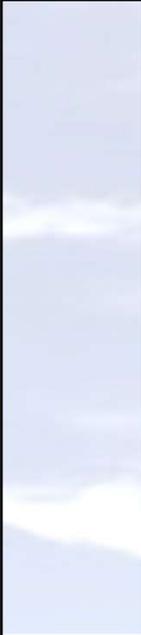




Linear Circuits and Systems



Kirchhoff's Circuit Laws

Course: Linear Circuits and Systems
Dr. Ahmed Dallal
Electrical and Computer Engineering
University of Pittsburgh



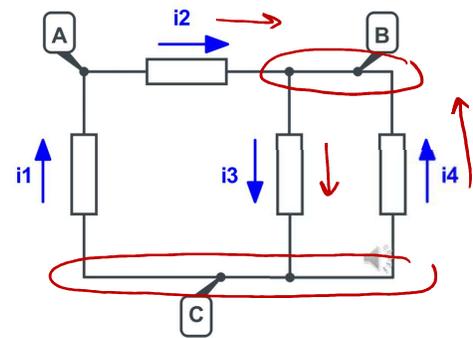
Kirchhoff's Current Law (KCL)

- The sum of all currents entering a node must equal to zero
 - Node equation: currents entering = currents exiting

$$\textcircled{A}: i_1 = i_2$$

$$\textcircled{B}: i_2 + i_4 = i_3$$

$$\textcircled{C}: i_3 = i_1 + i_4$$



CIRCUITLAB UltimateElectronics / KCL Three Node Example
<http://circuitlab.com/2-77250/553>

Kirchhoff's Current Law (KCL)

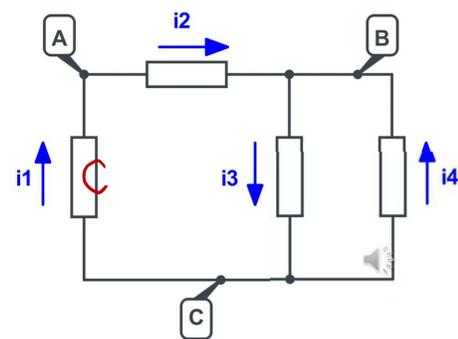
$$\textcircled{A}: i_1 = i_2$$

$$\downarrow$$

$$\underline{i_c(t)} = i_2(t)$$

$$\Downarrow$$

$$C \frac{dv_c}{dt} = i_2(t)$$



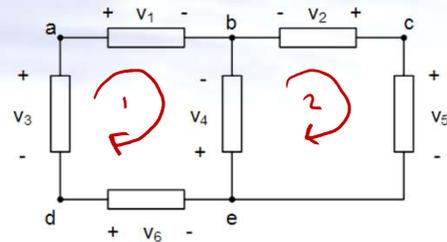
CIRCUITLAB UltimateElectronics / KCL Three Node Example
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Kirchhoff's Voltage Law (KVL)

