General characteristics of instruments

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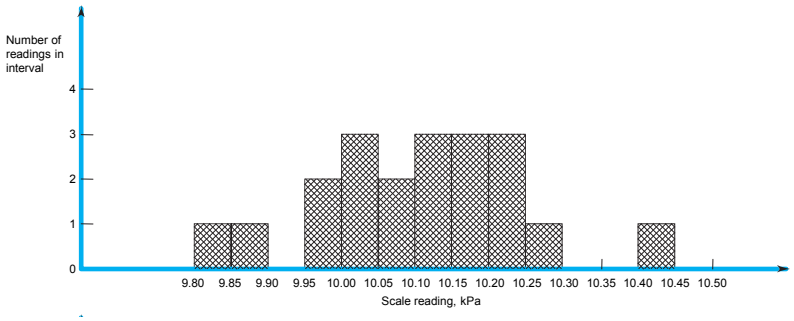
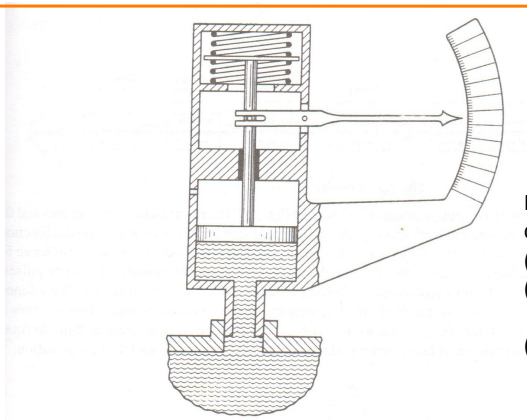
Distribution of data

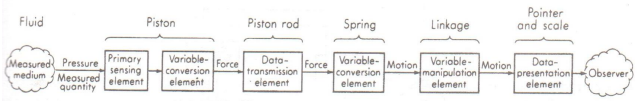


$$Z = \frac{\text{(number of readings in an interval/ total number of readings)}}{\text{width of interval}}$$

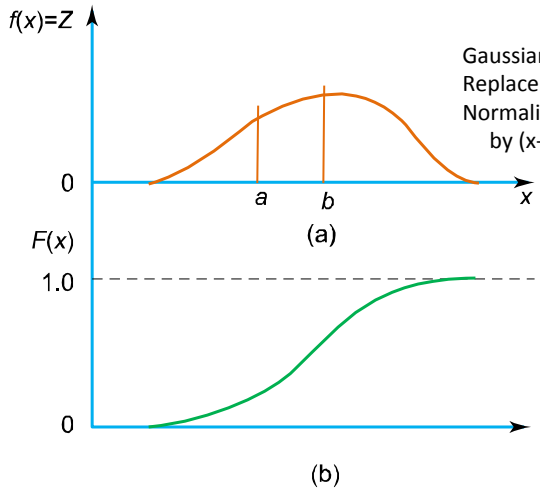
Pressure Gauge



Measured values will depend on:
(i) instrument,
(ii) how we use the instrument,
(iii) environment

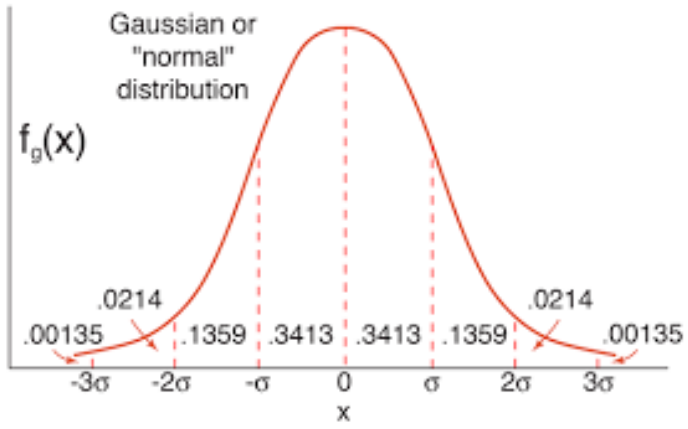


Probability distribution function



Gaussian function: $\exp(-x^2)$
Replace x by $(x-x_0)$
Normalize replace $(x-x_0)$ by $(x-x_0)/(\text{sigma})$

