Measurement system in engineering

ASSIGN BUSTER

Measurement Systems For Mechanical Parameters Measurement systems are methods and mechanisms to accurately record physical quantities. Since the measurement has to be accurate, it has to be converted into electronic form and therefore needs and electrical or electronic interface which can be subsequently computerized.

The greatest challenge is to record physical variables which are not related to electrical or electronics. Mechanical phenomenons like force, weight, torque, pressure etc also needs to be measured. In former times, this used to be measured in the form of mechanical measurements itself (like wind-cock to measure speed or direction of wind). These were, at best, crude devices which gives a " feel" of the magnitude of the physical quantity. They do not provide accurate measurements and therefore cannot be recorded and kept for future reference.

To overcome this, a new type of device was created. This is called transducer. These transducers are used to convert mechanical quantities into electrical signals which can be recorded. Measurement systems started gaining prominence in engineering and a new genre called " instrumentation" engineering was born.

Typical examples of transducers are

Force →Strain gauge

Pressure →Venturi meter

Flow →Venturi meter

These transducers effectively create a marriage between the mechanical engineering with the electrical/ instrumentation world. Some of the elaborations are as under:

Force Measurement :

This is done using Strain gauges. Strain gauges are constructed with materials whose electrical resistance value changes when force is applied on them. The variation in resistance is directly proportional to the force applied. The variation in resistance can be measured using a wheatstone bridge or a simple voltmeter-ammeter method.

The basic strain gauge is used in the industry in weighing scales, weighing systems etc. Different variations of the same are also used in measuring tension in a material (like paper, steel strip etc) as tension is also essentially force. A variation of the same can also be used to measure “ torque” - which is the angular force i. e force x distance.

Pressure measurement :

There are several ways of measuring pressure. The cruder ways of measuring pressure using manometers or bourdon tubes have now been replaced by more sophisticated measurement techniques. The most common way to measure pressure of a flowing liquid is to use a venturi. As the liquid passes through a “ venturi”, the velocity of the liquid increases and the corresponding pressure decreases known as “ Bernoullis Equation” (“ FlowMax engineering,” n. d.) This principle is used to measure the pressure. As a derivative of the same, the venturi meter can be used to measure “ flow” of the liquid as well – since “ flow” is proportional to square root of the pressure drop. An electronic circuit to generate the square root -“ Square Root extractor circuit” (“ Wikipedia – Transtronics”, 15 April 2008) is often used for this purpose.

There are other methods of measuring pressure / flow like “ Magnetic flow meter”, “ Rotameter”, etc

Temperature measurement :

This probably has the most diverse type measurement systems – starting from RTD / Thermocouple to Thermistors. Essentially the resistance temperature detectors are resistors whose value changes based on temperature (RTDs or thermistors) while thermocouples work on the principle of “ Seebeck effect” (“ Thomas Johann Seebeck”, 13 June 2003.) which leads to a temperature gradient generating an electrical potential which is proportional to the temperature difference.

There are many such transducers and measurement methods which has become such an integral part of our life that we dont realize that they are part of a separate field called “ instrumentation” or “ measurement systems”. Thus the digital weighing system which shows the weight accurately or even the elevator which beeps to indicate “ Overload” when we are too many crammed into the elevator are all manifestations of this field. Only it is too common now – too passe to be thrilled or excited about.

References

FlowMaxx Engineering. n. d. Retrieved on 9th February from http://www. flowmaxx. com/venturi. htm

Transtronics. 15 April 2008. Retrieved from Wikipedia on 9th February from http://wiki. xtronics. com/index. php/Mass_Flow_by_square_root_extraction

Thomas Johann Seebeck. 13 June 2003. Retrieved from on 9th February from http://chem. ch. huji. ac. il/history/seebeck. html

.