ALGORITHM TO CALCULATE THE MAXIMUM VALUE OF THE LOW-FREQUENCY MAGNETIC FIELD USING MICROPROCESSOR AND MAGNETIC SENSORS

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Abstract

In this article is considered the algorithm for measuring the low-frequency magnetic fields in the range 0,1 Hz to 100 Hz. The algorithm used to construct the apparatus for measuring low frequency magnetic fields generated by systems for magnetotherapy, using moving magnetic field. The possibility for simultaneously influence of low frequency magnetic field on different part of the human body is one additional advantage of systems for magnetotherapy, using moving magnetic field.

1. INTRODUCTION

During the past few decades, the advances in the theory and technology of modern electronics have led to improvements in medical diagnostic and therapeutic methods. As a result, bioelectric and biomagnetic phenomena have become increasingly important. Today it is not possible to imagine a hospital without electrocardiography and electro encephalography. The development of microelectronics has made the respective equipment portable and has increased its diagnostic power. Implantable cardiac pacemakers have made it possible for millions of people to return to normal life. The development of superconducting technology has provided the means to detect the weak biomagnetic fields induced by bioelectric currents. The latest advances in the measurement of electric currents flowing through a single ion channel of the cell membrane with the patch clamp have opened up completely new applications for bioelectromagnetism. With the patch clamp, bioelectromagnetism can also be applied to molecular biology, e.g. in developing new pharmaceuticals. These examples illustrate that bioelectromagnetism is a vital part of our everyday life. Modern bio-medical diagnostic technique involves two main groups of measuring instruments: ones for measuring bioelectric, bio-magnetic, etc. signals and imaging systems. Registration systems are non-invasive bio-signals – with sensors and electrodes attached to the surface of the body in the form of implants, needle electrodes or chemical sensors.

Measured magnetic field represents sinusoidal oscillation whose amplitude and repetition frequency change over time. The frequency of oscillation was varied between 0,1 Hz and 150 Hz. In such a repetition frequency oscillation sinusoidalnoto need to develop special algorithm by which it can in every moment of time to determine the maximum value of the signal.

Fig. 1

If measured value of amplitude of the curve in the classical way without the use of a special algorithm will not get correct measurement as at the time of measurement can be measured minimum or zero value.

Magnetic sensor - A small coil can be used as semiconductor for measurement of magnetic induction of low frequency magnetic field. The coil is made of dielectric on which reel is wound a copper wire with a thickness of 0,2 mm The coil is placed in a special housing with dimensions 15mm X 80 mm. It has a cylindrical shape and is easy to use by the physician. The coil is a small, because the magnetic field measured at fixed points in space.

2. PRINCIPLE OF THE ALGORITHM

Principle of the algorithm is as follows: For a short period of time eg 1 s made n number measurement. Largest measured value of the field for this period of time is determined for the maximum value of the field. In the algorithm are implemented additional conditions by which to reduce the error caused by disturbance die come in the area of measurement.

Fig. 2

Introduced the following conditions:

- Are defined maximum values of the measured field. When the measured value of the amplitude is greater than the maximum possible value, the measured value is ignored and then not be included in determining the maximum value of the measured magnetic field.
- Defining the Difference between maximum two adjacent measured values. When the difference between the two measured values is greater than the predetermined value is ignored.

In both cases, the errors in measurements can occur when the measured system noise and interference fall. Through the above-described conditions to a large extent the impact of interference can be eliminated.

3. DESCRIPTION OF THE ALGORITHM

Declaring variables: This section describes the absolute all variables that will be used in the program executed by the microprocessor

Determination of inputs for measurement: In this part of the program to determine which pins on the microprocessor will be used to obtain a refund quote sensors and which will be used for transmission of already processed information. Besides the type of conclusion here determines what kind will be the input signal - analog or digital. In our case the input signal to be analog.

Starting serial communication: The relationship between the microprocessor and the next device that will process the measured data is done via the serial interface. This step configures the speed of transmission of data between the microprocessor and the next device.

Calibration of the ADC - Sets the maximum value that will be applied on ADC

System testing: Condition in which the program is implemented consistently, unless interrupted power. Power microprocessor. Interruption of power. Supply the microprocessor establishes end of the program.

Recording of measured values from sensors in buffer: instantaneous measured values are stored in the local memory of the microprocessor.

Comparison of measured values: In this part of the program is compared to the value of the instantaneous measured value from the sensor, and the previous measured value, if the new measured value is greater than the previous value and the new measured value is greater than the maximum

permissible value measured set in defining the variables, the last measured value is stored in the microprocessor. If the above condition is not fulfilled, the last measured value is ignored.

Clock – 1: By this timer is achieved through a particular point in time (eg 1s) measured and filtered off value (eg 1s) sensors to provide the next device for further processing. When the value is accepted by the next device, it is deleted from the memory of the microprocessor.

4. CONCLUSION

Developed Algorithm to calculate the maximum value of the low-frequency magnetic field using microprocessor and magnetic sensors makes it possible to calculate precisely the intensity of the magnetic field in 16 points. By using this algorithm achieves a reduction of measurement error caused by external noises come into the system.

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