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The Report of Data Exchange of Multichannel Vibration Testing Equipment with the Program Environment of Researches Control

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Abstract
The summary: In the present article the urgency of development of new multichannel systems of the vibrating tests, allowing to enter external vibrating influence into each fixing point of nonstationary radio-electronic systems, is shown. The analysis of the basic tendencies of development of vibration testing equipment has been carried out. On its basis the prototype for development of the program environment of researches control, intended for increase of efficiency of nonstationary radio-electronic systems test on stability to influence of vibration at the expense of an account both inertial, and deformation components has been chosen. The block diagramme of a control system and the report of data exchange of multichannel vibration testing equipment with the program environment of researches control has been developed. The received results has been finished to algorithmic and program realization. The engineering technique of work with the software is presented.

Keywords: Intersystem Interaction, Vibration Stand, Phase Shift, the Program, Control, Report of Data Exchange.

Introduction

The main purpose of tests consists in acquisition of state information of tested object or system. This information can be used further for the decision of the most various problems [1, 2]. Before radio-electronic system (RES) will be allowed to use it is necessary to test its capability to the established requirements on all combination of considered factors. Such check is carried out by comparison of the measured values of RES factors with their set, or calculated values.

While in service the majority of RES types are exposed to mechanical influences. Character and intensity of influences can be various enough depending on sources of influence and their position to RES construction. Most often sources of mechanical influences on RES are: environment, subject powerplants, electromechanical devices with seesaw moving masses or unbalanced rotating rotors etc.

The basic method of transmission of hits and vibration-influence through fixing points. There are 2 kinds of influences:

1) Inertial influence-all fixing points of a construction under the influence of external forces move according to the same law, with identical amplitude and a sign. Such influence is a consequence of influence of an inertial component and does not consider deformation of a bearing surface. The given influence can easily be modelled at vibration stands.
2) Deformation influence-fastening points can move in an antiphase. The given influence is difficult for modelling on vibration stands because of compound movement of fixing points, and it is usually neglected that leads to increase of a systematic error hundredfold.

Thus, constant increase of requirements to reliability has led to appearance of new systems of the vibrating tests, allowing to enter external vibrating influence into each fixing point of RES with separate control of their parameters on each channel. Their further development and rationalization is an actual scientifically-practical problem.

The Analysis of Up-to-date Vibration Testing Equipment

Now there is bundle of designs, refer to researches conducting in the field of raising of efficiency of vibration testing equipment and techniques of carrying out of tests.

The basic direction in the field belongs to development of the complex equipment, allowing to expose object of tests to vibrating, shock, thermal and to other influences simultaneously [3,4]. There are developments and production prototypes, allowing to set vibrating influences in three planes simultaneously [5].

Nevertheless, not enough attention has been given to development of the test equipment, allowing to test transient response data of RES during imitation of influence of several sources of vibration (on frequencies from 100-5000 Hz).

On the basis of the spent analysis the prototype of the test equipment, allowing to operate amplitude and phase shift in each fixing point of investigated, has been chosen [6]. The lack of the considered prototype is insufficient automation of electronic control with which help operating modes and parameters of vibrating influence at each stage of concrete experiment on each channel are set manually. Therefore the decision about development of a program stationary system of four-channel vibrostand control is made. This system would allow:

1) to realize a vibrostand administration from the PC by means of COM interface;
2) to set software-based such parametres of COM interface, as data transfer speed, parities, quantity of data bits and stop bits;
3) to keep a choice of frequency of set influence in a range from 1 to 5 000 Hz;
4) to keep a choice of phase value of set influence, on each channel concerning the first, in a range from 0 to 360^0 with step 1^0.

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The developed block diagramme of the program is shown in figure 1. The structural composition of the scheme allows the user to choose accessible COM port, to set its options (according to the developed data exchange protocol) to set generator parametres, and to output sequence of test signals, according to requirements of tests of resistance to mechanical external influencing factors.

The basic program should contains the list of all used modules and some the executed operators providing creation of the necessary windows and communication of the program with an operating system (Windows7/10). Working capacity of the program is provided with a code containing in separate modules. The code of procedures and functions settles down in an executed part of the module which can be hidden from the user.