Gaussian function



Example

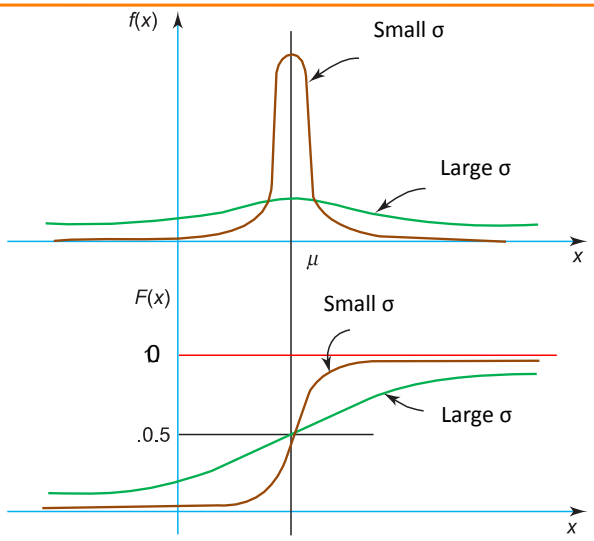
- You are measuring the length of 200 leaves collected from the same tree. The mean length is 7 cm and the standard deviation is 0.5 cm. How many leaves are expected to be in the range of (a) 6.5 cm to 7.5 cm, (b) 6 cm to 8 cm, (c) 6 cm to 7.5 cm?
- About 68% area lies between mean and +/-1 sigma, and about 95% area between mean and +/-2 sigma.

(a) Expect 0.68*200 = 136 leaves to be of length 6.5 cm and 7.5 cm.

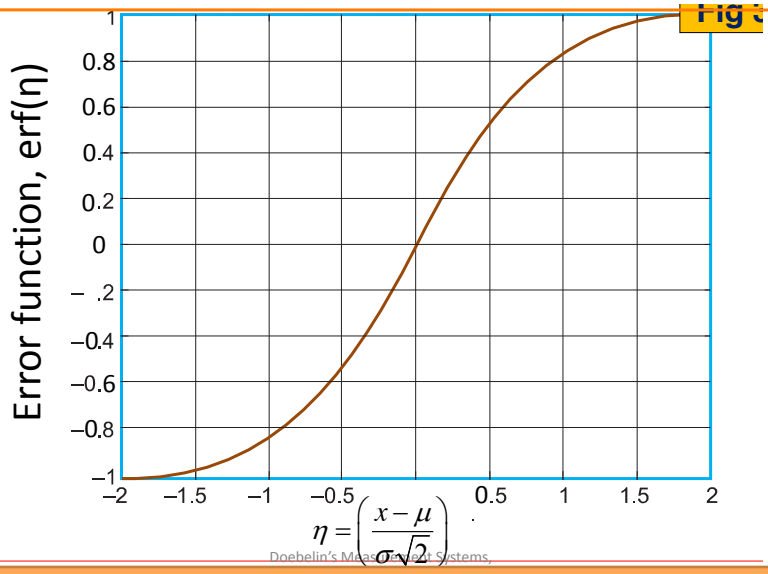
(b) Expect 0.95*200 = 190 leaves to be of length 6 cm and 8 cm.

(c) Complete it yourself. How will your answer change if the range is still 1.5 cm but size varies from 6.2 cm to 7.7 cm?

Gaussian distribution

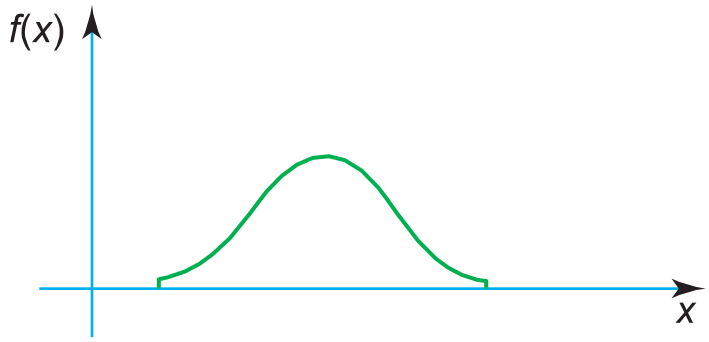


Error function



Doebelin's Measurement Systems,

Non Gaussian distribution



Effect of uncontrolled input