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VIRTUAL METHOD OF DETERMINING MODERN LOCAL VIBRATION PARAMETERS IN LIFE SAFETY TRAINING

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Annotation

Creating, incorporating, and improving virtual labs is now a task that needs to be done today, not tomorrow's technology.

In addition to the lecture materials, the virtual laboratory work can be demonstrated during the lecture. This eliminates the time gap between lectures and laboratory sessions, resulting in increased efficiency and quality of teaching. Effective use of virtual laboratories not only improves the quality of teaching, but also saves a lot of money.

The use of personal computers has led to the creation of virtual laboratories as an alternative to traditional training laboratories. A virtual laboratory is generally a numerical programming program that has an interface that mimics a researcher's real laboratory actions (work). With the help of numerical methods of calculations on modern personal computers with high speed and large amount of memory, it is possible to study complex examples with the same accuracy as the results obtained in experiments conducted on real objects.

In the following article, the use of personal computers led to the creation of virtual laboratories as an alternative to traditional training laboratories. A virtual laboratory is generally a numerical programming program that has an interface that mimics the real laboratory actions (work) of a researcher.

Keywords: distance learning, local vibration, alternative-virtual, simulation modeling systems, input efficiency, industrial packages, resonance mode.

Introduction

Tests and experiments in the study of electrical engineering and electronics no one doubts the necessity of transfer. But transfering them can cause serious difficulties (especially current ones) at the time). A good training laboratory should have modern measuring equipment and qualified personnel who can keep them in working condition.

Using modern numerical methods of calculations on modern personal computers with high speed and large amount of memory, it is possible to study complex examples with the same accuracy as the results obtained in experiments conducted on real objects.

Problem statement. In recent years, a new term "Virtual Learning Lab" (Virtual Learning Lab) has emerged in the field of application of Information and Communication Technology. In the field of technical education, the Virtual Training Laboratory is aimed at implementing the above requirements for computerization of training, meets the ideas of open and distance learning, helps to solve acute problems in the logistics of the educational process, at least in part.

Research style. To date, few scientific and methodological works on the topic of Virtual Learning Labs are mainly limited to the description of virtual equipment and laboratory work performed using them. But methodologically, the Virtual Learning Lab is wider, and in addition to virtual equipment, it includes virtual learning cabinets, mathematical and simulation modeling systems, training and industrial packages of applications, and more. The virtual learning laboratory can be used not only in laboratory materials, but also in student course and diploma projects, teaching and research work.

The use of virtual labs in the learning process is as follows has advantages:

- Increasing the activity and independence of students in the classroom;
- Increase the level of mastery of educational materials;
- Full control over the mastery of educational materials by each student;
- Facilitate the process of consolidation and consolidation of knowledge gained through training;
- Increase the effectiveness of the introduction of independent learning in the educational process. In traditional teaching methods, great emphasis is placed on laboratory and practical training, which serves to consolidate the theoretical knowledge acquired in the subject and to develop practical skills.

The use of computer technology in the modeling of real processes, including processes occurring in electrical circuits, provides an opportunity to expand and enrich laboratory practice.

Virtual laboratory is an ideal environment for conducting experiments and learning sciences in an interesting way. Interactive virtual reality allows you to perform simple experiments, as well as complex experiments listed below:

• experiments that require expensive and complex equipment;
• It is difficult or impossible to implement in real conditionsexperiments;
• large-scale experiments in real conditions;
• experiments that need to be carried out for a short period of time, etc.

Laboratory practice is of great educational and methodological importance. But today,

many laboratory equipment and devices do not meet modern requirements, as they were manufactured decades ago. Laboratory work is performed on physical models. They are not universal enough to check processes comprehensively. Due to the limited number of laboratory facilities, several students have to work on one facility at a time. At present, one of the directions of improving laboratory equipment is to make them computer-based [1].

The effectiveness of human activities largely depends on the tools, the ability of the organism to work, the organization of the workplace, the hygienic factors of the production environment, including natural light. One of the most important factors that increase work efficiency is the improvement of skills and competencies in work activities.

