

Lecture 02 Summary: Circuit Analysis and Theorems

Key Concepts in Circuit Analysis:

1. Circuit Basics:

- Branches: Represent individual circuit elements like resistors or voltage sources.
- Nodes: Points where two or more branches connect.
- Loops: Any closed path in a circuit; independent loops include at least one unique branch.

2. Fundamental Theorem of Network Topology:

- A circuit with b branches, n nodes, and l loops follows the formula: $l = b - n + 1$.

3. Series and Parallel Connections:

- Series: Elements share a single node and carry the same current.
- Parallel: Elements connect to the same two nodes and have the same voltage across them.

4. Kirchhoff's Laws:

- Current Law (KCL): The sum of currents entering a node equals the sum of currents leaving it.
- Voltage Law (KVL): The sum of all voltages around a closed loop is zero. Positive/negative signs are determined by current direction and voltage polarity.

5. Examples and Problem Solving:

- Practical examples illustrate the application of Ohm's Law, KCL, and KVL to calculate unknown currents and voltages in circuits.
- Equations are set up and solved using substitution methods and tools like TinkerCAD to visualize results.

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