Virtual System for Magnetic Field Measurement

Nikola Draganov[1] Totka Draganova[2] Anatolii Aleksandrov[3]

Abstract – **Progress of electronics and automation have increased the accuracy and reliability of the measurement processes, and with it the creation of new sensors and measurement systems.**

The magnetic field is one of the most commonly measured variables, but the accuracy depends on the system for processing measurement signals. Suitable for use in measuring and automatic techniques are computer-based systems for collecting and processing information.

The article presents an example computer-based system for measuring of magnetic field developed based magnetic field sensitive IC manufactured by Melexis, DAQ-module for data acquisition and LabView software environment of the company National Instruments®.

Keywords **– Hall sensors, measuring of magnetic field, DAQ-systems, virtual instruments.**

I. INTRODUCTION

Different types of sensors for measurement and detecting of magnetic field like as Hall elements, magnetoresistors, magnetotransistors,, magnetodiodes, magnetothyristors, magnetosensitive integrated circuits are known. Hall elements are among the widely used galvanomagnetic elements. Their planar structure [4] is absolutely compatible with modern integral technologies and is conductive to magnetosensitive integrated circuits making. They have good magnetic sensitivity, a wide change range of measured magnetic field and high reliability of output signal [1-4].

In much areas of automatics, instrumentation, electronics, machine building, chemical industry and etc is necessary to fulfill precise automatized measurements cheking and observation of different processes and quantities. A creating of a such kind apparatuses is possible but their bulk, reliability and operational period do not justify the experiments. In the modern electronic system it is made by fulfilling of virtual devices which enable information signals collection and their treatment, visualization, storage and decision taking for processes control.

The purpose of the present working is to create and investigate an automatized virtual system for measurement of magnetic field on a basis of magnetosensitive integrated circuit MLX242 manufactured by Melexis and DAQ-module USB6009 manufactured by National Instruments for data acquisition [5, 6].

[1]Nikola Draganov is with the Faculty of Electrical Engineering and Electronics at Technical University of Gabrovo, 4 Hadgi Dimitar, Gabrovo 5300, Bulgaria, E-mail: ndrag@abv.bg.

[2]Totka Draganova is with the Faculty of Electrical Engineering and Electronics at Technical University of Gabrovo, 4 Hadgi Dimitar,Gabrovo 5300, Bulgaria, E-mail: totka_draganova@mail.bg.

[3]Anatolii Aleksandrov is with the Faculty of Electrical Engineering and Electronics at Technical University of Gabrovo, 4 Hadgi Dimitar, Gabrovo 5300, Bulgaria, E-mail: alex@tugab.bg.

II. RESENTATION

Block diagram of a realized virtual system is shown in a Fig.2. It is composed of magnetosensitive integrated circuit (IC) of the type MLX242. Its power supply leads U_{CC}, GND and the output lead U_O are connected to DAQ–module for data acquisition and processing of the type USB6009 which is connected by USB interface to personal computer [6].

The chosen magnetosensitive IC is linear transducer of magnetic field to electrical voltage. Its conversion characteristic $U_O=f(B)$ at U_{CC}=const is investigated and depicted in Fig.1. It is disposed in the first and fourth quadrants and shows a good linearity. The investigation is fulfilled for magnetic field B=(-50÷50)mT and supply U_{CC}=5V. For this type sensor is typical that in magnetic field absence the output voltage is U_O = 2,5V at U_{CC}=5V. This chosen voltage enables to use the build in DAQ-module stabilized supply (5V).

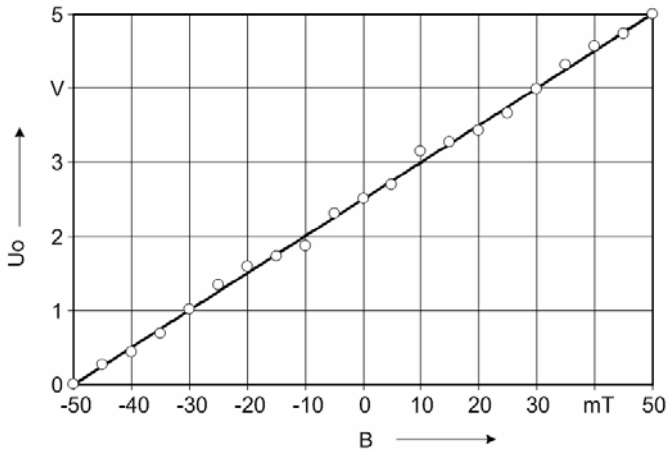

Fig.1. Conversion characteristic $U_O=f(B)$, U_{CC}=5V of magnetic field linear transducer MLX242

The module USB-6009 collects and treats an information. It has 14bits analog-to-digital converter with a system of 10 channels. A signal from an investigated galvanomagnetic sensor is handed to one of all converter input.

