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

$\therefore \delta A = A(3/100) \Rightarrow \delta A = \pm 3\% A$

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

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

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

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

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

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

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

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

$= a(a^2+b^2)^{-1/2} \cdot \frac{1.5}{100} a + b(a^2+b^2)^{-1/2} \cdot \frac{1.5}{100} b$

$= a^2(a^2+b^2)^{-1/2} \cdot \frac{1.5}{100} + b^2(a^2+b^2)^{-1/2} \cdot \frac{1.5}{100}$

$= (a^2+b^2) \cdot \frac{1.5}{100} \cdot (a^2+b^2)^{-1/2}$

$= (a^2+b^2)^1 \cdot (a^2+b^2)^{-1/2} \cdot \frac{1.5}{100}$

$= \frac{1.5}{100} \times (a^2+b^2)^{1-1/2}$

$= \frac{1.5}{100}(a^2+b^2)^{1/2}$

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

$\delta c = \frac{1.5}{100} c \Rightarrow \delta c = \pm 1.5\% c$

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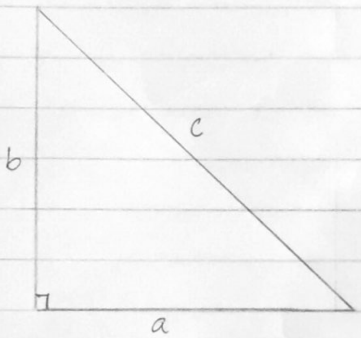
CHEMICAL ENGINEERING
ENG 281: ENGINEERING MATHEMATICS

1 The hypotenuse of a right-angled triangle is denoted by C, and the 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

Soln



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

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

$\Rightarrow \frac{\partial A}{\partial a} = \frac{1}{2} b \quad , \frac{\partial A}{\partial b} = \frac{1}{2} a$

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

$\delta A = \frac{1}{2} b \cdot \frac{1.5}{100} a + \frac{1}{2} a \cdot \frac{1.5}{100} b$

$\delta A = \frac{1}{2} ab \cdot \frac{1.5}{100} + \frac{1}{2} ab \cdot \frac{1.5}{100}$

$\delta A = \frac{1}{2} ab \left(\frac{1.5}{100} + \frac{1.5}{100} \right) \Rightarrow \frac{1}{2} ab \left(\frac{3}{100} \right)$