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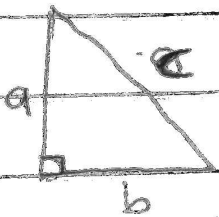
Matric No: 17/ENG104/051 Dept: Elect/Elect

College: Engineering

Course: ENGR 281

The hypotenuse of a right angle triangle is denoted as 'c' and the other two sides as 'a' and 'b' is $\pm 1.5\%$. Find the maximum possible error in calculating the length of the hypotenuse.

Solution



$$\text{Area} = \frac{1}{2} ab$$
$$= \frac{ab}{2}$$

$$\frac{\partial A}{\partial a} = \frac{b}{2}, \quad \frac{\partial A}{\partial b} = \frac{a}{2}$$

$$\delta a = \pm 1.5\% a = \left(\frac{1.5}{100}\right) a = \left(\frac{3}{200}\right) a$$

$$\delta b = \pm 1.5\% b = \left(\frac{1.5}{100}\right) b = \left(\frac{3}{200}\right) b$$

$$\delta A = \frac{\partial A}{\partial a} \delta a + \frac{\partial A}{\partial b} \delta b$$

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

$$= \frac{ab}{2} \left(\frac{3}{200} + \frac{3}{200}\right)$$

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

$$\delta A = 3 \text{ percent of } A.$$

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

$$\frac{\partial c}{\partial a} = \frac{1}{2} (a^2 + b^2)^{-1/2} (2a)$$

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

$$\frac{\partial c}{\partial b} = \frac{1}{2} (a^2 + b^2)^{-1/2} (2b)$$

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

$$\delta a = \pm \frac{3a}{200}$$

$$\delta b = \pm \frac{3b}{200}$$

$$\delta = \frac{\partial c}{\partial a} \delta a + \frac{\partial c}{\partial b} \delta b$$

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

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

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

$$= \frac{3}{200} \cdot c \therefore \delta c = 1.5\% \text{ of } c$$