

SEE1123

INSTRUMENTATION & ELECTRICAL MEASUREMENT

Transducers

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6.0 Definition

A transducer provides a means of converting an energy into a different form of energy.

6.1 Classification of Transducers

Transducers can be classified as active and passive transducers

6.2 Temperature Transducer

There are various types of temperature transducers available in the market such as thermocouple, pyrometer and thermistor.

6.3 Potentiometer

A potentiometer is a device which can be used to measure resistance.

6.4 Capacitive Transducer

A capacitive transducer can be used to measure displacement.

As is already known a capacitor consists of a combination of plates which can hold a charge. The charge in the capacitor is the ratio of the capacitance over the voltage. The capacitance is a function of the distance between the two plates (d), the area of the plate (A), and the constant (k) of the dielectric which fills the space between the plates. In other words it can be expressed as **$C = k\epsilon A/d$** .

ϵ or pronounced as epsilon is the permittivity constant.

By moving the plates or by having different dielectric, a capacitive transducer can be used for measuring position, displacement, gauging, or any other related parameters.

6.4 Capacitive Transducer (cont)

VARIABLE SEPARATION

By varying the separation of parallel plates, motion can be detected. Capacitance is inversely proportional to spacing. A large value of capacitance will be obtained if spacing is small. .

VARIABLE AREA

If one of the plates slides, the overlapping area between the plates will change. Capacitance changes linearly with motion.

VARIABLE DIELECTRIC

Another variation which can be measured is the dielectric variation. This is caused by having different dielectrics between the capacitive plates.

6.5 Linear Variable Differential Transformer (LVDT)

Linear Variable Differential Transformer or abbreviated as LVDT is a transducer which can measure displacement accurately. It is widely used in industries. It consists of a primary winding and two secondary windings. LVDT is a passive transducer since it needs an external energy to power it. As such it is energized by an AC supply usually having a frequency range of 1 to 10 kHz. with a cylindrical core passing via the center.

6.5 Linear Variable Differential Transformer (LVDT) (cont)

Its operating principle is based on an alternating magnetic field in the center of the transducer inducing a signal into the secondary windings depending on the location of the core.

When the core moves, the signal in the secondary windings change. If the core is located at the center, the output of LVDT will give a zero signal. If the core moves in either direction, the signal output will increase. LVDT displays an output having a linear relationship with the core movement.

6.6 Strain Gage

A strain gage is a useful device for measuring strain and other related parameters.

A strain gage make use of the concept of the change in resistance with applied force. Various parameter related to force such as pressure, tension and weight can be change into resistance by a strain gage. When an object is subjected to a force, stress and strain will occur.