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SENSORS WITH FIRST-ORDER CONCENTRATED PARAMETERS OF APERIODIC TYPE

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Abstract This article presents the types of sensors, their principle of operation and appearance

Keywords sensor, measurement, function, sensitivity

The sensitivity of the sensor is the ratio of the increase in the output value of the sensor to the increase in its input value:

$S=\frac{dY}{dX}$

The sensitivity of the sensor is constant for the linear part of the transformation function. The sensitivity of the sensor describes the degree of perfection of the process of changing the measured value in it.

The sensitivity limit of the sensor is the minimum change in the value of the input value that can be reliably detected. The sensitivity limit is related to both the nature of the measured value and the perfection of the process of converting the measured value in the sensor. The limit of the sensitivity limit comes from the information energy theory of measuring devices

$C=\frac{W_{sh}}{\eta_E}$

here W_{sh} - noise energy at the sensor input; η_E– this is the information-energy efficiency of the sensor, which describes the ratio of the useful power spent to change the information to the total power spent for measurement [1].

$C=\gamma^2 2Pt$

here: γ^2 - sensor accuracy; P - power used for measurement; t- measurement time. And so $W_{sh}=\gamma^2 Pt\eta_E$

Determined by the nature of the process W_{sh} the value is approx 3,5×10-20 Dj due to the fact that the combination of values that make up the sensitivity limit of the sensor also has limitations.

Sleeve for advanced sensors η_E 10^{-5} from 10^{-6} does not exceed and accordingly, the threshold of sensitivity is at least10^{-15}... 10^{-14} Dj will be around.

As an example, let's analyze the classifications of sensors designed to measure various physical phenomena:

Thermocouples, RDTs and Thermistors: sensors for temperature measurement. Including:

- ✓ thermocouples,
- ✓ thermistors,
- ✓ resistive temperature sensors,
- ✓ as well as infrared thermal sensors.

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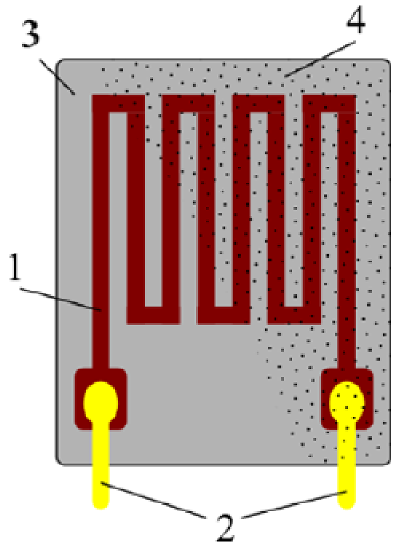
Figure 1. Different types of thermal sensors. From left to right: thermocouples, thermistors, and RTDs.

Strain gauges: sensors designed to measure the deformation of an object, such as pressure, tension, weight, etc.



1-tenzomaterial, 2-external joint steam, 3-bottom of the board, 4-protective layer. Figure 2. General view of strain gauge

Load sensors: sensors designed to measure weight and load.

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Strain gauge weight sensors are of various types (S-shaped, cylindrical, ball, etc.) and are classified according to the maximum load, sensitivity, class of protection against environmental conditions and scope of application [2].

S-shaped cylindrical hammer

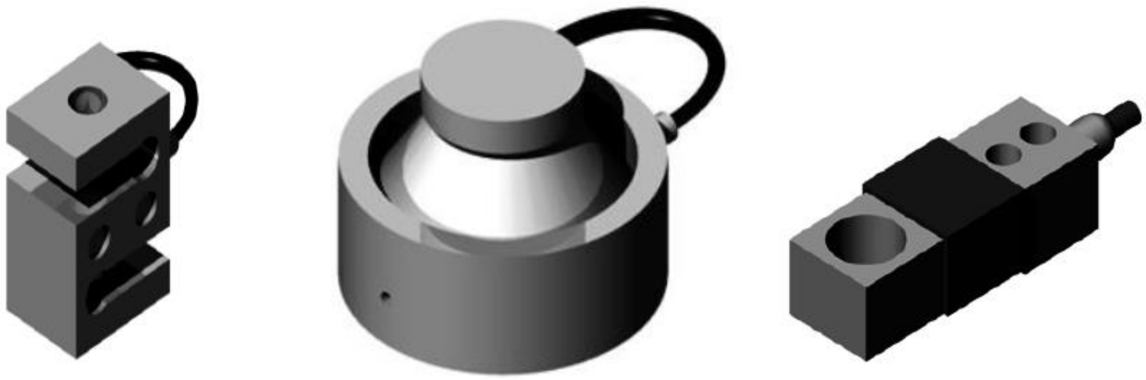

Figure 3. Overview of load sensors

LVDT sensors: sensors designed to measure distance displacement. LVDT sensors (linear rectification differential transformers) are used to measure linear displacement/position over relatively short distances. They consist of a tube into which a rod is inserted. The base of the pipe is determined and the end of the rod is fixed to the moving part [3].

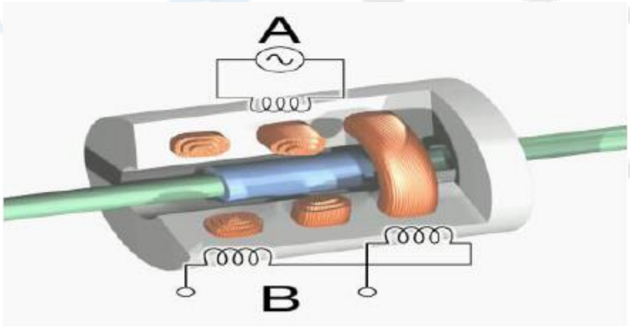

Figure 4. Cutaway view of LVDT sensor

When the rod exits or enters the tube, the sensor outputs signals that represent the position of the rod from the starting point to the maximum deflection. The rod does not touch the inner walls of the pipe, which almost eliminates friction, and the LVDT sensor itself does not contain electronic components, so it is often used in harsh conditions [4].

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