The creation of virtual laboratories is also one of the key issues in the development of distance education and the introduction of new information technology tools in the educational process.

Programs such as MATLAB, MathCAD, Delphi can be used as a design and modeling environment in the preparation of virtual laboratories. Modeling can be done at an abstract level or in a way that is close to the physical processes that take place in the devices.

Many programs, such as MATLAB, can model complex dynamic processes in real time. In addition, a computer program-based modeling environment allows you to create a library of elements in the form of hierarchical content that is ideally suited for creating virtual labs.

There are a number of anti-fatigue trends in production, among which in recent years there have been trends such as ergonomics, production aesthetics.

Improving working conditions, bringing the production environment in line with hygienic requirements is one of the ways to increase labor productivity. Dust, gas. reducing noise and vibration, creating a normal microclimate, not only prevents occupational diseases, but is a necessary condition for a high share of work capacity.

The main area of engineering activity is the design, manufacture and operation of equipment, machinery and other technical facilities. The widespread use of computers places additional demands on the professional qualifications of the modern engineer, one of whom must have mastered new information technologies.

As mentioned above, in the context of occupational safety, workers will not be exposed to hazardous and harmful factors in production. It is possible to zero the impact of hazardous and harmful factors of production on workers in the organization of the technological process in the existing production conditions. (i.e., so that workers are not exposed to hazardous and harmful production factors).

But the essence of engineering skills remains the same, and is determined by intuition, that is, engineering intuition, based on the knowledge of the physical properties of technical objects and their in-depth analysis. To build an adequate mathematical model, it is necessary to have an in-depth knowledge of the physical nature of the object being modeled. In order to make technically correct solutions in human-computer complexes, it is necessary to have a deep understanding of the results of modeling and take into account the factors that are difficult to formulate.

Vibration is a mechanical vibration, the simplest type of which is harmonic vibration. Vibration occurs during the operation of machines and mechanisms that have unbalanced and unbalanced rotating organs with movements of a reciprocating and shock nature.

Measurement and regulation of vibration. The currently produced measuring equipment is based on the use of electrical methods that ensure high accuracy of converting mechanical vibrations into electrical ones using magnetic-electric and piezo-electric sensors (vibration receivers: the signal is amplified, converted (integrated, differentiated) and fed to the recording device).

Devices are subdivided into: optical, mechanical, electrical.

Measurement of vibration parameters should be carried out in accordance with the established standards for the requirements for measuring instruments, sensors.

Vibration classification:

By the method of transmission to a person, vibration is divided into:

- common, transmitted to the human body through the supporting surfaces;
- local, transmitted through human hands.

According to the direction of action, vibrations are subdivided along the "axes" of the coordinate system: with a common X, Y, Z and local Xp, Yp, Zp vibration. General vibration is subdivided into 3 categories according to its source:

- transport (when driving on terrain);
- transport and technological (when moving indoors, on industrial construction sites);
- technological (from stationary machines, workplaces).

Significant noise and vibration are generated during the use of equipment and vehicles in modern manufacturing processes, which can adversely affect the health of workers. From the point of view of labor protection, noise and vibration are the most common negative factors of production in the production process, and in some cases, these factors can be considered as dangerous factors. In addition to the effects of noise and vibration, the negative effects on the human body include infrared and ultrasonic vibrations. Let's look at the basic physical characteristics of noise, vibration, ultrasound and infrared.

Mechanical vibrations of a machine or its parts are called vibrations. According to the

state standard, vibration is classified according to the method of transmission (impact) to humans, the direction of impact and the source of its occurrence.

- Vibration is divided into general vibration (transmitted to the human body through the base surface) and local vibration (transmitted through the human hand).

-Vibration in the direction of vibration is divided into vibrations acting along the axes of the orthogonal coordinate system.

-Vibration according to the source is divided into general vibration, transport vibration, technological and transport-technological vibration.

