Mata Kuliah

RISET INFORMATIKA

Informatics Research

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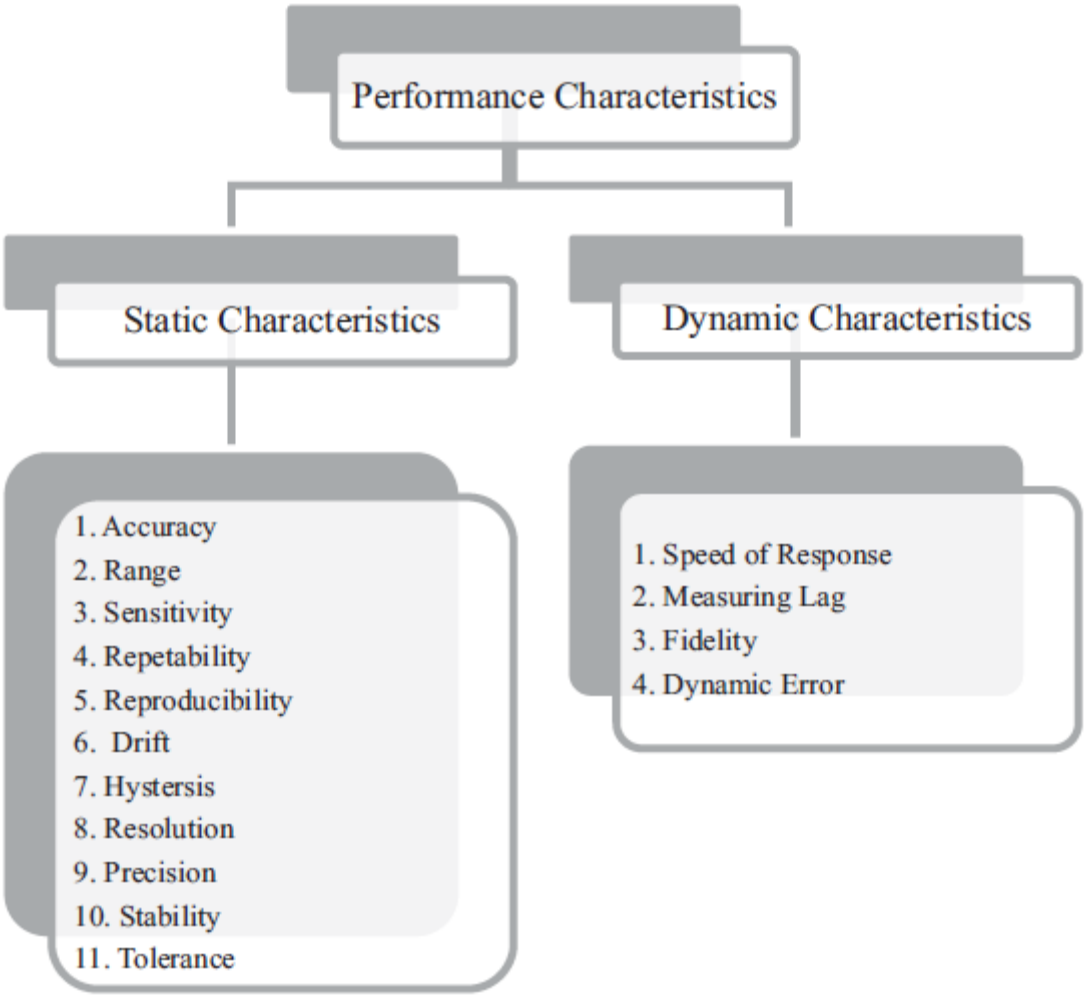
Performance Characteristic



Research Methodology: A Practical and Scientific Approach
Vinayak Bairagi, Mousami V Munot

Static Performance

(i) **Accuracy**: It is defined as the degree of closeness with which the measured value approaches the true value of the quantity being measured.

$$Accuracy = True\ Value - Measured\ Value \tag{4.1}$$

Accuracy is generally defined in terms of ± percentage. Usually the true value is unknown over all the operating conditions; so it is approximated with some standard.

The accuracy is classified in the following ways:

- Point accuracy: It is specified at only one particular point of scale. Point accuracy does not give any information about the accuracy at any other point on the scale
- Accuracy as percentage of scale span: The accuracy of an instrument can be expressed in terms percentage of scale span when an instrument has uniform scale
- Accuracy as percentage of true value: True value is defined as an average of all measured values. Accuracy can be measured as percentage of true value over all measured values

Static Performance

(ii) **Range (or Span)**: The range/ span of an instrument is defined as the maximum and minimum values of the inputs or the outputs for which the instrument is recommended to use.

(iii) **Sensitivity**: It is defined as the ratio of the incremental output to the incremental input. While defining the sensitivity, it is assumed that the input-output characteristics of the instrument are approximately linear in that range.

(iv) **Repeatability**: It is defined as the variation in scale reading of an instrument for the same quantity to be measured.

