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## 1 Acknowledgments

This document is copied almsot 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 **|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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