Georgia Institute of Technology

Linear Circuits

Nathan V. Parrish
PhD Candidate & Graduate Research Assistant
School of Electrical and Computer Engineering

An introduction to linear electric circuit elements and a study of circuits containing such devices.

Georgia Institute of Technology

Nathan V. Parrish
PhD Candidate & Graduate Research Assistant
School of Electrical and Computer Engineering

Wye-Delta Transforms and the Wheatstone Bridge

- *Transform resistors from a wye configuration to a delta configuration and vice-versa*
- *How to use a wheatstone bridge to measure a resistance*

Previous Lesson

- Obtaining Circuit Equations
- Maximum Power Transfer

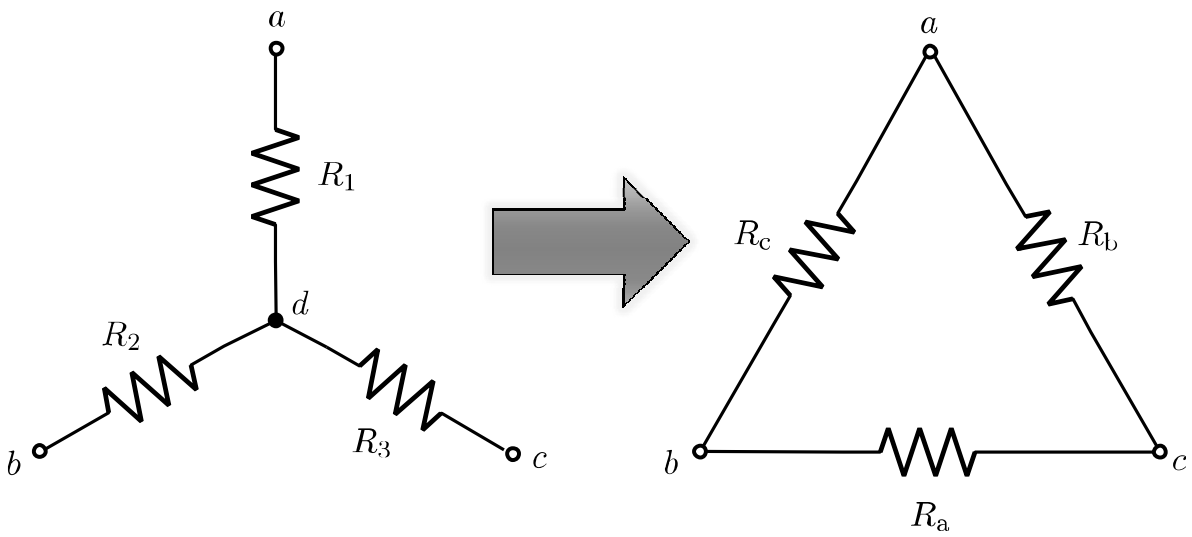
Module 2: Resistive Circuits

- Resistance
- Kirchhoff's Laws
- Resistors
- Superposition
- Systematic Solution Methods
- Maximum Power Transfer
- Wye-Delta and Wheatstone Bridge
- Application: Sensors

Learning Objectives

- Transform resistor circuits between wye and delta configurations
- Specify a test resistor which balances a Wheatstone bridge
- Identify whether the resistor under test in a Wheatstone bridge is below or above the target resistance

