OGOMUEGBUNAM FAVOUR CHIBI

CHEMICAL ENGINEERING

17/ENG01/021

ENG281 Assignment 2.

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 ±1.5%, find the maximum possible error in calculating (a) the area of the triangle

(b) the length of the hypotenuse.

Sol

(a) Area = $\frac{1}{2}ab$.

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

$$\frac{\partial A}{\delta a} = \frac{b}{2} \qquad \frac{\delta A}{\delta b} = \frac{a}{2}.$$

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

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

$$= \pm \frac{a \cdot b}{2}\left[\frac{3}{200} + \frac{3}{200}\right] = \pm \frac{A \cdot 3}{100}$$

$\therefore \delta A$ = 3 percent of A

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

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

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

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

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

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

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

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

$$= \pm\frac{3}{200}(h)$$

~~$\therefore dh = 0.015$ % percent of h~~

$\therefore dh = 1.5$ percent of h