Oefenopgaven EE1320 Meettechniek – college 2: Sensoren[1]

Michiel Pertijs, versie 28 april 2012

Regtien: opgaven 7.8, 7.11

5.4 A piezo-electric acceleration sensor is composed of a piezo-electric element with a charge sensitivity S_q= 5 pC/N, a sensor capacitance C= 1 nF and a 100 gr seismic mass is attached. Calculate the sensor output voltage if subjected to a (non-static) acceleration of 1 m/s^2.

5.5 Read-out of the piezo electric accelerometer described in the previous question 5.4 involves a cable between sensor and a 1x voltage amplifier. The cable has a capacitance C_c= 40 pF between inner conductor and shield and the amplifier has an input capacitance C_v= 80 pF. Calculate the error for voltage read-out if these capacitances had not been taken into consideration in the design of this data-acquisition system.

The specifications of a LVDT are:

- operating range: +/- 50 mm and
- sensitivity: + 4 mV/(mm·V)

5.6 The LVDT is driven using at 8 kHz sine wave excitation voltage with 2V rms amplitude. Calculate the output amplitude (rms) for a +30 mm displacement.

5.7 How can a displacement over +30 mm be distinguished from a displacement over -30 mm?

[1] Het merendeel van de weergegeven opgaven is afkomstig uit
R.F. Wolffenbuttel, “Measurement of Electrical and Non-electrical quantities”, editie 2010.

Figure 5.28 shows an experimental approach for temperature measurement at high temperatures using a thermocouple with cold junction compensation. The Seebeck coefficient for the Chromel-Alumel couple is equal to 40 μV/K. The Seebeck coefficients of both the Alumel-copper and the Chromel-copper are not defined. The cold-junction is at temperature T_h.

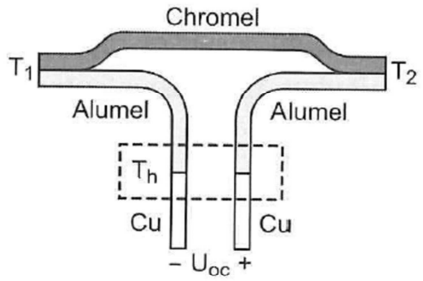

Figure 5.28, Practical measurement with a chromel-alumel thermocouple.

5.9 Derive an expression for the thermocouple output voltage, U_{oc}.