LET271: Elektriska mätsystem och mätmetoder

Giuseppe Durisi

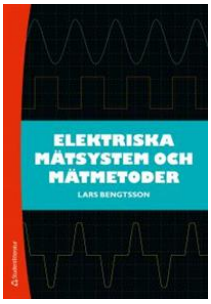
Chalmers, Sweden

2017

Administrative information

- Lecturer: Giuseppe Durisi
- Teaching assistant: Jesper Pedersen, Sven Jacobsson
- English used for lectures but...
- ...book as well as some course material and exercise sessions in Swedish

Book



Also available as ibook in English

Administrative information

- Organization: lectures, exercises, 4 lab sessions
- Solving the lab assignments is required to pass the course
- Compulsory report to hand in after Lab 4.
- 4 extra points available by solving extra tasks in Lab 3 and Lab 4
- All course material in pingpong

Changes from previous year

- Labs have been updated (new hardware, new lab lectures) in 2016; Lab4 shortened as requested

your feedback is important to us!

Do compile the student questionnaire at the end of the course!

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- One extra Labview support lecture added: step-by-step introduction
- Extra compendia on thermocouples and measurement errors to be uploaded in pingpong to replace the corresponding chapters in the book
- Tried to harmonize the notation in the statistical part of the course with the one used in the parallel course *mathematical statistics*

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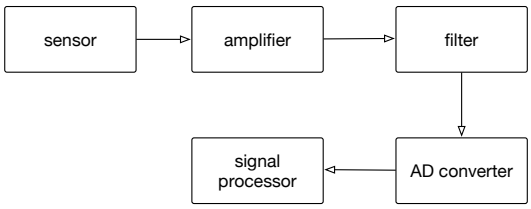
What is a measurement system?

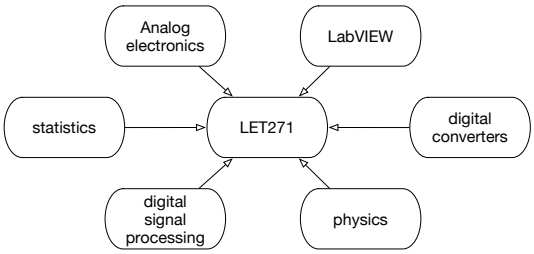
- A measurement system provides info about the magnitude of a physical quantity that needs to be measured.

Modern measurement systems

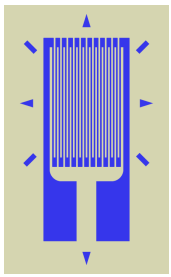
Modern measurement systems



Will touch many different fields



Strain gauges



Source: wikipedia

Piezo-electric sensors

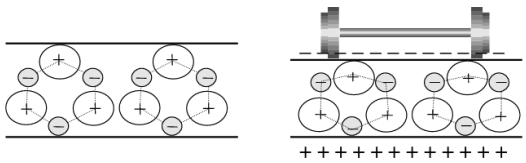


Fig 2.10 When the crystal lattice is deformed, a charge displacement occurs in the crystal

Position sensors—strain gauges

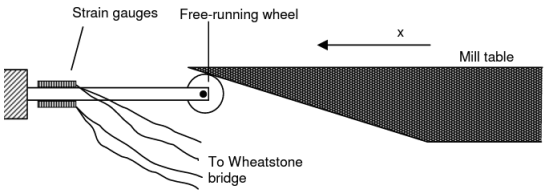


Fig 2.26 Position sensor based on the strain gauge principal

Position sensors—potentiometer

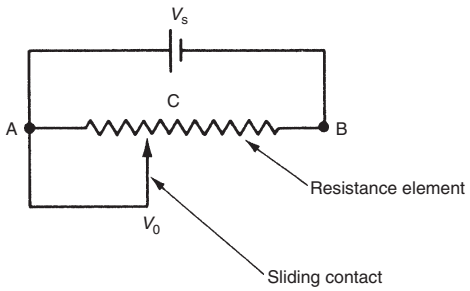


Figure 19.1
Resistive potentiometer.

