SOFTWARE MEASUREMENT INFORMATION PROCESSING MEMS SENSOR

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The technique of data processing and software implementation of the research output signal with the MEMS pressure sensor with an analog output and a nonlinear output characteristic. Designed the layout, provides interfacing of the output signal of the sensor with a personal computer. The mathematical method polynomial approximation of the nonlinear output characteristic and the method of its implementation in a software environment LabVIEW.

Keywords: MEMS sensor, pressure, analog-to-digital converter, microcontroller, nonlinearity, virtual instrument, LabVIEW.

For selected studies MPXV10GC6U silicon piezoresistive pressure sensor in the sensor housing SOP firm Freescale Semiconductor, intended for measuring the pressure in the range from 0 to 10 *kP*. Due to lack of normalized output and compensation of temperature error on the measurement result with such a sensor nonlinearity error affects the output characteristics [1].

Problem Definition:

An ideal linear output characteristic described by the formula: $V_{out} = V_{off} + sensitivity * P$, where the V_{out} - output value in *mV*, V_{off} - the initial offset of the sensor, *P* - pressure [2]. Nonlinearity error of *1%* of full scale, which is *30 mV*.

As ADC using a precision *16-bit* delta-sigma ADC Texas Instruments ADS1110 firms with differential inputs and continuous self-calibration. Built-in reference voltage source provides a range of *2.048 V* in the differential input $\pm 2.048\ V$. ADS1110 uses I^2C serial interface and operates from a single power supply voltage *+ 2.7 ... 5.5 V*. The ADS1110 can perform the conversion with a frequency *15, 30, 60, 240* samples per second. Built-in amplifier with programmable gain to 8 can measure weak signals with a high resolution [3].

Relevance:

Pairing the test bench with a personal computer provides ARDUINO UNO board based on MK Atmel AVR ATmega328P. As part ARDUINO UNO: 14 digital inputs / outputs, 6 analog inputs, a quartz resonator *16 MHz*, connectors: USB, power supply, circuit programming (ICSP) and the reset button.

Market analysis:

Linearization of the output parameter sensor carried virtual instrument LabVIEW software environment in the company National Instruments, by introducing correction factors and the actual non-linear approximation to the ideal output characteristic line [3]. To find the real conversion

functions necessary to perform calibration of sensor used. Calibration is performed in the operating range of the sensor from *0* to *10 kP* in steps of *1 kP*. Experimental points obtained during calibration approximated by a polynomial of degree *N*, the more the higher the degree of the polynomial approximation accuracy. LabVIEW enables us to construct a polynomial approximating the desired degree and calculate its coefficients using the General Polynomial Fit.

The developed program laid equation of perfect function and obtained by constructing a polynomial coefficient of the equation of a polynomial function. The measured voltage value from the ADC received by an MC is transmitted to the program, which is the value given to the ideal linear function, and the resulting polynomial. The difference in the values is the correction factor, the measured value approximating to the ideal linear transducer conversion function. Thus, realized linearization function allows you to reduce the multiplicative error sensor nonlinearity. Also, the program eliminates zero initial displacement sensor and ADC, eliminating the additive error sensor and ADC.

To display the graph the ideal sensor and the actual output of a polynomial function, simultaneously with the measurement results, given initial degree of the polynomial in the appropriate window. For clarity, the display located below the graph of the cell, the current value is not linearized output voltage from the sensor to the *mV* and *V*, and the corresponding pressure in *kP*. Below are the cells that display compensated (reduced to an ideal output characteristic) in the *mV* voltage, and corresponding to this pressure value *kP*.

Research:

In this paper, the method of compensation nonlinearity basic error of MEMS sensors parameters. To compensate for nonlinearity of the analog pressure sensors has developed a program for the study of the characteristics of the sensor output analog and implemented an algorithm of its linearization.

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