1 Acknowledgments

This document is copied almost verbatim, with a few extra annotations, from Dr. Hai Xiao’s lecture notes of Spring 2006.

2 Definitions

Measurand A physical parameter being quantified by measurement

Confidence interval ?

3 Static characteristics

3.1 Accuracy/unaccuracy/measurement uncertainty

Accuracy: • Accuracy is a measure of how close the measured value is to the true value
• Accuracy is a qualitative concept

Measurement uncertainty:
• Uncertainty: parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand. The parameter may be, for example, a standard deviation (or a given multiple of it), or the half-width of an interval having a stated level of confidence.
• Standard uncertainty: uncertainty of the result of a measurement expressed as a standard deviation
• Expanded uncertainty: quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand.

3.2 Precision/repeatability/reproducibility

Precision:
• The closeness of agreement between independent test results obtained under stipulated conditions
• Qualitative concept
• Precision should not be confused with accuracy

Repeatability:
• Closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement
• Same (repeatability) conditions include:
  – the same measurement procedure
  – the same observer
  – the same measuring instrument, used under the same conditions
  – the same location
  – repetition over a short period of time
• Precision under repeatability conditions
• Also a qualitative concept

Reproducibility:
• Closeness of agreement between the results of measurements of the same measurand carried out under changed conditions of measurement
• The changed conditions may include:
  – principle of measurement
  – method of measurement
  – observer
  – measuring instrument
  – reference standard
  – location
  – conditions of use
  – time
• Precision under reproducibility conditions
• Reproducibility is also a qualitative concept

3.2.1 Qualitative v. quantitative

Qualitative terms should never have a number directly associated with the term:
• See also the NIST website.
• Wrong: the precision of the measurement results is 2 \( \text{Agr} \) m
• Correct: the precision of the measurement results, expressed as the standard deviation obtained under repeatability conditions is 2 \( u_m \)
3.3 Tolerance
3.4 Dynamic range (range of span)
3.5 Linearity
3.6 Sensitivity of measurement
3.7 Threshold
3.8 Bias
3.9 Resolution
3.10 Sensitivity to disturbance
3.11 Hysteresis
3.12 Dead space

4 Docutils System Messages

Undefined substitution referenced: “Agr”.

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