Nodal Analysis

Background

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Intro to ECSE
Kirchhoff's Current Law (KCL)

• **Definition:** The algebraic sum of all currents at a node is zero.
  
  ▪ **Other words:** The sum of currents entering a node equals sum of currents leaving that node.
  
  ▪ **Alternatively,** if we assume all currents leave a node, the sum of all currents leaving a node is zero.

\[
\sum_{n=1}^{N} I_n = 0
\]
• KCL is based on conservation of charge

• **Uses**: Along with Ohm’s law, KCL is used to perform Nodal analysis
Example

\[ I_1 = \frac{V_B - V_A}{R_1} \]
\[ I_2 = \frac{V_B - V_C}{R_2} \]
\[ I_3 = \frac{V_B - V_D}{R_3} \]

\[ \sum_{n=1}^{3} I_n = 0 \]

\[ \frac{V_B - V_A}{R_1} + \frac{V_B - V_C}{R_2} + \frac{V_B - V_D}{R_3} = 0 \]