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17/ENG04/070

ELECTRICAL/ELECTRONICS

ENG 281

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ENGINEERING MATHEMATICS I

The hypotenuse of a right-angled triangle is denoted as C and the other two sides are denoted as a and b . If the possible error of measuring each of a and b is $\pm 1.5\%$. Find the maximum possible error in calculating.

- The area of the triangle
- The length of the triangle

Solution

$$a. A = \frac{1}{2}bh \Rightarrow A = \frac{1}{2}ab \Rightarrow A = \frac{ab}{2}$$

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

$$\delta A = \pm \frac{ab}{2} (0.15) + \frac{ab}{2} (0.15)$$

$$\delta A = \pm A (0.30) = \pm 30\%A.$$

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

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

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

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

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

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

$$\delta C = \sqrt{a^2 + b^2} (\pm 1.5\%)$$

$$\delta C = \pm 1.5\%C$$