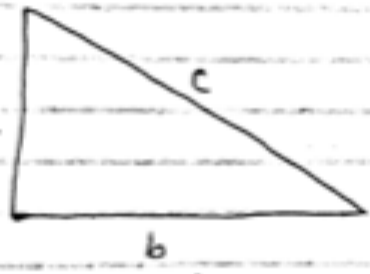
Ehwa Tochukwu Divine
17/ENG07/010
Petroleum Engineering
ENG 281 Assignment.

1) The hypotenuse of a right-angled triangle is denoted as c and the two other 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, and
b) the length of the hypotenuse

Answer

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



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

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

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

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

$\delta A = \pm A(0.015) \pm A(0.015)$

$\delta A = \pm A(0.03)$

$\delta A = \pm 3\% A$

b) Since the triangle is a right angled triangle, $C^2 = a^2 + b^2$

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

$\delta C = \frac{\partial C}{\partial a} \cdot \delta a + \frac{\partial C}{\partial b} \cdot \delta b$

for

$\frac{\partial c}{\partial a}$

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

let $a^2 + b^2$ be u

$c = u^{1/2}$

$\frac{dc}{du} = \frac{u^{-1/2}}{2}$

$u = a^2 + b^2$

$\frac{du}{da} = 2a$

$\therefore \frac{\partial c}{\partial a} = \frac{2a \cdot u^{-1/2}}{2}$

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

for

$\frac{\partial c}{\partial b}$

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

let $a^2 + b^2$ be u

$c = u^{1/2}$

$\frac{dc}{du} = \frac{u^{-1/2}}{2}$

$u = a^2 + b^2$

$\frac{du}{db} = 2b$

$\frac{\partial c}{\partial b} = \frac{2b \cdot u^{-1/2}}{2}$

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

$\delta c = a(a^2 + b^2)^{-1/2}(\pm 0.015a) + b(a^2 + b^2)^{-1/2}(\pm 0.015b)$

$= a^2(a^2 + b^2)^{-1/2}(\pm 0.015) + b^2(a^2 + b^2)^{-1/2}(\pm 0.015)$

knowing $(a^2 + b^2)^{1/2} = c$

$= \frac{a^2}{c}(\pm 0.015) + \frac{b^2}{c}(\pm 0.015)$

$= \pm 0.015\left[\frac{a^2}{c} + \frac{b^2}{c}\right]$

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

Recall $c^2 = a^2 + b^2$

$= \pm 0.015\left(\frac{1}{c} \cdot c^2\right)$

$\delta c = \pm 0.015\, c$

$\delta c = \pm 1.5\%\, c$