Wye-Delta Transformation

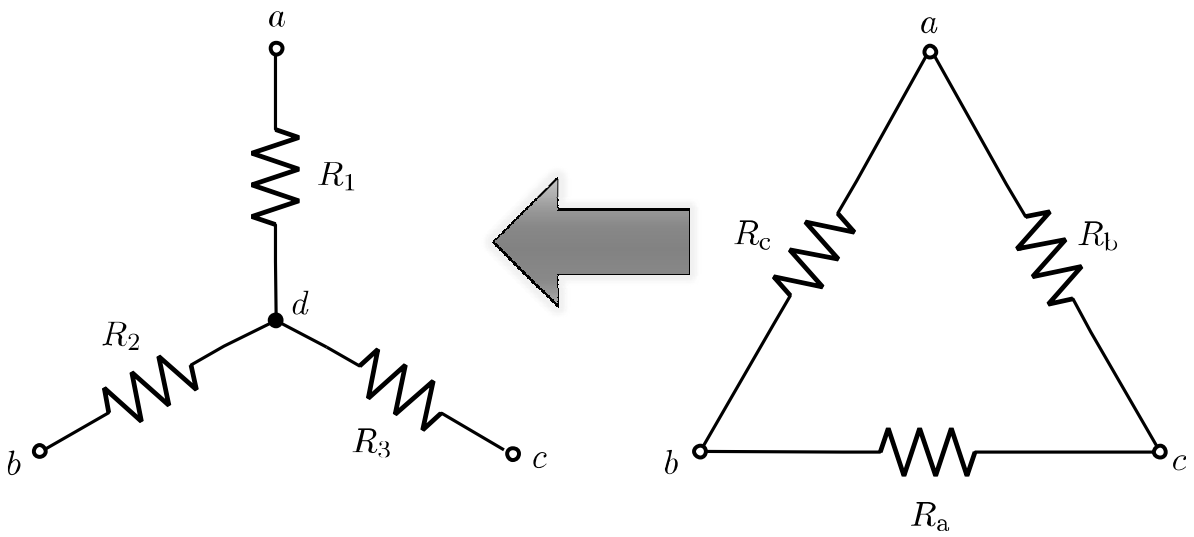


$$R_a = \frac{R_1R_2+R_2R_3+R_1R_3}{R_1}$$

$$R_b = \frac{R_1R_2+R_2R_3+R_1R_3}{R_2}$$

$$R_c = \frac{R_1R_2+R_2R_3+R_1R_3}{R_3}$$

Summary

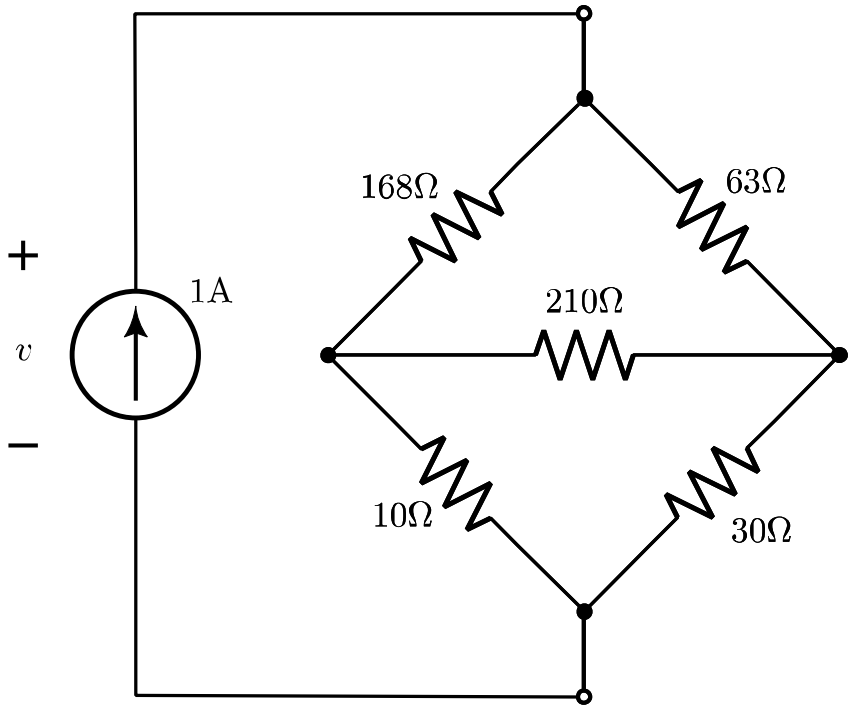


$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$$

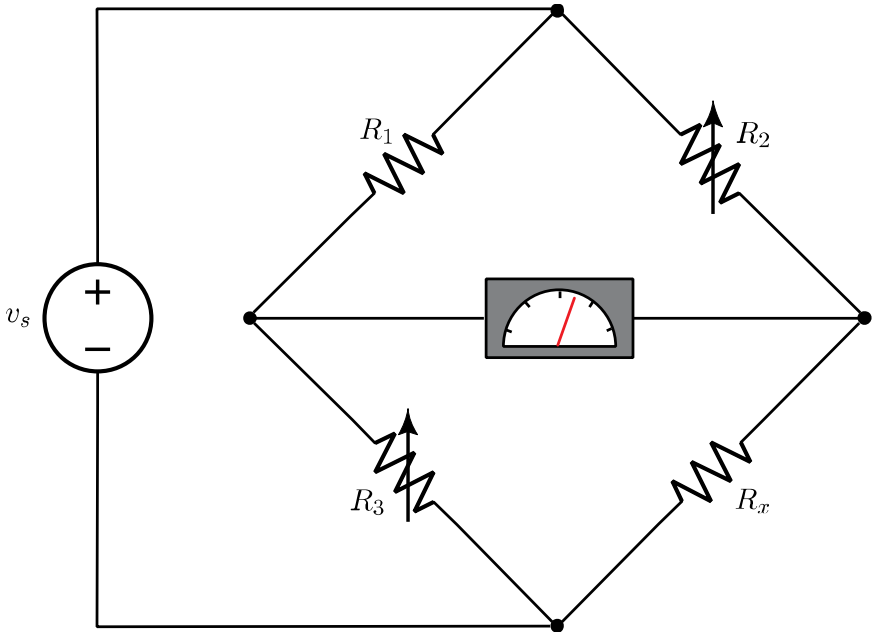
$$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$$

Example



Wheatstone Bridge



$$\frac{R_1}{R_2} = \frac{R_3}{R_x}$$

Summary

- Used Y-Δ transform to simplify circuits
- Balanced a Wheatstone bridge
- Identified whether the resistor under test was above or below balanced resistance based on current across the bridge

Next Lesson

- Applications of resistors in sensors
- Experiment using Wheatstone bridge