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CIRCUITS, CIRCUIT ANALYSIS, KIRCHHOFF'S LAWS

KVL + KCL

CONCEPT This lesson on Circuits, Circuit Analysis, Kirchhoff's Laws - KVL + KCL will cover the fundamentals of circuit analysis using Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL). You will learn how to apply these laws to solve for unknown values in circuits with multiple resistors, voltage sources, and current sources.

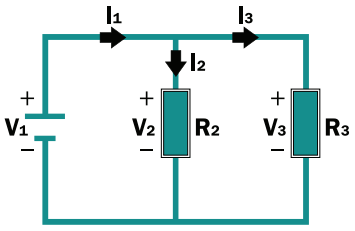
BACKGROUND

The history of circuits and circuit analysis can be traced back to the early 19th century with the development of electrical telegraphy. As electrical technology advanced, the need for understanding and analyzing circuits became increasingly important. In 1845, Gustav Kirchhoff formulated Kirchhoff's laws, which provided a method for analyzing complex circuits by applying the principles of conservation of energy and conservation of charge. Over time, the development of new electronic components and technologies has expanded the scope and complexity of circuit analysis, leading to the development of advanced simulation software and other tools.

APPLICATION

One example of an application of circuits and circuit analysis using Kirchhoff's Laws (KVL and KCL) is in designing and analyzing electrical circuits for electronic devices such as smartphones.

KIRCHHOFF'S CIRCUIT LAWS



Kirchhoff's Current Law **(KCL)**

$$\sum_{k=1}^{n} I_k = 0 \quad I_1 = I_2 + I_3$$

Kirchhoff's Voltage Law **(KVL)**

$$\sum_{k=1}^{n} V_k = 0 \quad V_1 = V_2 + V_3$$

EXAMPLES

CIRCUIT COMPONENTS: These are the fundamental building blocks of a circuit, including resistors, capacitors, inductors, voltage sources, and current sources.

KIRCHHOFF'S VOLTAGE LAW (KVL): This law states that the sum of all voltages around any closed loop in a circuit must be equal to zero.

KIRCHHOFF'S CURRENT LAW (KCL): This law states that the sum of all currents entering and exiting a node in a circuit must be equal to zero.

CIRCUIT ANALYSIS TECHNIQUES: These are methods for simplifying and analyzing complex circuits, including series and parallel combinations, equivalent resistance, and nodal analysis.

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