



## ACOUSTIC MONITORING METHOD IN THE MECHANICS

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### ABSTRACT

*Found out effective directions of perfection of non-destructive control of details of bodies of rotation. Investigational influence of voice vibrations is on the exposure of defects. The worked out methodology of experimental researches and conducted experimental researches are for the exposure of defects by means of gain-frequency characteristic of non-destructive method of control. The worked out mathematical models of gain-frequency characteristic are for being of deviations from the set indexes of details. Set forth practical recommendations in relation to application of non-destructive method of control for help of gain-frequency characteristic in machine-building processes..*

**Keywords:** gain-frequency characteristic, non-destructive control, network design.

### 1. INTRODUCTION

The scales of production allowed to conduct verification each and shortage of imperfect wares. As far as development of industrial production products became more difficult, number of her descriptions constantly tall. The question of verification of separate not properties of wares appeared, but it to functional ability on the whole. The checking of quality of products, essence of that consisted in the exposure of imperfect products and exception of it from a productive process, system began to be folded.

Improvement of quality of industrial products, increase of reliability and longevity of equipment and wares maybe on condition of perfection of production and introduction of control system by quality, that is determined as a "aggregate of descriptions of object, that behave to his ability to satisfy the conditioned or predictable necessities".

Control of quality of products consists in verification of accordance of indexes of her quality to the set requirements.

Treasure, absence of impermissible defects; accordance of physical mechanical properties and structure of basic material and coverage; accordance of geometrical sizes and cleanness of treatment of surface to the necessary norms and others like that: the widen use of non-destructive methods of control, standards, that does not require an undercut, or

destruction of the finished goods, allows to avoid the severe losses of time and material charges, provide partial or complete automation of operations of control at the simultaneous considerable upgrading and reliability of wares.

Today not a single technological process of receipt of responsible products is inculcated in industry without the corresponding non-destructive checking system. Actuality is directly related to complex control of parameters of surfaces of details of machines, development and introduction of the improved non-destructive method of control and at possibility of creation of the checking system.

Aim of work of – development of the improved non-destructive method of control that by means of application of gain-frequency characteristic can provide the necessary upgrading of surfaces of details of machines. Scientific novelty: new principles of upgrading of surfaces of details of machines are offered [1]. The worked out new method of control of bodies of rotation is a non-destructive method of control for help of gain-frequency characteristic of detail.

## 2. TESTING METHODOLOGY

The complex checking a few methods system can be built on the basis of 1001045042610f the control of all volume of products by every method or on the basis of sampling test by that or other (whether all) method of control. Sometimes additional control comes true only in those areas, wherever a basic method provides the set requirements, or targets at the increase of informing.

Control of forgings, if purveyances do not have allowance on the dead band of ultrasonic seeker, also uses combination acoustic and superficial methods of fault detection.

In especially responsible cases for the increase of reliability of exposure of defects of different types conduct control of the weld-fabricated connections the methods of the radiation x-raying and acoustic. Control of founding, as a rule, is executed by the method of the radiation x-raying, and an acoustic method is used for determination by the places of location of found out defects. Control of mushroom screws foresees combination of acoustic methods with superficial methods, such as capillary, magnetic and vertical current.

For control of internal surfaces vertical current methods and periscope review (by-optical method of control) or periscope review and acoustic control are used.

The review of literature specifies on the necessity of decision of problem of perfection of non-destructive method of control for help of amplitude-frequency by description. The formed problem influences on quality of machine-building products and that is why requires a management. A necessity of being of decision is also actuating, because the methods of control used today are capacity of resources, foremost, power-hungry and labor intensive.

In connection with that in the conditions of market economy one of terms of maintenance of competitiveness of products there is the use of maintenance of resources technological processes, one of perspective directions there is application of non-destructive method of control on the basis of gain-frequency characteristic and creation of the new checking simultaneously of different parameters of detail (quantitative and quality) system.

Worked out experimental setting (Fig. 1) that is folded: notebook 1, experimental purveyance 2, pies element 3, metallic sticks 4. By means of software on computer did the voice record of detail, by means of the program "All Sound Editor" did voice file (put a concrete zone to the sound is a voice impulse, and converted a voice file into a new format), by means of the program "Spektra PLUS 5.0" converted voice amplitude into a numerical kind [5].