Position sensors—variable inductance

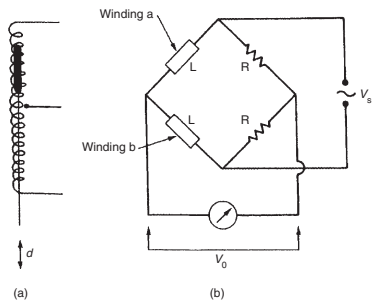


Figure 19.4
(a) Variable inductance transducers; (b) connection in a bridge circuit.

Position sensor—differential transformer

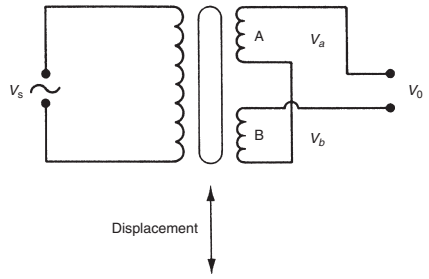


Figure 19.2
Linear variable differential transformer.

Accelerometer

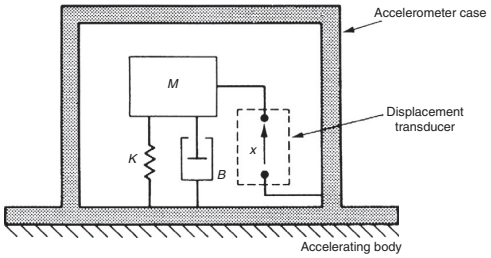


Figure 19.14
Structure of an accelerometer.

Accelerometer—piezoelectric sensor

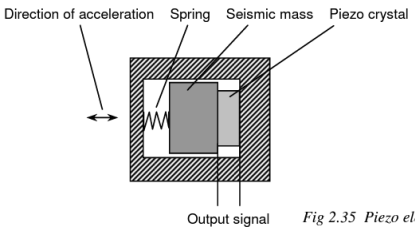
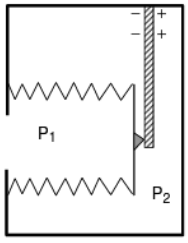
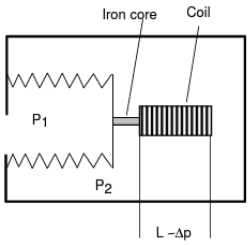


Fig 2.35 Piezo electric accelerometer

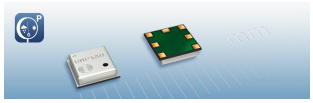
Pressure sensors



Pressure sensors

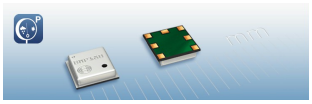


Bosch BMP180 pressure sensor



- Sensitive to light?

Bosch BMP180 pressure sensor



- Sensitive to light?
- Piezo-resistive material (semiconductor) $\Rightarrow$ photo-currents

Level sensors

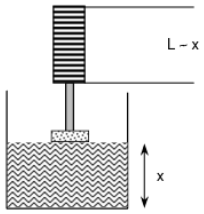


Fig 2.65 Inductance proportional to liquid level

Level sensors

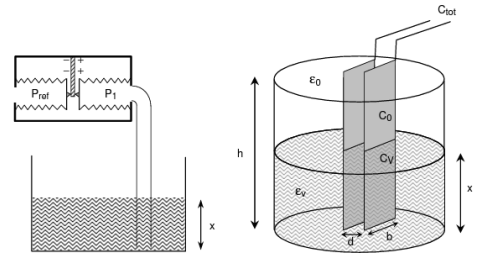
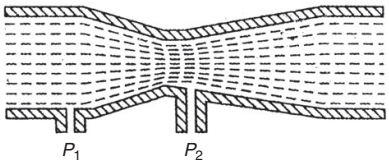


Fig 2.67 Level sensor using pressure sensors *Fig 2.68 Capacitive level sensor*

Flow sensors—Venturi tube



Resistance thermometers

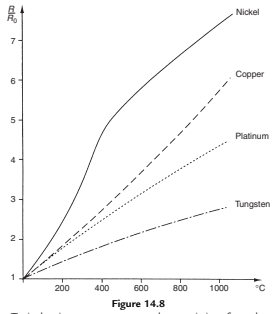


Figure 14.8
Typical resistance-temperature characteristics of metals.

Block diagram of measurement systems