# 10 Second guide to error analysis

If the parameters of the function are uncorrelated, take the total differential:

$$df(a,b,c) = \frac{\partial f(a,b,c)}{\partial a}da + \frac{\partial f(a,b,c)}{\partial b}db + \frac{\partial f(a,b,c)}{\partial c}dc$$

Approximate the error in the function this way:

$$\Delta f(a,b,c) \approx \sqrt{|\frac{\partial f(a,b,c)}{\partial a}|^2|\Delta a|^2 + |\frac{\partial f(a,b,c)}{\partial b}|^2|\Delta b|^2 + |\frac{\partial f(a,b,c)}{\partial c}|^2|\Delta c|^2}$$

Here's an example:

$$ex. \quad f(a,b,c) = abc = 450,\ a = 10, b = 15, c = 3.0 \quad \Delta a = 1 \quad \Delta b = 2, \quad \Delta c = 0.8$$

$$\frac{\Delta f(a,b,c)}{f(a,b,c)} = \frac{1}{abc}\sqrt{|bc|^2|\Delta a|^2 + |ac|^2|\Delta b|^2 + |ab|^2|\Delta c|^2} = \sqrt{|\Delta a/a|^2 + |\Delta b/b|^2 + |\Delta c/c|^2}$$

$$= \sqrt{|1/10|^2 + |2/15|^2 + |0.8/3.0|^2} = 0.314 \qquad or \quad \Delta f(a,b,c) = 141.5$$

A VERY much more complex intro to errors fitting etc. can be found at:
http://www.hep.vanderbilt.edu/~wjohns/classes/225b/lecture1/page.pdf
And the case with correlated errors can be found at:
http://www.hep.vanderbilt.edu/~wjohns/classes/225b/lecture2/page.pdf