

Circuit Analysis Techniques

Circuit Analysis Techniques

1. Introduction

- Circuit analysis determines voltages, currents, and power in electrical networks.
- It provides systematic methods for solving complex circuits.

2. Kirchhoff's Laws

- **Kirchhoff's Current Law:** the sum of currents entering a node equals the sum leaving.
- **Kirchhoff's Voltage Law:** the sum of voltages around any closed loop is zero.
- These laws form the basis of most analysis methods.

3. Node and Mesh Analysis

- **Nodal analysis:** uses node voltages and KCL to solve for unknowns.
- **Mesh analysis:** uses loop currents and KVL.
- Both reduce circuits to solvable sets of equations.

4. Network Theorems

- **Thevenin's theorem:** replaces a network with one voltage source and series resistance.
- **Norton's theorem:** uses an equivalent current source and parallel resistance.
- Superposition analyzes one source at a time and sums the results.

5. Practical Application

- Choose the method that simplifies the given circuit.
- Verify results using power balance and Ohm's Law.
- Simulation tools help check manual calculations.