Fig. 1. The general view of the experimental setting

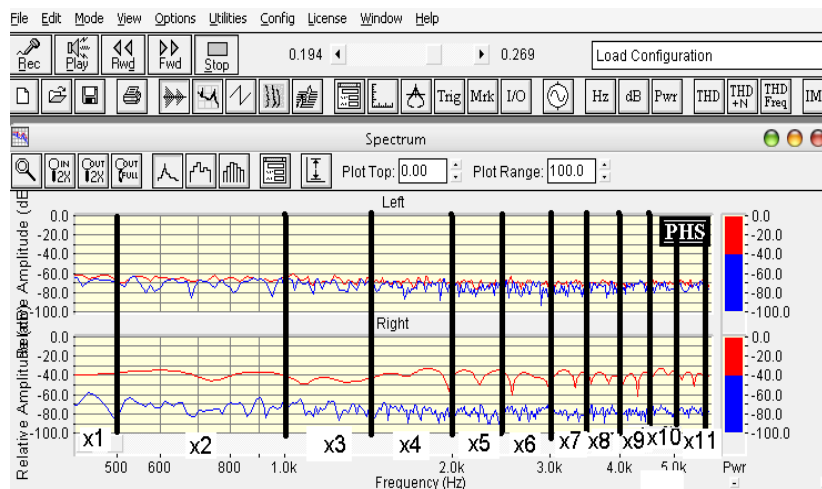


Fig. 2. Treatment of voice file and division on frequency segments

After canvassing plenty of data was got, for their classification and further treatment the concept of integral index was entered, for this purpose all spectrums of frequencies (0-5500 Hertz) was broken on 11 frequency segments through every 500 Hertz. For every frequency segment answers a frequency filter (Fig. 2) is certain.

For realization of experiment there were the used standards of diameter a 45 mm and breadthways 10 mm from material steel 45.

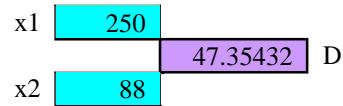
### 3. RESULTS AND DISCUSSION

Our experimental researches are base on supposition about the increase of control of quality by means of comparing of gain-frequency characteristic of standard detail to the gain-frequency characteristics of details of party.

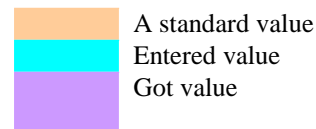
The mean values of experimental data were used as a weekend for the construction of mathematical model (Tables 1 and 2).

Table 1. A weekend is given for the checking of diameter system

X4	105.6184	250
X5	80.04061	88
x4	0.078144	2.282443
x5	-0.24128	-0.1129
A1_1	0.131428	1.189305
A1_2	-0.86966	-0.74128
A1_3	0.066853	0.793615
A1_4	-0.50195	-0.37358
Syndrome 1_1	0.5679	0.922439
Syndrome1_2	-0.89687	-0.88113
Syndrome1_3	0.400671	0.888095
Syndrome1_4	-0.83387	-0.78884
A2_1	-0.00087	-0.0819
A2_2	0.896871	0.881134
Syndrome2_1	-0.00866	-0.45024
Syndrome2_2	0.899686	0.898077
A3_1	-0.42802	0.014222
A3_2	0.613652	1.055238
Syndrome3_1	-0.81061	0.124514
Syndrome3_2	0.859876	0.913438
d	0.059683	-0.64568
D	48.05968	47.35432



Conditional denotation of colors



On results an experiment by means of Neuro Pro software 0.25 a mathematical model was built on the basis of network design, where entrance symptoms were integral indexes of frequency filters (x1, x2, x3, x4, x5, x6, x7, x8, x9, x10, x11), and by eventual syndromes is a value of diameters, value of width of details.

A one layer network was built with the initial amount of neurons 11, that grew short after simplification of network.

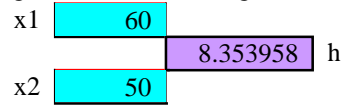
On the basis of the obtained data by means of network design the new method of non-destructive control was worked out for help of gain-frequency characteristic, that gives an opportunity of creation of the checking system, that, leaning against verbal description of two mathematical models of treatment of these integral indexes of diameters and width, can watch the process of control of parameters of detail.

For this purpose it is necessary to use the value of frequency filters (x4, x5, x9, x11). Giving an acoustical signal in ranges (2000-2500; 2500-3000; 4000-4500; 5000-5500 Hertz) a corresponding frequency filter controls integral indexes and as a result will get the exact meaning controlled to the parameter(diameter, width).