The software environment is provided by LabView v.8.5 program package manufactured by National Instruments. The created virtual device consists of two modules: instrumental in which are placed measuring instruments and program where is introduced a virtual system real software. They are depicted respectively in Fig.3 and Fig.4.

On the instrumental panel (Fig.3) are placed two identical measuring instruments for measurement of output voltage U_O from magnetosensitive IC an of applied magnetic field inductance B.

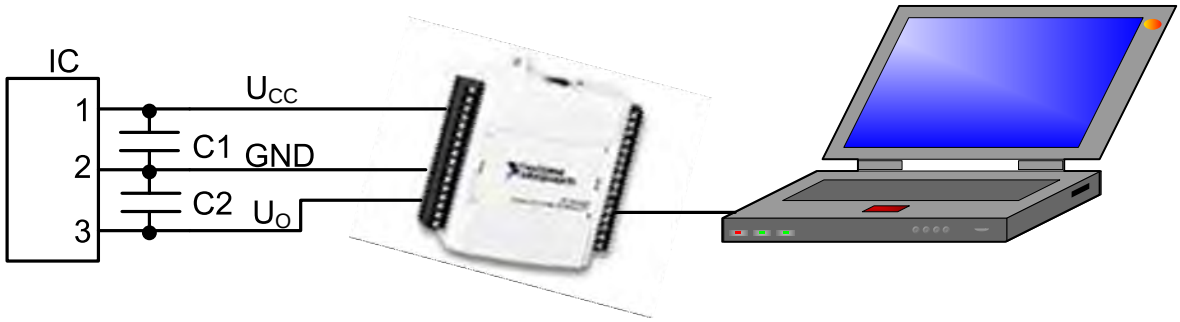

Fig.2. Block diagram of a system for magnetic field measurement

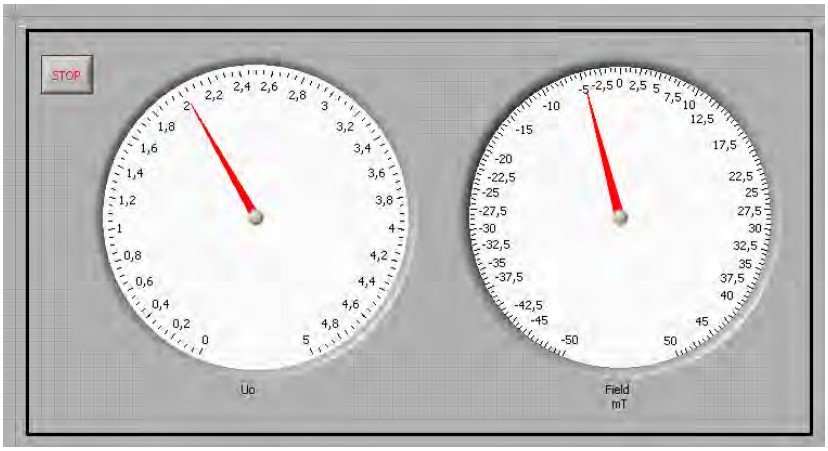

Fig.3 Instruments panel

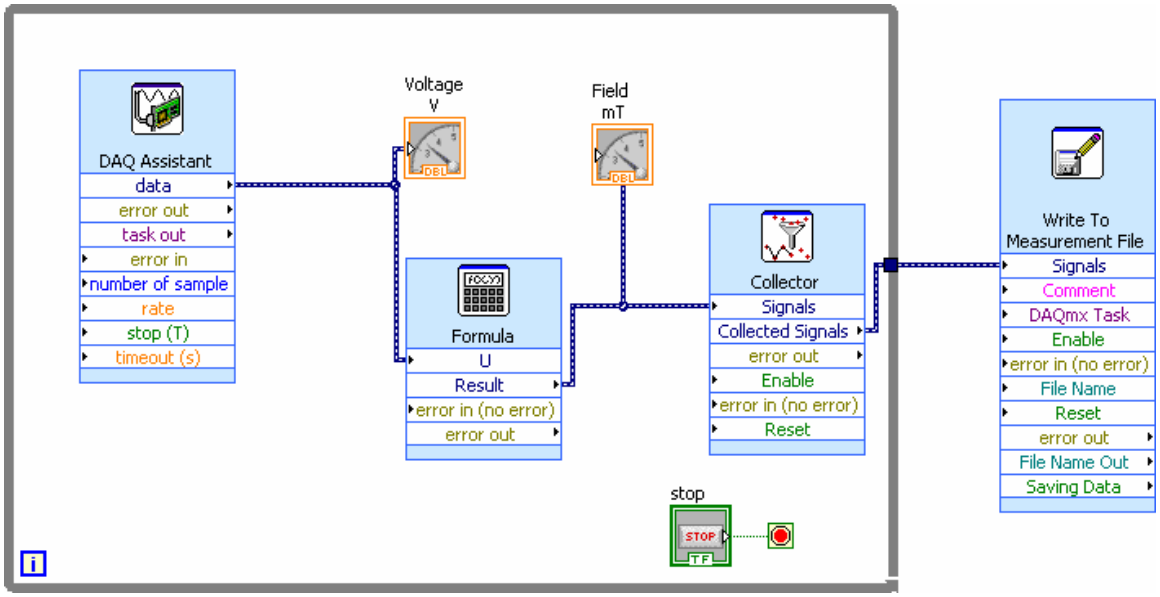

Fig.4 Software block schematic diagram

By means of depicted in Fig.2 experimental obtained conversion characteristic the output signal from magnetosensitive IC is transformed in magnetic field. By means of the lesser squares method is obtained a describing the conversion characteristic mathematical equation:

$$U_O = 0{,}0501B + 2{,}5001 \quad (1)$$

For a magnetic field is necessary the obtained equation to be introduced in block Formula (Fig.4). To input U on the block diagram is handed the measured by DAQ Assistant signal which represents the magnetosensitive IC output voltage. The magnetic field measured magnitudes are obtained on output Result.

The results are storaged in generated by a program package file. For this purpose in block diagram (Fig. 4) blocks Collector and Write To Measurement File are introduced. The first gives for the recording of measurements necessary number. The second shows an address and a file type with data.

III. CONCLUSION

