Root Sum Square intro

Use when there is an equation relating the measured variables to the unknown

*Easiest of statistical concepts 😊

Ex: Electric Circuit

\[ V = IR \Rightarrow I = \frac{V}{R} \]

Want to find \( I \)
Can only measure \( V \) and \( R \)
What relationship?

Dependent variable \( \frac{V}{R} \)
Independent variables \( V, R \)

How does error in measurement of \( V \) and \( R \) relate to error in \( I \)?

Statistical specification of uncertainty
\( R \): measured value of resistance
\( \Delta R \): such that

\[ R - \Delta R < R < R + \Delta R \]

is an interval that is true 67.7% of the time,

Ex:
\[ R = 1.0 \Omega \quad \Delta R = 0.1 \Omega \] then \( 0.9 < R < 1.1 \)

to confidence of 67.7%

\( \Delta R \): one standard deviation tolerance on measurement
assumes "normal" distribution
Example

\[ R = 1.0 \, \Omega \quad \varepsilon_R = 0.1 \, \Omega \]
\[ U = 1.0 \, V \quad \varepsilon_U = 0.1 \, V \]

Worst case

\[ I_{\text{lowest}} = \frac{U_{\text{max}}}{R_{\text{high}}} = \frac{0.9}{1.1} = 0.818 \, A \]
\[ I_{\text{highest}} = \frac{U_{\text{high}}}{R_{\text{low}}} = \frac{1.1}{0.9} = 1.22 \, A \]

\[ 0.818 < I < 1.22 \, A \]