- For a loop, the voltage drops across elements in a loop must add to zero

$$L1: -V_3 + V_1 - V_4 - V_6 = 0$$

$$L2: V_4 - V_2 + V_5 = 0$$

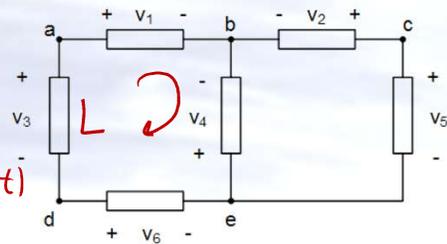


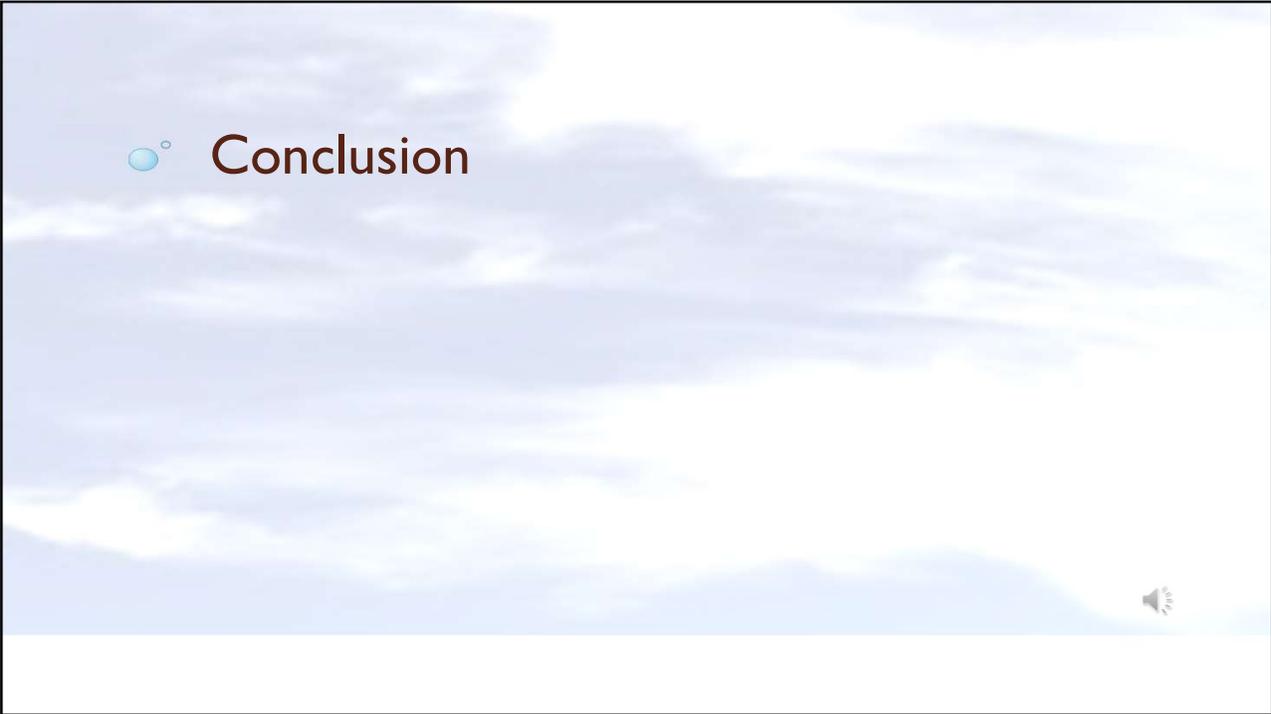
Kirchhoff's Voltage Law (KVL)

$$-V_3(t) + V_1(t) - V_4(t) - V_6(t) = 0$$

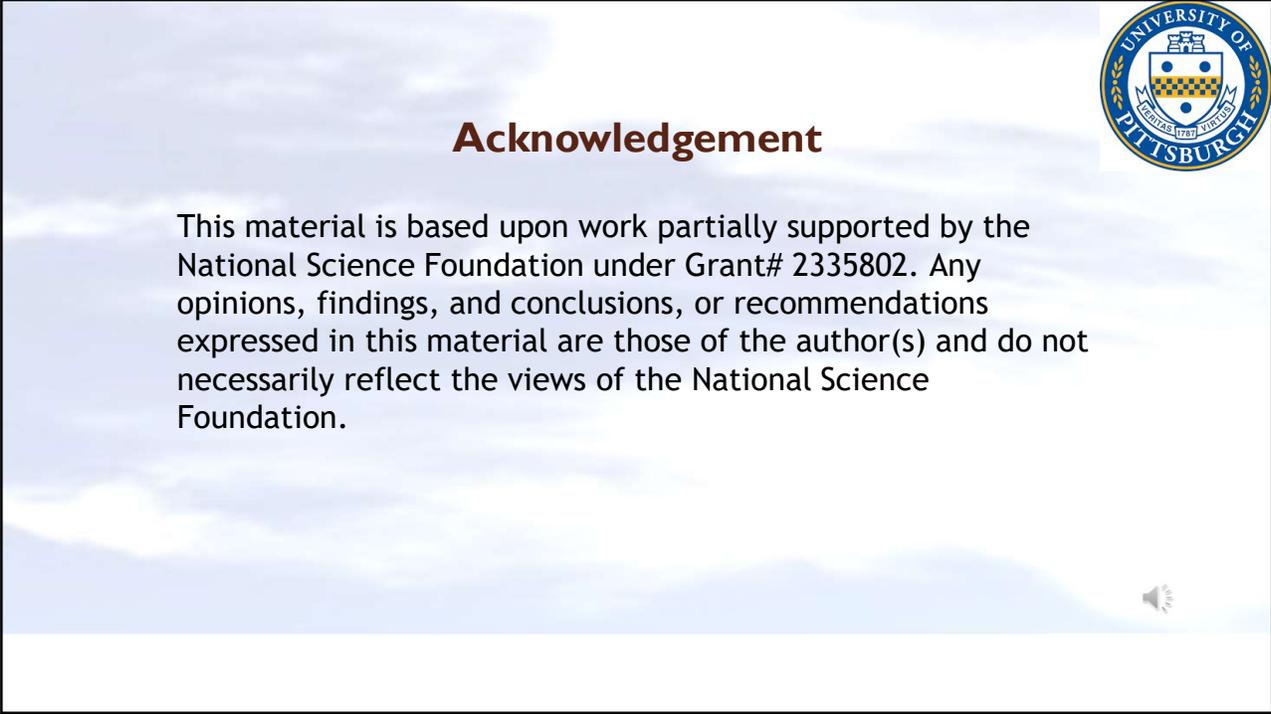
$$\downarrow$$

$$-L \frac{di_L}{dt} + V_1(t) - V_4(t) - V_6(t) = 0$$





Conclusion



Acknowledgement



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THE END

