BFF3302 SENSOR AND INSTRUMENTATION SYSTEM

Introduction to the sensor & instrumentation

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Chapter Description

- Aims
  - Obtain basic knowledge about electronic, measurement, sensors, and instrumentation
  - Able to analyse particular sensor, instrument, and measurement situation.

- Expected Outcomes
  - Determine general treatment of instrument elements and their characteristic
  - Analyse transducer elements, intermediate elements, and data acquisition system (DAQ)
  - Determine principles of the work and derive mathematical model of sensors for measuring motion and vibration, dimensional metrology, force, torque and power, pressure, temperature, flow and acoustics

- References

  - B.C.Nakra and K.K. Chaudhry, 2012. Instrumentation measurement and analysis, 3rd ed., Tata-McGraw-Hill.
  - Introduction to signal processing, instrumentation, and control : an integrative approach / Joseph Bentsman Hackensack, NJ : World Scientific Pub., 2016
  - Transducers for instrumentation / M. G. Joshi, New Delhi, India : Infinity, 2017
  - Instrumentation and measurement in electrical engineering / editor : Harinirina Randrianarisoa, New York : Arcler Press, 2017

Problem

An elastic type of pressure measuring instrument is of diaphragm type. The central deflection of the diaphragm was founded to be 0.25mm of an applied pressure of 10^6 *Pa*. The output displacement of diaphragm has been fed to an LVDT (linear variable differential transducer) with a built-in amplifier having a sensitivity of 40V/mm. Finally, the output is displayed on an analog voltmeter which has a radius of scale line as 60mm and has a voltage range from zero to 10 volts in an arc of 150˚.

i. Sketch the block diagram of the pressure-measuring instrument.

ii. Determine the sensitivity of the given diaphragm gauge in terms of mm/bar (1 bar = 10^5 *Pa*).

- A Bourden pressure gauge having a linear calibration which has a 50 mm long pointer. It moves over a circular dial having an arc of 270˚. It displays a pressure range of 0 to 15 bar. Determine the sensitivity of the Bourden gauge in terms of scale length per bar (i.e. mm/bar).

- A thermocouple having the following characteristics:
  - sensitivity of 4.8 mV/˚C
  - output is connected to a moving coil millivoltmeter with sensitivity of 1˚/mV.
  - length of the pointer of the instrument is 30 mm.

Determine the overall sensitivity of the system in mm/˚C.