(v) **Reproducibility**: It is defined as the degree of closeness with which a given value may be repeatedly measured by an instrument. It is specified in terms of scale readings over a given period of time.

Static Performance

(vi) **Drift**: Drift is grouped into following three categories:

- Zero drift: Zero drift occurs in an instrument when whole calibration gradually shifts due to undue warming up of an electronic component, slippage and permanent set
- Span drift or Sensitivity drift: If there is proportional change in the indication all along the upward scale, the drift is called span drift or sensitivity drift
- Zonal drift: It is defined as drift for a portion of span of an instrument

The details of drift (span and zero) are depicted in Figure 4.2.

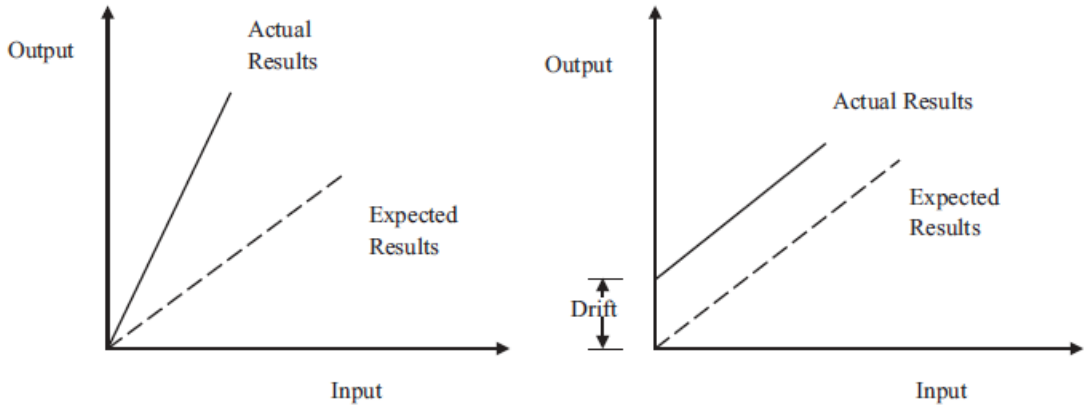


FIGURE 4.2
Span Drift and Zero Drift

Static Performance

(vii) **Hysteresis**: Hysteresis exists not only in magnetic circuits, but in instruments also. For example, the deflection of a diaphragm type pressure gauge may be different for the same pressure, but one for increasing and other for decreasing. The hysteresis is expressed as the maximum hysteresis as a full-scale reading[4].

(viii) **Resolution**: Resolution is defined as the smallest change in input which can be measured by the instrument. If the input is slowly increased from some arbitrary input value instrument does not respond until a certain increment is exceeded. This increment is called as resolution as depicted in Figure 4.3.

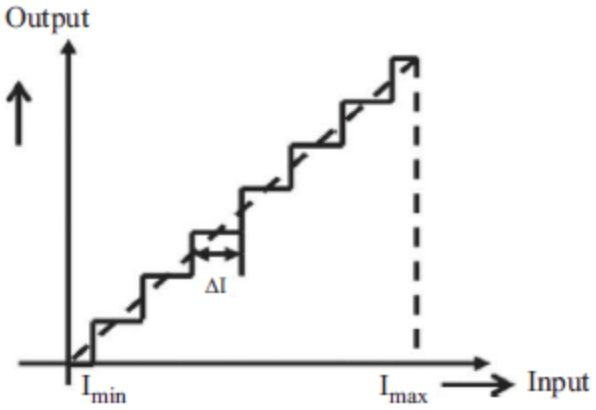


FIGURE 4.3
Resolution

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Static Performance

(ix) **Precision**: A researcher should understand difference between precision and accuracy. Precision indicates the repeatability or reproducibility of an instrument, but does not indicate accuracy. If an instrument is used to measure the same input, but at different instants of time, the successive measurements may vary randomly. The random fluctuations of readings are commonly represented with a Gaussian distribution. A precision of an instrument indicates that the successive reading would be very close, or in other words, the standard deviation σ_e of the set of measurements would be very small.

(x) **Stability**: It is defined as the ability of an instrument to maintain its performance throughout its specified operating life.

(xi) **Tolerance**: Tolerance is defined as the maximum allowable error in the measurement of an instrument.

Dynamic Performance

(i) **Speed of response**: It indicates how fast the measuring system responds to changes in the measured quantity.

(ii) **Measuring lag**: It is the retardation or delay in the response of a measurement system to changes in the measured quantity. The measuring lags can be categorized as follows.

- Retardation type: In this type of measuring lag an instrument responds immediately after the change in quantity being measured occurs
- Time delay lag: If the response of an instrument begins after a dead time on the application of the input this type of measuring lag is called as time delay lag

(iii) **Fidelity**: It represents faithful reproduction. It is the degree to which an instrument indicates the changes in the measured variable without dynamic error.

(iv) **Dynamic error**: It is defined as the difference between true value of the quantity being measured changing with time and the value indicated by the measurement system assuming zero static error. It is also called as measurement error.

Thank You!