SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

23ECE304-SMART SENSORS AND DEVICES
III ECE / V SEMESTER

UNIT 1 – OVERVIEW OF MEASUREMENTS AND SENSORS

TOPIC –CLASSIFICATION OF ERROR

NO MEASUREMENT IS ACCURATE!

Errors occur because of:

1. Parallax error (incorrectly sighting the measurement).
2. Calibration error (if the scale is not accurately drawn).
3. Zero error (if the device doesn't have a zero or isn't correctly set to zero).
4. Damage (if the device is damaged or faulty).
5. Limit of reading of the measurement device (the measurement can only be as accurate as the smallest unit of measurement of the device).

Definitions

1. Limit of Reading: is the smallest unit of measurement on the measuring instrument.

2. The Greatest Possible Error (also called the absolute error): is equal to half the limit of reading.

3. The Upper and Lower Limits: are the smallest and largest value between which a measurement can lie.

Basically Three types of errors are studied:-

1. Gross Errors

2. Systematic Errors

3. Random Errors

Gross Error

Gross Errors mainly covers the human mistakes in reading instruments and recording and calculating measurement results.

Example:- Due to oversight, The read of Temperature as $31.5°$ while the actual reading may be $21.5°$.

Gross Errors may be of any amount and then their mathematical analysis is impossible. Then these are avoided by adopting two means:-

1. Great care is must in reading and recording the data.

2. Two , Three or even more reading should be taken for the quantity under measurement.

Systematic Error

Systematic Errors classified into three categories :-

1. Instrumental Errors

2. Environmental Errors

3. Observational Errors

Instrumental Error

These errors arises due to three main reasons.

1. Due to inherent shortcoming in the instrument.

    Example:- If the spring used in permanent magnet instrument has become weak then instrument will always read high. Errors may caused because of friction , hysteresis , or even gear backlash.

2. Due to misuse of the instruments.

3. Due to Loading effects of instruments.

Environmental Error

These errors are due to conditions external to the measuring Device including conditions in the are surrounding the instrument.

These may be effects of Temperature, Pressure, Humidity, Dust, Vibrations or of external magnetic or electrostatic fields.
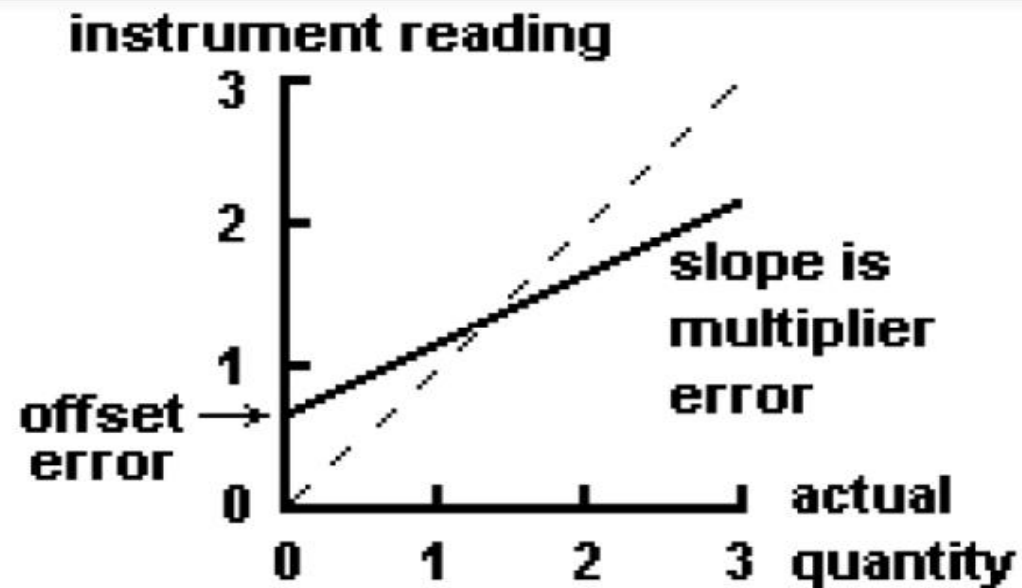
Observational Error

There are many sources of observational errors:-

-- Parallax, i.e. Apparent displacement when the line of vision is not normal to the scale.

-- Inaccurate estimate of average reading.

-- Wrong scale reading and wrong recording the data.

-- Incorrect conversion of units between consecutive reading.

Systematic and Instrumental Error

Here in Graph, Full Line shows the systematic Error in non Linear Instrument.

While Broken Line shows response of an ideal instrument without Error.

Random Error

The quantity being measured is affected by many happenings in the universe. We are aware for some of the factors influencing the measurement, but about the rest we are unaware. The errors caused by happening or disturbances about which we are unaware are Random Errors. Its also known as residual Errors.