2. Calculating the distance according to the measured time.
3. Testing the air temperature to use it for temperature compensation to calculate the distance under measurement;
4. The LED display shows the distance and temperature;
5. When the system is not normal, the circuit reset starts.

Ultrasonic ranging is widely used at present. The ASIC is used to design various distance measuring instruments considering the principle of ultrasonic ranging. However, it is a single function of the application-specific integrated circuit and its cost is high. A single chip processor as the core of the distance measuring instrument can realize the preset, multiple port detection, display, alarm and other functions. It is characterized by simple design, low cost, high control accuracy and reliability.

The design of the block diagram has been developed. It is going to be tested for further analysis and improvement to increase its accuracy and practicability.

AMPLITUDE-FREQUENCY CHARACTERISTICS OF ELECTROMAGNETIC EMISSION DURING UNIAXIAL COMPRESSION

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Introduction

Investigation of the state of the object under load is one of the tasks of non-destructive testing. For this it is developed a variety of methods based on different physical phenomena, such as an acoustic emission [1], which allows to evaluate the concentration of defects on the parameters of acoustic signal, accompanied by their formation and development. Moreover, the character of energy distribution of acoustic emission may serve as a measure of estimate [2].

To study the dynamics of crack it is also used electromagnetic emission (EME), due to the formation of an alternating electromagnetic field in the separation of charges in the mouth developing cracks, at the interfaces of heterogeneous media, the interaction of acoustic waves with inclusions having piezoelectric properties.

For the first time this phenomenon has been used in the Tomsk Polytechnic University in developing methods for forecasting geodynamic phenomena (earthquakes, rock bursts, landslides). In the future, efforts were focused on the phenomenon EME in developing methods for non-destructive testing of defects and strength [3-5].

It was investigated the effect of the stress-strain state of the sample on the parameters of electromagnetic emission during pulsed acoustic excitation, the effect of the volume defects on spacetime characteristics of the electromagnetic response due to the mechanoelectrical conversions in dielectric samples, determined the nature of the EME energy distribution of the level of operating loads and possible criteria for monitoring the stress strain state [6-8]. However, it was not carried out analyzing the EME frequency response, depending on the load until the destruction of the samples.

Experiment results and discussion.

For the experiment the sample was prepared of an epoxy resin with sand filling comprising quartz. Specimen dimensions were 60×80×100 mm3 . The edge 60×80mm2 served as basis. Hammering device on the basis of piezoelectric transducer was pressed by the end edge 100x60mm2. Symmetrically the plates with capacitive sensors were located at the edges 100×80mm2 . The sample was placed in the press and subjected to a stepwise uniaxial compression .

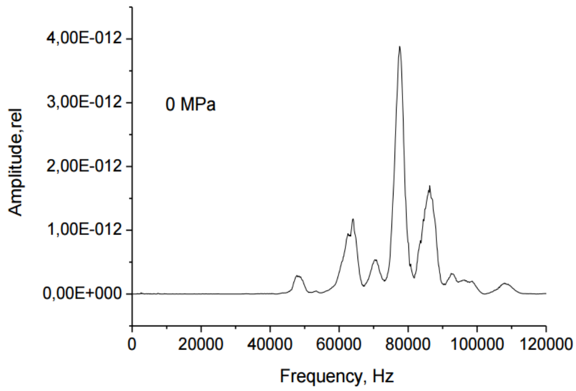

Figure 1. EME frequency response power of the sample without load.

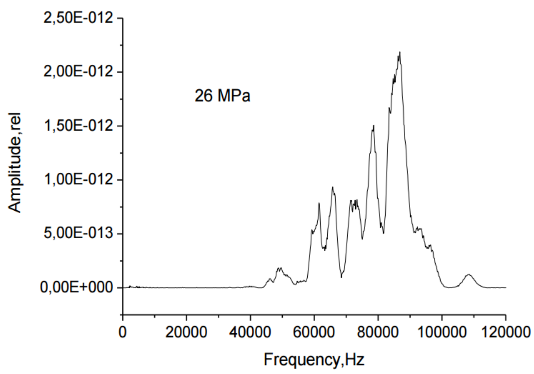

Figure 2. EME frequency response power of the sample under 26 MPa load

The step size was about 4 MPa. At each the step of the pressure the sample was excited by a series of 80 mechanical pulses with the registration responses using the capacitive receiver connected to an input of the differential amplifier.

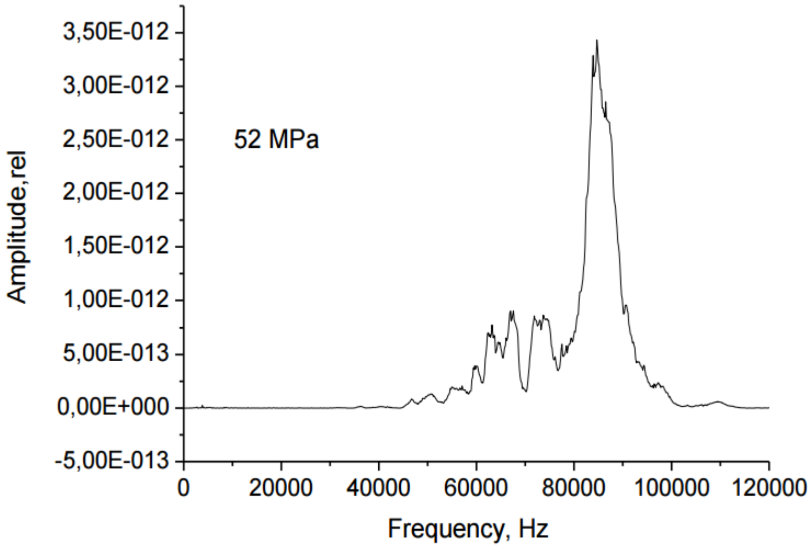

Figure 3. EME frequency response power of the sample under 52 MPa load.

