Specialized Meter Of Parameters Of Ultrasonic Oscillation Systems

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Abstract—The article is devoted to a problem of definition of characteristics ultrasonic piezoelectric oscillatory systems. The developed device intended for the solution test of ultrasonic piezoelectric oscillatory systems is presented.

ULTRASONIC production engineering gain all greater extending, both to the industries, and in a life.

Application of ultrasound in the industry allows to speed up many, slowly proceeding in usual requirements, processes, such as impregnating, extraction, to increment velocity a leakage of some chemical reactions. Application of ultrasonic oscillations allows to carry out processes, impracticable (or difficultly implemented) in usual requirements, it is shaped processing of brittle materials, such as a glass, a stone to carry out welding termiplastikal materials without their heating, to gain true emulsions and suspensions [1].

In a conditions of life ultrasonic devices are applied to clearing and a sink.

The ultrasound has found the application and in medicine, with its help not only diagnose diseases of interior bodies, but also bloodless operations on removal of malignant new growths are spent.

All this variety of applications of ultrasonic production engineering leads to necessity to develop ultrasonic vibrating systems with reference to each of engineering process. In last years there are opportunities of model operation of vibrating systems (their mechanical properties), however theoretical calculation of electrical parameters, and also the finding of their connection with mechanical remains enough challenge.

Effective action of ultrasonic oscillations on the handled medium depends not only on properties of the medium, but also from used working tools, and also from parameters of ultrasonic oscillations, such as amplitude, frequency. For example, efficiency of process of impregnating of porous products nonsingly increases under activity of ultrasound if the vibration amplitude in the impregnating fluid makes 1,5-2,5 microns.

In this connection, at a development cycle of new vibrating systems, and working tools of various shapes, it is desirable to have an opportunity of a natural estimate of their mechanical and energy performances, functionalities (the limiting parameters). For simplification of development and tooling of oscillators of ultrasonic technological kettles it is necessary to know electrical

Figure 1 – Block diagram of designed system
Figure 2  Electrical circuit diagram
performances of vibrating systems, and also connection of mechanical and electrical performances of vibrating systems.

For research of performances of the vibrating systems numbered above, the special inventory (stand), having following performances is necessary:
- Adjusting range on frequency 18 - 44 Khz;
- The sine shape of an output voltage;
- Power dressed in a loading 100 - 200 W.

The block diagram of the stand.

The mainframe of the stand is the oscillator intended for feed of ultrasonic piezoelectric vibrating systems. Special demands are made to the oscillator, such as a wide gamut of adjusting range on frequency, a frequency stability in a time, small deformations of an output voltage, stability of amplitude of an output voltage, and also an opportunity of introduction of self-acting frequency control. Considering merits and demerits of oscillators for feed of piezoelectric transformers of ultrasonic vibrating systems [1,2,3], it is possible draw a deduction that for embodying tasks in view the oscillator should to be builted under the plan with the output stage working in the active regime. The generalized block diagram of such oscillator is presented in figure 1.

The master oscillator represents the controllabled oscillator of a sine voltage. It should provide amplitude of a signal necessary for a power amplifier on the exit, and have a sufficient gamut of reorganization (rebuilding) on frequency.

The control package power in such oscillators carries out guidance of amplitude of a sine voltage on the exit. This knot should provide maintenance of amplitude of a starting signal at the given level in the given frequency gamut that will allow to compensate irregularity amplitude a frequency characteristic (AFC) a power amplifier and the master oscillator.

The power amplifier defines, finally, energy measurings, the control package power in a loading and the control package operation of the stand.

Technical datas of the developed ultrasonic oscillator:
- Adjusting range on frequency, KHz From 15 up to 50;
- The peak output power, W 200;
- The peak output voltage, In 480;
- A peak current in a loading, A 0,9.

Technical datas of the block of measurings:
- A gamut of measuring of working frequency ultrasonic
  The oscillator, KHz From 10 up to 60;
- A gamut of measuring a supply voltage vibration system, V From 0 up to 500;
- Ultrasonic vibrating system, A From 0 up to 1.

The developed stand is intended for examination of parameters of ultrasonic vibrating systems by their operation in various technological mediums, functionalities developed vibrating systems, and also definition of electrical parameters (a supply voltage...
at which the optimum operating mode is realized). Gained, by means of the developed stand, data make the certain (particular) worth at a development cycle and tune of the ultrasonic process equipment.

In the important parameter describing ultrasonic action, the amplitude of mechanical oscillations of a radiating surface of a ultrasonic vibrating system is. Many processes, such as a ultrasonic pulverization, wimbling, etc. flow at strictly certain values of amplitude of mechanical oscillations of the working termination of a ultrasonic vibrating system. So, for example, the vibration amplitude is necessary for ultrasonic drilling matching a size of the corpuscles, wimbling used in production engineering, an abradant.

Thus, at a design stage of ultrasonic inventory, and also at a stage of adjustment of production engineering it is necessary to know absolute a value of amplitude of mechanical oscillations of the working terminations and their dependences on a supply voltage submitted on a vibrating system.

For reception of such data was possibly use of the developed stand together with matching additional inventory (for example, with an optical measurer of amplitude of mechanical oscillations [4]). The plan of measuring installation for conducting joint measurings with use of optical installation for measuring amplitude of mechanical oscillations, is presented in figure 3.

The diagram of dependence of amplitude of mechanical oscillations from a supply voltage of a vibrating system is presented in figure 4.

From the diagram given in figure 4 it is visible, that with pinch of amplitude of a powering voltage on the transformer of a vibrating system the amplitude of mechanical oscillations does not grow proportionally to it, and is aimed to the certain value which is defined by performances of an explored vibrating system (geometrical factors, properties of a material of a vibrating system, etc.).

Data obtained as a result of trial it is possible to use for definition of output characteristics of the oscillator of optimum operating modes of the presented ultrasonic vibrating system necessary for achievement.

References