the currents in all branches was measured. The values were also obtained by calculation and compared to measured results.

Results: kirchoff's current law

Error analysis: Kirchoff's current law

Observation and analysis: Kirchoff's current law

It was observed that measurements were confirmed by calculations.

Negligible error values were obtained. This means that the instruments used,

DMM, had high accuracy and precision.

Possible causes of error in the experiment are stray resistances from the conductors and round off errors in arithmetic.

MORE RESULTS (TO BE COMPLETED BY CLIENT)

Discussion

In the case of maximum power transfer theorem, it was observed that power

transmitted increases with load up to a point where load is equal to internal resistance of the source. After that, the power delivered to the load declined gradually. This result can be confirmed arithmetically as shown below.

Pload= I2RL

I= VRL+r

Pload= V2RL+r2RL

Differentiate the power with respect to load and equating to zero to get point of maxima.

dPloaddRL= V2RL+r2-2RLRL+rRL+r2= 0

Equating the above equation to zero, it is obtained that the point of maxima is:

RL= r

Conclusion

Current and voltage in a circuit can be obtained using Kirchoff's laws, Thevenin theorem and Superposition theorem. From the experiment, these theorems were proven. In addition, it was confirmed that maximum power transfer occurs when the load equals internal resistance. In practice, this implies that the load has to be matched to the source for maximum power. Matching is very important especially in communication systems. The objective of the experiment was achieved. A few errors were noted but their magnitude was negligible thus the results were credible.