Measurement Systems

Sensor Technology

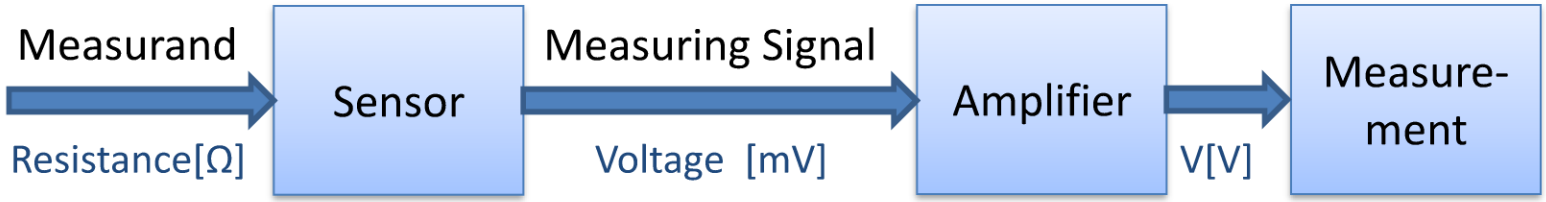
Applied Mechatronics

Module 2.3

by Wolfgang Neff

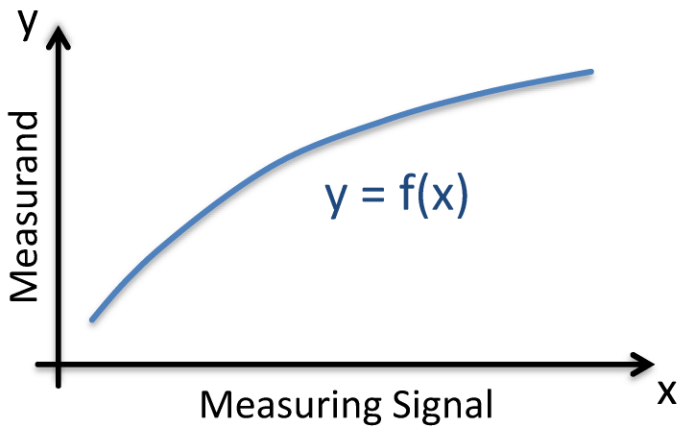
Sensors (1)

- Definition
  - First Element of the Measurement Chain
  - Input is the measurand (quantity to be measured)
  - Output is a measuring signal



Sensors (2)

- Mode of Operation
  - Input gets transformed appropriately
    - Input is the quantity of interest
    - Output is a quantity that can be measured
    - Output is a function of the measurand



Sensors (3)

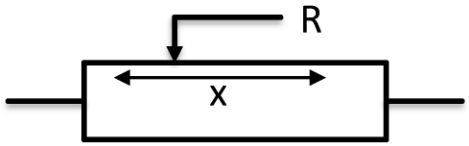
- Principles of Measurement
  - Physical Relationship between Input and Output
    - Measurand → Measuring Signal
  - Example: Resistive Sensor
    - Measurand: Resistance R[Ω]
    - Measuring Signals: Voltage V[V] and Current I[A]
    - Physical Relation: Ohm's Law
    - Functional Relation: $R = \frac{V}{I}$

Sensors (4)

- Principles of Measurement (continued)
  - Overview of important principles of measurement
    - Resistive Sensors
    - Inductive Sensors
    - Capacitive Sensors
    - Magnetic Field Sensors
    - Piezoelectric Sensors
    - Photosensors

Sensors (5)

- Important Sensors (obligatory sensors)
  - Position, Angle and Displacement
    - Potentiometer
      - Measurand: Position, x[m]
      - Measuring Signal: Resistance, R[Ω]
      - Principle of measurement:
        The resistance of a linear slider potentiometer depends on the position of the slider. If the resistance is measured the position of the slider can be determined.
      - Functional Relation: R = f(x) – exemplary, real relation required
      - Sketch:



Sensors (6)

- Important Sensors (continued)
  - Position, Angle and Displacement
    - Potentiometer
    - Linear and Rotary Encoder
    - Capacitive Displacement Sensor
    - Inductive Non-Contact Position Sensors
  - Force, Strain and Pressure
    - Strain Gauge
    - Piezoelectric Sensor

Sensors (7)

- Important Sensors (finished)
  - Temperature Sensor
    - Resistance Thermometer
    - Thermocouple
    - Thermistor

Sensors (8)

- Further Sensors (free elective sensors)
  - Moisture
  - Speed
  - Light
  - Proximity
  - Gas
  - Etc.
  - Humidity
  - Acceleration
  - Torque
  - Level
  - Smoke

Sensors (9)

- Required Skills (for the free elective sensors)
  - Outline the measurand (sensor input)
    - Do not forget to specify the physical unit
  - Outline the measuring signal (sensor output)
    - Do not forget to specify the physical unit
  - Explain the functional relation
    - How the output correlates with the input
  - Draw a functional sketch

Addendum

- Further Information
  - [BRI13] Ch. 3.5 Sensorik
- Bibliography
  - [BRI13]: BRIEGLER, ADOLF and others, 2013, Elektrotechnik Fachkunde 1. Wien : Jugend & Volk. ISBN 978-3-7100-2911-0.