

"Bottom-up" estimation of measurement uncertainty by simulation

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Measurement uncertainty is estimated by Type A (identifying and combining every source of MU) or Type B, summarizing experience, however conceived. See diagram!

$$u_c(z) = u(f(x, y)) = \sqrt{\left(u(x) \times \frac{\partial(z)}{\partial(x)}\right)^2 + \left(u(y) \times \frac{\partial(z)}{\partial(y)}\right)^2 + 2 \times \text{cov}(x, y) \times \frac{\partial(z)}{\partial(x)} \times \frac{\partial(z)}{\partial(y)}}$$

simplified to

$$u_c(z) = u(x \pm y) = \sqrt{u^2(x) + u^2(y) \pm 2 \times \text{cov}(x, y)}$$

$$= \sqrt{u^2(x) + u^2(y) \pm 2 \times u(x) \times u(y) \times r(x, y)}$$

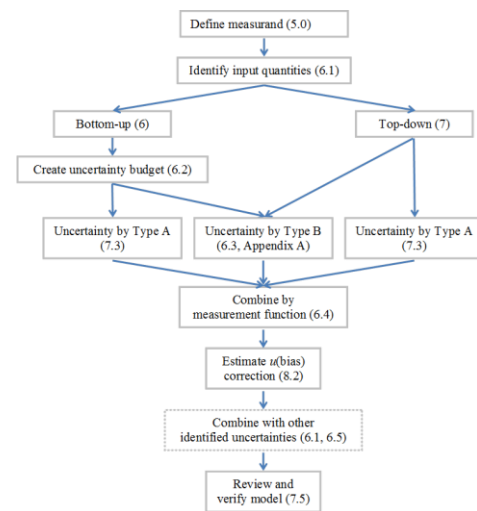
or if variables are independent:

$$u_c(z) = u(x \pm y) = \sqrt{u^2(x) + u^2(y)}$$

Gaussian (rel uncert)		Gaussian (abs uncert)		Rectang (R), triang (T) distr		Licenced to Archive		
U-Crea	U-Vol	S-Crea	Time			Algorithm	Limit distribution interval	
Average: 15.0	1500	0.12	1440			135.870	Procedure uncert (%CV)	
s(X): 0.450	22.50	0.006	15				Z-score limit	
%CV (%): 3.00	1.50	5.00	1.04				108.9	
Rectangular (R) or, triangular (T) distribution?						k=1	Allow values <=0?	
Found						Average: 136.228	k:	
Average: 15.0	1500	0.1	0.0	0.0	1440	8.2913	16.58	
St dev: 0.450	22.39	0.01	0.00	0.00	15.12	6.09	12.2	
%CV: 3.00	1.49	5.0	1			Number obs: 10 000	Adjust graph: 80	
N: 10 000	Kidney clearance					Interval k: 2	119.646	152.811
Simulation						Cl ₉₅ (s(X)):	8.178	8.408
Gaussian (rel uncert)		Gaussian (abs uncert)		Rectang (R), triang (T) distr		Licenced to Archive		
Const 1	S-Crea	Conv conv- > SI	Exp1	Age base	Age	Algorithm	Limit Proc	
Average: 141.0	115.0	79.20	-1.21	0.99	50.0	63.220		
s(X): 7.050	5.750	0.000	0.012	0.000	50			
%CV (%): 5.00	5.00	0.00	1.00	0.01	50.1			
Rectangular (R) or, triangular (T) distribution?						k=1		
Found						Average: 63.661	k:	
Average: 141.0	115.0	79.2	-1.2	1.0	0	7.4079	14.82	
St dev: 6.993	5.67	0.00	0.01	0.00	0.00	11.64	23.3	
%CV: 4.96	4.93	0.0	-1.0	0.0	0.0	Number obs: 10 000		
N: 10 000	CKD-EPI					Interval k: 2	48.845	78.477
Simulation						Cl ₉₅ (s(X)):	7.307	7.512

Procedure: Pt-Clearance				Independent vari		
Variable:	U-Crea	U-Vol	S-Crea	Time		
Value:	15.00	1500.0	0.115	1440.000		
Stand. uc., constant:				15.00		
Stand. uc., relative:	0.030	0.015	0.050			
Stand. u _c :	0.450	22.5	0.006	15.000		
Variable:	Value:	Relative sources of uncertainty				
U-Crea	15.0	0.70				
U-Vol	1500.0	0.60				
S-Crea	0.115	0.50				
Time	1440.0	0.40				
		0.30				
		0.20				
		0.10				
		0.00				
		U-Crea/U-Vol-S-Crea/Time				
Nominal		135.87	139.95	137.91	129.40	134.47
Rel. Contrib:		0.257	0.064	0.648	0.030	
Comb u _c :		8.04	Rel. u _c :	0.059	k = 2	Exp. U _c :

Graphic approximation (Kragten).



Program can be obtained from author, anders.kallner@ki.se