Virtual system for measurement of magnetic field on a basis of magnetosensitive integrated circuit MLX242 manufactured by Melexis and measuring system DAQ-6009 manufactured by National Instruments has been created. The magnetosensitive integrated circuit is investigated. Its conversion characteristic is obtained. A mathematical equation describing this characteristic is drawn.

By means of a virtual system instruments panel is possible to measure as applied to sensor magnetic field so a generated by him output voltage.

It is foreseen to keep results of measurements in generated by programm product LabView special file.

A created virtual system for magnetic field measurement can find a wide application in electronics, instrumentation and automatics. Its possibility to collect and treat measuring information makes it accessible for anyone research laboratory. Thanks to the small gauges of used components (sensor and DAQ-module) and their operation without external power supply a function of measuring system is increased. This system can be used out of laboratories in field conditions.

REFERENCES

[1] Aleksandrov, A., N. Draganov. Galvanomagnetic regulator of induction motor rotation frequency, Proceedings of papers – ICEST, Niš, Serbia, 29 June -1 July 2005, p. 66-69.
[2] Aleksandrov, A., N. Draganov. Study of a galvanomagnetic digital-to-analogue converter, Proceedings of papers – ICEST, Niš, Serbia, 29 June -1 July 2005, p. 60-65.
[3] Draganov, N., A. Aleksandrov. Galvanomagnetic antilock braking system. Proceedings of papers – ELMA, Sofia, 15-16 Sept. 2005, p.134-136.
[4] Draganov, N. Investigation of three wire connection of Hall element with orthogonal magnetic sensitivity. Proceedings of papers – UNITECH–08, Gabrovo, Bulgaria, 21-22 Nov. 2008. Vol.1, p.138-141.
[5] Melexis, product technical data rev. 12.2011
[6] National Instruments, Lab View – user guide.