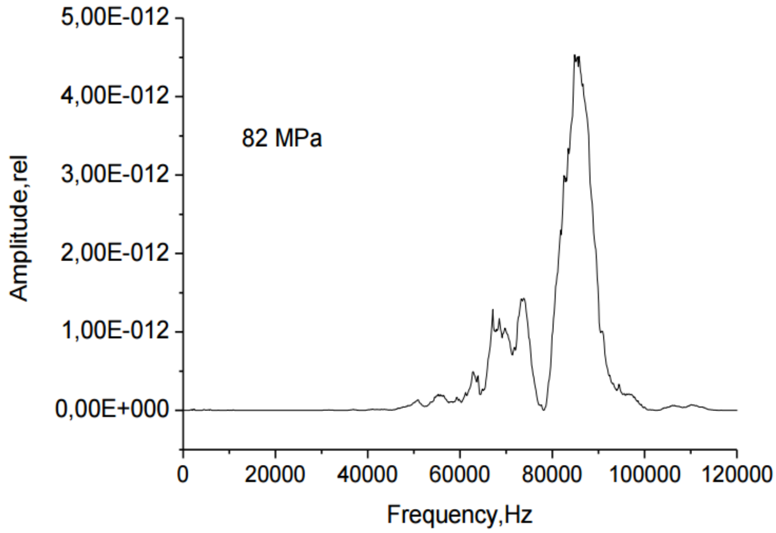

Figure 4. EME frequency response power of the sample under 82 MPa load.

Amplitude-frequency response characteristics were calculated using the fast Fourier transformation. The EME spectra calculated for different values of the applied pressure are shown in figures 1,2,3,4. The figures show that the increase in load leads to the transformation of the spectrum: decrease in the intensity of the low-frequency peaks and the appearance of a broad intense higher frequency peak with a maximum at a frequency of 88.5 kHz.

Analysis of the amplitude-frequency characteristics was conducted for the cut EME responses in which portions from the beginning of the response to a certain time tn excluded. The presence of a broad spectrum band with maxima at frequencies of 87.85 kHz and 89.74 kHz has been revealed. Peak amplitudes at these frequencies at tn of 48 μs and 64 μs reached the maximum value that is significantly greater peak amplitudes for other frequencies. This ratio of peaks in the spectrum with minor changes remains up to tn is 105 μs. With a further increase tn amplitude of the peaks at the frequencies 87.85 kHz and 89.74 kHz begin to decrease and at tn equal 160 μs almost become indistinguishable. The amplitude of the excitation pulse at the same time was decreased by 46 times. When tn is 1500 μs and the pressure is 82 MPa in the EME spectrum more low-frequency peaks at 1.9 kHz, 3.8 kHz, 7.9 kHz, 11 kHz appear.

Values of tn 48 μs and 64 μs coincide with periods of natural oscillations of the sample excited longitudinal and transverse waves. The sample can be excited vibrations of ultrasonic waves with a frequency of 88,5 kHz with wavelength, propagating at a speed 1325 m/s, equal to 1/4 of the sample thickness d, that corresponds to the speed of the surface wave in the sample.

The analysis used the speed of the longitudinal wave, measured in the experiment, and the velocities of transverse and surface waves obtained from the estimates.

Analysis of the EME spectra indicates the major role in the formation of the eigen oscillations of the sample frequencies given geometrical dimensions of the sample and the rate of propagation in it longitudinal, transverse and surface waves.

The appearance of size d/4 may also indicate the existence of a quasi-Rayleigh waves in the sample [9] of length equal to d, at which the maximum displacements and maximum stresses are created on the surface of the component parallel to the surface and that at a depth approximately equal to ¼ wavelength changes according to the direction and sign.

Conclusion.

In the experimental geometry studies the main contribution to the response of EME create born normal vibrations, which are damped standing waves. This work was financially supported by The Ministry of Education and Science of the Russian Federation in part of the science activity program.

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INCREASING OF DATA PROCESSING SPEED FOR PHASED ARRAY SYSTEMS

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Ultrasonic testing is widely used in non-destructive testing due to its safety and versatility. Advanced Phased Array systems with high speed scanning have become promising for 3D object imaging.

A phased array system is a multi-channel ultrasonic system, which uses the principle of a time-delayed triggering of the transmitting transducer elements combined with a time corrected receiving of detected signals. The main advantage of phased array systems is their ability to vary the insonification angle in the inspection object (sound beam sweeping and focusing). This in turn reduces the number of inspection units required for any automated system.