

Thursday Reading Assessment: DC Circuits and Error Propagation

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March 17, 2022

1 Memory Bank

- $(x \pm \sigma_x) + (y \pm \sigma_y) = (x + y) \pm \sqrt{\sigma_x^2 + \sigma_y^2}$... Adding two averages with errors.
- $V = iR$... Ohm's Law, with V for voltage, i for current, and R for resistance.
- $P = iV = i^2 R_{tot} = V^2 / R_{tot}$... The power consumption is the product of current and resistance.
- $R_{tot} = R_1 + R_2$... Total resistance of two resistors in series.
- $R_{tot}^{-1} = R_1^{-1} + R_2^{-1}$... Total resistance of two resistors in parallel.

2 Error Propagation

Suppose a resistor has a resistance of $1 \text{ k}\Omega$, and another has a resistance of $2 \text{ k}\Omega$. *Each value is only accurate to 5%.* (a) What are the errors in $\text{k}\Omega$ of the resistors? (b) If they are connected in series, how would we quote the total resistance, accounting for errors?

3 Parallel Resistors, Power Consumption

Consider Fig. 1. (a) What is the current from the battery? (b) How long will the battery last?

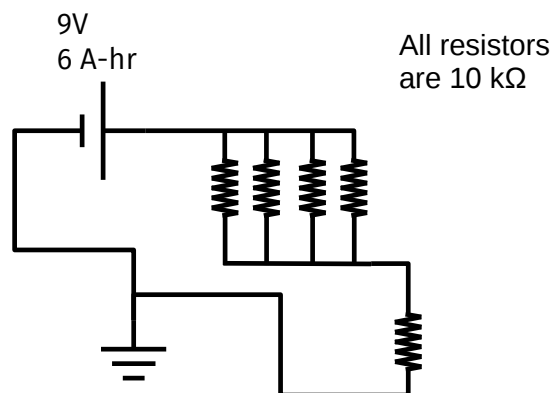


Figure 1: A network of four resistors in parallel, all with $R = 10 \text{ k}\Omega$, in series with a fifth identical resistor.