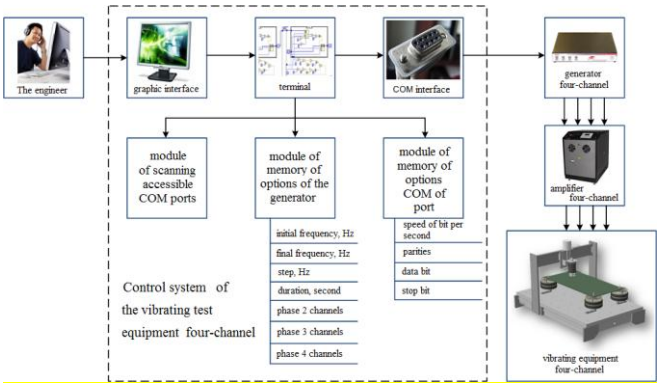

Fig. 1. Block diagramme software structure

During work the data exchange report between a control system and the hardware of the vibrating equipment (tab.) is offered. Use of the offered report allows to carry out following functions:

- Generator start is carried out on command «start» 0b00011100 (bin), 28 (dec);
- Generator adjustment is carried out by a package from eight Byte with heading «setting» 0b00111000 (bin), 56 (dec). After command reception «setting» the generator expects seven bytes with options. Then passes in a sleeping mode;
- Generator transfer in a sleeping mode during synthesising of a test signal is carried out on command «mute»-any byte behind an exception «start» and «setting».

TABLE.1. Commands of the report of data exchange

№	register	parametre name	Settlement formulas, the description and possible variants
1	56 (dec)	Command «setting»	Package heading
2	freq_M	Initial frequency	freq_M = FH / 5.632 (round(integer))
3	last	Final frequency	Last = 1 → FK = 1442 Hz Last = 2 → FK = 2884 Hz Last = 3 → FK = 4326 Hz Last = 4 → FK = 5767 Hz where FK-demanded final frequency
4	width	Duration	Quantity of the periods on one frequency
5	step	Step of change of frequency	Step = Δf / 0.022 where Δf-demanded displacement of frequency
6	phase_2	Phase of the second channel	phase_2 = ϕ2 * 360 / 256 where ϕ2-demanded displacement of a phase of the second channel concerning the first channel
7	phase_3	Phase of the third channel	phase_3 = (360-ϕ2 + ϕ3) * 360 / 256 where ϕ3-demanded displacement of a phase of the third channel concerning the first channel
8	phase_4	Phase of the fourth channel	phase_3 = (360-ϕ3 + ϕ4) * 360 / 256 where ϕ4-demanded displacement of a phase of the fourth channel concerning the first channel

An Engineering Technique of Work with the Program

The sequence of carried out actions of the operator at work with the offered software consists of the task of parametres of the generator, a choice accessible COM port, the task of its options (according to the developed report of data exchange) and a conclusion of sequence of test signals. We will consider in more details each of them.

At a stage of the task of parametres of the generator the user should set initial and final frequencies, duration (in the periods), a step of change frequencies (Hz), and as a difference of a phase concerning the first channel. As the entrance data

of process the data from the technical project serves. The target data of process are the parametres of generated signals prepared for the further work.

At a stage of a choice accessible COM port the user should specify number of that port through which switching of the software with the hardware will be carried out. As the entrance data of process parametres of generated signals serve. The target data of process is number chosen COM port.

At a stage of a conclusion of sequence of test signals the program transfers in chosen COM port the data in the form of a machine code which contain the information on a range and parametres of test signals. As the entrance data of process number chosen COM port serves. The target data of process is generation of test signals in the set range of frequencies.

Thus, the engineering technique of work with the software allows to operate vibrating tests by means of the equipment four-channel.

Conclusion

In the given work the problem of automation of process of tests onboard RES on stability to external vibrating influences by means of the multichannel test equipment is solved. The control system block diagramme, the data exchange report is developed. The received results are finished to algorithmic and program realisation. The engineering technique of work with the program is developed.

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