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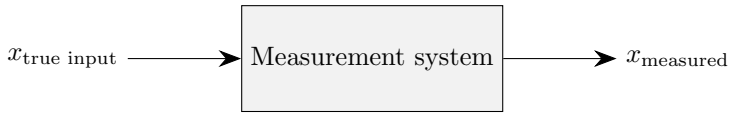
1 Uncertainty Analysis

When we report an experimental result, we should report:

$$x = \bar{x} \pm U_x$$
or
$$\mu_x = \bar{x} \pm U_{\bar{x}}$$

where, In 95% of x $\begin{cases} U_x = \text{expanded uncertainty of } x \\ U_{\bar{x}} = \text{expanded uncertainty of } M_x \end{cases}$
This tolerance term is U_x

For measurands that vary continuously, one cannot measure their values exactly, i.e, there will always be uncertainty



$x_{\text{measured}} =< x > +\alpha_x + \text{Random Errors} + \text{Systematic Errors}$

Where,

- $< x >= \mu_x =$ population mean
- $\alpha_x = fluctuation$
- Random Error - Intrinsic to the measurement sytem itelf(ex. noise)
  - Generally different for each successuve measurement
- Systematic error (symbol β) - Occurs in the same way each time a measurement is made (ex. A thermometer always reads 1 C° too high)
- Elemental error
  - An identifiable error source
  - Classifies as either random or SystematicAlso arise from environent variation

Examples:

accuracy	systematic	β
hysterisis	systematic	β
installation	systematic	β
linearity	systematic	β
repeatability	systematic	β
noise	random	ϵ
environmental	random	ϵ
resolution	random	ϵ
digitization	systematic	β
reading	random	ϵ
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