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

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

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

let $C = (a, b)$

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

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

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

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

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

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

$\Rightarrow \pm \frac{1}{\sqrt{a^2+b^2}} \left(\frac{1.5\, a^2}{100} + \frac{1.5\, b^2}{100}\right) \Rightarrow \pm \frac{1}{\sqrt{a^2+b^2}} [0.015 a^2 + 0.015$

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

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

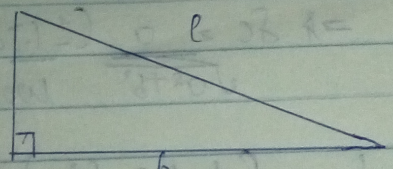
$= \pm \frac{1}{C} \cdot 0.015\, C^2$

$= \pm \frac{1}{C} \cdot 0.015\, C^2 = \pm 0.015\, C_4 = \pm 1.5\%\, C_{11}$

Name: Ezechinyeluga Chinonso Emmanuel
Dept: Electrical Electronics Engineering
Mat no: M/ENG04/024
CODE: ENG 291

Assignment:
The hypotenuse of a right angled triangle is denoted as C and the other two sides are denoted as a, b. If the possible error of measuring of a and b is $\pm$ 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 = 1/2 ab

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

let $A = f(a,b)$

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

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

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

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

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

$\Rightarrow \pm ab/2\,[0.015 + 0.015] \Rightarrow \pm 0.03\frac{ab}{2}$

recall $A = \frac{ab}{2} \Rightarrow \delta A = \pm 0.03A \Rightarrow \pm 3\%A$ //