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Electrical / Electronics Engineering

The hypotenuse of a right angle triangle is denoted as 'c' and the other two sides are denoted as 'a' and 'b'. Find the max possible error in calculating the length of the hypotenuse.

$$A = \frac{1}{2} a \cdot b = \frac{a \cdot b}{2}$$

$$\frac{\Delta A}{A} = \frac{b}{2} \cdot \frac{\Delta b}{b} + \frac{a}{2} \cdot \frac{\Delta a}{a}$$

$$\Delta a = \pm \frac{3a}{200} \quad \Delta b = \pm \frac{3b}{200}$$

$$\Delta A = \frac{\Delta A}{A} \cdot A + \frac{\Delta A}{b} \cdot b$$

$$= \frac{b}{2} \left( \pm \frac{3a}{200} \right) + \frac{a}{2} \left( \pm \frac{3b}{200} \right)$$

$$= \pm \frac{a \cdot b}{2} \left( \frac{3}{200} + \frac{3}{200} \right)$$

$$= \pm \frac{A \cdot 3}{100}$$

$$\Delta A = 3\% \text{ of } A$$

$$c = \sqrt{a^2 + b^2} = (a^2 + b^2)^{\frac{1}{2}}$$

$$\frac{dc}{da} = \frac{1}{2} (a^2 + b^2)^{-\frac{1}{2}} \quad (2a)$$

$$= \frac{a}{\sqrt{a^2 + b^2}}$$

$$\frac{dc}{db} = \frac{1}{2} (a^2 + b^2)^{-\frac{1}{2}} (2b)$$

$$= \frac{b}{\sqrt{a^2 + b^2}}$$

$$da = \pm \frac{3a}{200} ; db = \pm \frac{3b}{200}$$

$$dc = \frac{dc}{da} \cdot da + \frac{dc}{db} \cdot db$$

$$dc = \frac{a}{\sqrt{a^2 + b^2}} \left( \pm \frac{3a}{200} \right) + \frac{b}{\sqrt{a^2 + b^2}} \left( \pm \frac{3b}{200} \right)$$

$$= \pm \frac{3}{200} \sqrt{a^2 + b^2}$$

$$= \pm \frac{3}{200} \cdot c$$

$$dc = 1.5\% \text{ of } c$$