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Eng 281

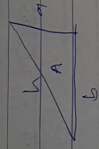
Computer Engineering

(1)

The hypotenuse of a right-angled triangle is classified as c , and the other two sides are labeled as a and b for the possible error of measurement each of ± 0.15 . Find the maximum possible error in calculation.

- a) the error of the triangle, and
- b) the length of the hypotenuse.

Solution



$$A = \frac{1}{2} ab$$

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

$$= \frac{b}{2} \delta a + \frac{a}{2} \delta b$$

$$= \frac{b}{2} (+1.5 a) + \frac{a}{2} (+1.5 b)$$

$$= \frac{b}{2} (0.15 a) + \frac{a}{2} (0.15 b)$$

$$= \frac{ab}{2} [0.15] + \frac{ab}{2} [0.15]$$

$$= \frac{ab}{2} [0.015 + 0.015]$$

$$\text{Recall } A = \frac{ab}{2}$$

$$= A (0.03)$$

$$0.03 \times 100 = 3\%$$

(2)

b) $h = \sqrt{a^2 + b^2}$

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

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

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

$$\sqrt{a^2 + b^2} \left(\frac{+0.015}{a} + \frac{+0.015}{b} \right)$$

$$= \frac{+0.015}{\sqrt{a^2 + b^2}} + \frac{+0.015}{\sqrt{a^2 + b^2}}$$

$$= \frac{0.015 + 0.015}{\sqrt{a^2 + b^2}} = \frac{0.03}{\sqrt{a^2 + b^2}}$$

$$= \frac{0.03}{1} = 0.03$$

$$= h \cdot \left[\frac{0.015}{a} + \frac{0.015}{b} \right]$$

$$= 0.015 \cdot \left(\frac{1}{a} + \frac{1}{b} \right)$$

$$= 1.59 \cdot 10^{-3}$$