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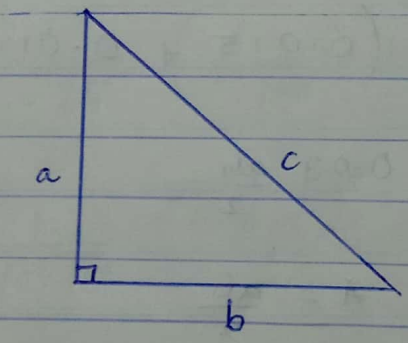
ENG 281 (ENGINEERING MATHEMATICS)

The hypotenuse of a regut angled triangle triangle is denoted as c and the othe two sides are denoted as a and b. if the Possible error of measuring each of a and b is ± 1.5% find the maximum possible error in Calculating

a) The area of the triangle
b) The length of the hypotenuse

Solution



Area of triangle = $\frac{1}{2}ab$.

let the area $A = (a, b)$

$$\Rightarrow \frac{\partial A}{\partial a} = \frac{b}{2}$$

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

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

$$= \frac{b}{2} \cdot \left(\frac{\pm 1.5a}{100}\right) + \frac{a}{2} \cdot \left(\frac{\pm 1.5b}{100}\right)$$

$$= \frac{ab}{2}\left(\frac{\pm 1.5}{100}\right) + \frac{ab}{2}\left(\frac{\pm 1.5}{100}\right)$$

$$= \pm \frac{ab}{2}\left(\frac{1.5}{100}\right) + \left(\pm \frac{ab}{2}\right)\left(\frac{1.5}{100}\right)$$

$$= \pm \frac{ab}{2}\left(\frac{1.5}{100} + \frac{1.5}{100}\right)$$

$$= \pm \frac{ab}{2}\left(0.015 + 0.015\right)$$

$$= \pm 0.03 \frac{ab}{2}$$

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

$\therefore \partial A = \pm 0.03A$

b) $C^2 = a^2 + b^2$

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

let $c = (a, b)$

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

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

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

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

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

$$\Rightarrow \partial c = \frac{a}{\sqrt{a^2+b^2}}\left(\pm\frac{1.5a}{100}\right) + \frac{b}{\sqrt{a^2+b^2}}\left(\pm\frac{1.5b}{100}\right)$$

$$= \frac{1}{\sqrt{a^2+b^2}}\left(\pm\frac{1.5a^2}{100}\right) + \frac{1}{\sqrt{a^2+b^2}}\left(\pm\frac{1.5b^2}{100}\right)$$

$$= \pm\frac{1}{\sqrt{a^2+b^2}}\left(\frac{1.5a^2}{100} + \frac{1.5b^2}{100}\right)$$

$$= \pm\frac{1}{\sqrt{a^2+b^2}}\left(0.015a^2 + 0.015b^2\right)$$

$$= \pm\frac{1}{\sqrt{a^2+b^2}}\cdot 0.015\left(a^2+b^2\right)$$

$$= \pm\frac{1}{c}\cdot 0.015c^2 = \pm 0.015c$$