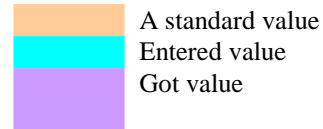
To advantages of this checking system it is possible to take that, it gives an opportunity to control parameters not only quantitative (value of lengths, diameters) but also quality (roughness, hardness, presence of internal defects), for this purpose it is necessary only to enter additional frequency filters that will be adjusted on control certain to the parameter.

Table 2. Weekend is given for the checking of width system

X9	61.8979	60
X11	58.48668	50
x9	-0.0292	-0.05556
x11	0.175679	0.018519
A1_1	0.176585	0.201853
A1_2	0.256084	0.298198
A1_3	-0.57226	-0.66113
A1_4	-0.12214	0.061384
A1_5	-0.0065	-0.16173
Syndrome1_1	0.150082	0.167952
Syndrome1_2	0.203875	0.229701
Syndrome1_3	-0.36397	-0.398
Syndrome1_4	-0.10884	0.057834
Syndrome1_5	-0.00646	-0.13921
A2_1	0.291744	0.352111
A2_2	0.04269	-0.00767
Syndrome2_1	0.744731	0.778815
Syndrome2_2	0.299179	-0.07124
A3_1	-0.74381	-0.59825
A3_2	0.89848	0.562143
Syndrome3_1	-0.88149	-0.85679
Syndrome3_2	0.899848	0.848975
h*	-1.72162	-1.64604
h	8.27838	8.353958



Conditional denotation of colors



The tuning of checking system is necessary. Offer the chart of the checking (Fig. 3) system that consists in that, a detail, falling from a tray on the special metallic platform, radiates a sound that by means of piezoelement is passed on a microchip, where processing of data is. After processing of data the system gives a conclusion about marriage or to the non marriage detail that can be accompanied by a signal.

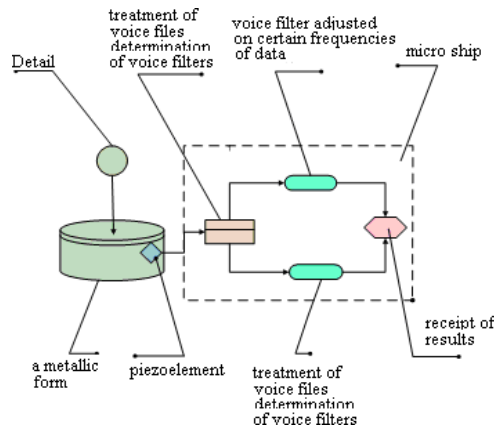


Fig. 3. The chart of the possible checking system

Thus, we came to that it is necessary it is more deep and carefully to continue research of the checking system, clearer to show irrefutable advantages and necessity for application of this system in a production.

Due to introduction of new non-destructive method of control of details of machines after treatment it is attained:

- It is an exception of power expenses as compared to other types of control of details (application of accumulators). The charges of electric power appear ponderable at making of large size details;

- It is possibility of receipt of the checking of quantitative and quality indexes system by perfection of method of non-destructive control for help of gain-frequency characteristic;

- It is possibility of mechanization of operation of control (Figure 3);

- It is reduction of labour intensiveness and time of control of operation in comparison of control a comfortable method;

- It is a decline of prime price, increase of the labour and improvement of terms of labour productivity due to mechanization of works on an enterprise.

Introduction of the new checking system will allow decreasing paying for the productive and circulating funds of enterprise through reduction of duration of cycle of making of details, and also will allow improving organization of production on an enterprise, so as introduction of the new checking system will eliminate delays on hand control of details.

#### 4. CONCLUSION

There were the considered questions of perfection of non-destructive method of control of surfaces of machines and offered new checking of quantitative and quality parameters of detail system. On results work it is possible to do next conclusions:

1. At the analysis of literary sources on this question found out large enough attention to the question of non-destructive methods of control of surfaces of details of machines. Questions that touch the new complex methods of control of details of machines are considered only in the scientific articles, abstracts of thesis of candidate's and doctoral dissertations. The question of the checking systems is full not enough considered, and those checking systems that will control simultaneously a few parameters it is not considered in general.

2. Methodology of realization of researches is worked out, that allows application of non-destructive method of control on the basis of gain-frequency characteristic.

3. On the basis of the obtained data by means of network design, the new method of non-destructive control was worked out for help of gain-frequency characteristic, that gives an opportunity of creation of the checking system, that, leaning against verbal description of two mathematical models of treatment of these integral indexes of diameters and width, can watch the process of control of parameters of detail

4. Introductions of this checking system in the process of treatment of details of machines at making of party of details from 250 things allow getting an economic effect in size of a 3172.07 hour as compared to the operation of hand control

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