2.6 Probability and uncertainty

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

KEY WORDS expanded uncertainty • propagation of uncertainty

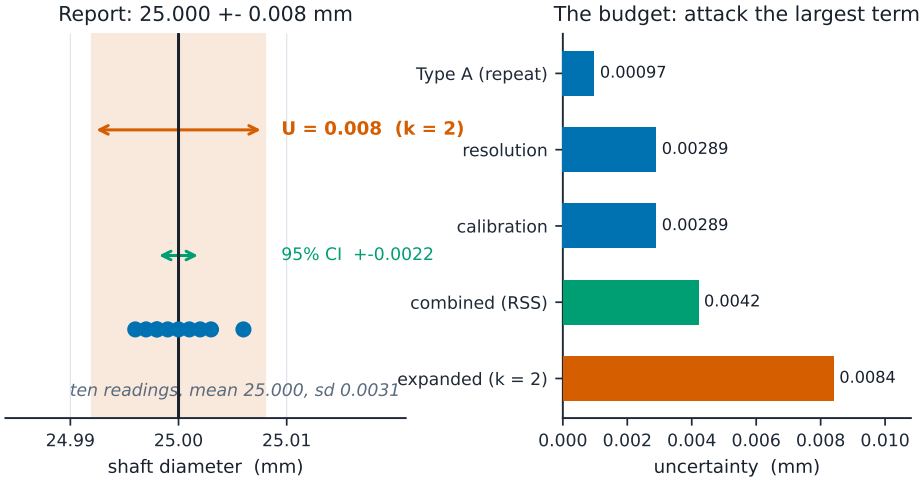
Objective

Build an uncertainty budget, expand it, and propagate it into a computed result.

1 Key knowledge and worked examples

■ Budget, expansion, propagation

Type A $s/\sqrt{n}$; Type B rectangular $a/\sqrt{3}$, resolution $q/\sqrt{12}$; combine by RSS; $U = ku_c$ with $k = 2$; propagate by the partial-derivative rule, RSS for independent inputs.



The interval travels with the number

■ Worked example. The pivot shaft

Mean 25.000, sd 0.0031, se 0.00097; budget 0.00097 / 0.00289 / 0.00289 - $u_c = 0.0042$, $U = 0.008$; area 490.9 ± 0.3 mm2 ✓.

2 Practice

Eight readings of a link length (mm): 18.4, 18.6, 18.5, 18.3, 18.7, 18.5, 18.4, 18.6. Resolution 0.02 mm; calibration certificate ±0.01 mm. t(7, 95%) = 2.365.

2.1 The mean, sd and standard error (four decimals). [3]

2.2 The two Type B terms (four decimals). [2]

2.3 u_c and U $(k = 2)$, and the report line. Which term dominates this time? [4]

2.4 The link's cross-section $A = \pi d^2/4$ at the mean diameter: A (one decimal) and its propagated interval (one decimal). [5]

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