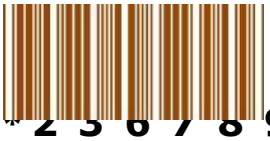
Electrical engineering and radio electronics



Cand.t.s. Valentyn Petryk, Olexandr Povshenko
National Tekhnical University of Ukraine "Igor Sikorsky Kyiv Polytekhnic Institute "

STUDY OF A MOBILE EDDY CURRENT FLAW DETECTOR

Modem development of technology makes it possible to find a new application for means that provide the acquisition, transformation and information trans- mission through the communication channel.

The purpose of this work is to try to use such tools to create a universal system for nondestructive testing of remote objects, information on the state of which is transmitted operatively over long distances for further processing and making the necessary decision.

In [1,2], an analysis of possible technologies for wireless data transmission in flaw detection was carried out, and in [3-5] some were implemented. However, the coverage radius of the monitored territory is limited to hundreds of meters.

GSM technology is proposed to significantly increase the distance at which information can be collected for wireless transmission to the server. The most optimal way to transfer data over the GSM network is to use GPRS technology. The most optimal way to transfer data over the GSM network is to use GPRS technology. Its main feature is the ability to connect permanently a subscriber to the network, i.e., the presence of an active virtual communication channel. For the time of transmission of the data packet, the subscriber is provided with a real (physical) radio channel, which for the rest of the time is used to transmit packets of the other network users.

Thus, the subscriber does not occupy the physical channel permanently and therefore pays only for traffic, and not for the entire session time. As a result, the cost of transferring a megabyte of information is reduced significantly. GPRS technology is optimal for applications in continuous or quasi-continuous monitoring of production processes, control of mobile and stationary objects, and for supporting applications in which the low cost of traffic has a key role.

The maximum possible data exchange rate with the help of GPRS technology can theoretically reach 170 Kbit / s. As a data transfer channel, the use of a TCP / IP network is proposed, and the physical protocol is GPRS. In this case, each of the network devices is assigned a unique IP-address. With respect to our system, different options are possible for allocate the IP addresses of the information processing center (IPC) and concentrators of control sensor networks.

The most common variant is the presence of a static IP-address in the IPC, and the subscribers have dynamic IP-addresses. The static IP-address is allocated by the IPC not by the cellular operator, but by the Internet provider when the IPC is connected to the Internet through a dedicated access channel (formed using LAN, ADSL or other technologies).

At the moment, the task of creating a device with a convenient and flexible data transmission and processing system that can transfer them to various devices, including a WEB server, and to save data on removable small-size media for further processing is solved.

The system is based on the STM32F7 microcontroller with the ARM Cortex- Mi core. The system has developed a frequency synthesizer based on the AD9850 chip, which operates in the range 1Hz - 40 MHz, which allows the use of sensors of various types and configurations. Data transfer is carried out using the Wi-Fi module ESP 8266. With this module, information can be transferred to various devices (computer, smartphone, and tablet) for processing.

The possibility of recording data from the sensor to a removable FLASH medium is developed. To process and output data on a computer, the Lab VIEW environment is used.

Now, work is under way to improve the methods of transmission and processing of information, as well as optimizing the system.

As a data transmission device, several cell phones and GSM modems were considered. During the testing, Wavecom GSM / GPRS modem Fastrack showed the best results due to the support of multiple transmission protocols, low power requirements and high sensitivity of the receiver and transmitter power.

The basis of the communication module can be taken by the development of Wavecom - the wireless processor Q2687. It includes a 32-bit microcontroller, a GSM transceiver and many external data buses.This processor is the core of the system

being developed, which performs all the communication functions and the basic logic of working with the measuring transducer.

The program implemented on the module performs the following functions:

- continuous status check of the transmitter and GSM network;
- accumulation of instantaneous parameter values for technical accounting purposes;
- tracking the presence of all indicators within the acceptable limits, in case of going beyond them - notification about this through the GPRS-channel and SMS;
- periodic interrogation of the average hourly values of the measured parameters and their transfer to the central base via the GPRS channel;
- when receiving a voice call - sending the current instantaneous values of the measured parameters to the central database;
- when receiving a CSD call, the organization of a direct connection to the transmitter for programming or reconfiguration;
- if it is not possible to use one mobile operator network for work, automatic switching to the use of an alternative network.

For experimental studies, a piece of aluminum АД31Т5 with a thickness of 5 mm was chosen with defects of the crack type: depth from 0.1 mm to 3 mm, opening 1 mm. The control was carried out using a differential overlaid eddy current transducer (ECT).

In Fig. 1 shows the experimentally obtained dependences of the amplitude of the ECT signal on the crack depth as a result of monitoring at different frequencies.

To date, a basic module has been developed for solving the problem of transmitting information about the status of the monitoring object in the IPC, which implements Wi-Fi technology.

Studies of the use of data transmission in the creation of a universal system for non-destructive testing of remote sites demonstrated the convenience of control, the ability to quickly transfer control data over long distances without loss, the ability to access

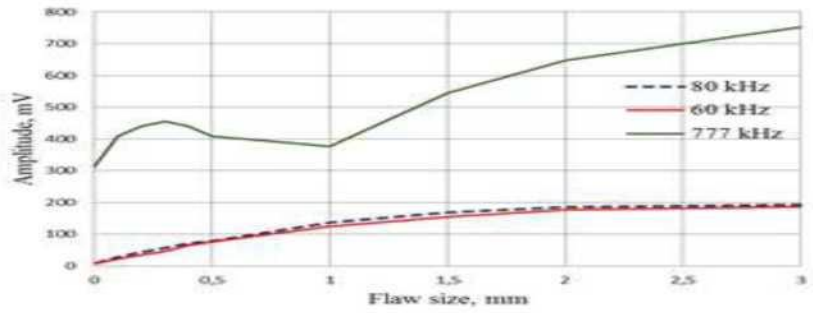


Fig. 1. Dependences of the sensor signal amplitude on a crack depth

the results of several operators, further processing by several algorithms at the same time for a more accurate result. Similarly, the use of such systems simplifies and speeds up the procedure for comparing the results of control of similar objects.

References:

1. Петрик В.Ф. Використання безпровідних технологій передачі даних для вирішення задач у неруйнівному контролі / О.Л.Кустовський, В.Ф.Петрик, К.М.Сєрий, Д.О.Мельник // Вісник НТУ «ХПІ». 2012. - № 40. — С.71-77.

2. Петрик В.Ф. Использование беспроводных технологий в дефектоскопии / В.Ф.Петрик, Г.М.Ковтун, Д.М.Топиха // Научни Известия НТСМ: материалы международной конференции «Дни НК 2014». - Созополь, 2014. - № 150. - С. 486-488.

3. Протасов А.Г. Телеметрический вихретоковый дефектоскоп / А. Г. Протасов, В. Ф. Петрик, А. Л. Дугин // Научни Известия НТСМ: материалы международной конференции «Дни НК 2014». - Созополь, 2014. - № 150. - С. 34-36.

4. Протасов А.Г. Вихрострумовий дефектоскоп з телеметричним каналом зв’язку / А.Г.Протасов, К. М. Сєрий, О. Л. Дугін, В. Ф. Петрик // Вісник НТУ «ХПІ», 2014. - № 19.- С. 132-139.

5. Petryk, V. Wireless data transmission in ultrasonic nondestructive testing / Valentyn Petryk, Anatoliy Protasov, Kostyantyn Syeryy, Serhiy Ukrainec // Ж-л «Научные известия на НТСМ»: материалы международной конференции «Дни НК 2017». - Созополь, 2017. - №1 (216). - С. 121-123.