Vibration reduction measures should be identified, with the industry fully mechanized and automated. Because the only way to completely eliminate the effects of vibration is to automate the whole technology and ensure that people do not enter the vibration zones. This is because vibration may not affect the worker unless the shops are operated remotely. Currently, the following methods are used to reduce vibration at non-automated production sites:

1) Reduce vibration at the source of emission.

2) Reduction in the path of propagation.

Z) Reduce the effects of vibration by creating special working conditions.

4) Use of personal protective equipment.

5) Determining health measures.

The following methods of combating vibration can be used as a conclusion to the analysis of the vibration equation of a system with one degree of freedom:

1) Reduction of vibration by exposure to the source of emission;

2) Loss of resonance mode is achieved by selecting a reasonable mass of the mechanism or by increasing the priority of the vibrating system.

3) The method of vibrodamprification is carried out by converting vibrational energy into other types of energy.

4) Dynamic quenching of vibration - as a result of applying a certain force to the system through the vibrating base, it is ensured that the vibration does not pass to the foundation.

Vibration is characterized by frequency, amplitude, and speed. All band frequencies are divided into octave bands: 1; 2; 4; 8; 16; 32; 63; 125; 250; 1000; 2000 Gts. The level of vibration parameters is also used to characterize the vibration.

The main characteristic of vibration is the spectrum of the level of vibration velocity. Vibration velocity level L (dB),

$$L = 10\lg v_d^2/v_{02} = 20\lg v_d / v_0 , \quad (1)$$

determined by the equation

Where vd - is the oscillating velocity at the point of measurement;

v0–is the threshold (weak) value of the oscillating velocity, v0 = 5 10-8 m / s.

The effect of vibration on the body. The vibration spectrum contains low-frequency vibrations, which have a negative effect on the human body.

Vibration reduces workers' productivity and increases the number of injuries. Some vibrations have a detrimental effect on the nervous and cardiac systems. Vibrations that correspond to the frequency of vibration of certain internal organs of a person are especially harmful.

Local vibrations injure the nerve muscles, the locomotor organs, and lead to tremor disease. Vibration causes fatigue and pain in the human heart. At the same time, vibration has a negative effect on blood circulation, hearing and vision. Vibration normalization. By normalizing vibration, its negative effects on the human body can be prevented. There are 3 requirements for normalizing the effects of vibration:

1. maintaining performance;
2. provide convenience;
3. Ensuring health and safety.

Logarithmic rate of vibration velocity Lv (dB)

$$Lv = 20 \lg vtt / 5 \times 10\text{-}8, \quad (2)$$

determined by the formula.

Where vtt - is the actual value of the vibration velocity, m / s; $5 \times 10\text{-}8$ Threshold value of oscillation speed, m / s. If the vibration measuring device shows the logarithmic level of tension in dB and the vibration rate is given in m / s, then the arithmetic mean value of vibration is calculated in watts vtt (m/c) according to the table or formula. That is

$$vsk = 5 \times 10\text{-}8 \times 10Lv/20, \quad (3)$$

In this case, the oscillation acceleration Wsk (arithmetic mean value in m/s2) is calculated by a similar formula.

$$Wsk = 3 \times 10\text{-}4 \times 10Lv/20, \quad (4)$$

where $3 \times 10\text{-}4$ is the threshold (base) value of the oscillation acceleration.

Lw is the logarithmic rate of oscillation acceleration according to the device, dB.

Different frequencies of vibration affect the human body differently. For a person standing on a vibrating surface, the two resonance peaks are 5… 12 Gts and 17… 25 Gts, and for a sitting person it is 4–6 Gts. The resonant frequency of vibration for the human head is around 20… 30 Gts.

Vibration protection. The main measures in the prevention of vibration disease are organizational and technical measures such as changing the kinematic schemes of

vibration transmission mechanisms at the source of vibration, balancing the moving load, reducing the size difference in the assembly and preparation of parts, the use of vibration dampers .

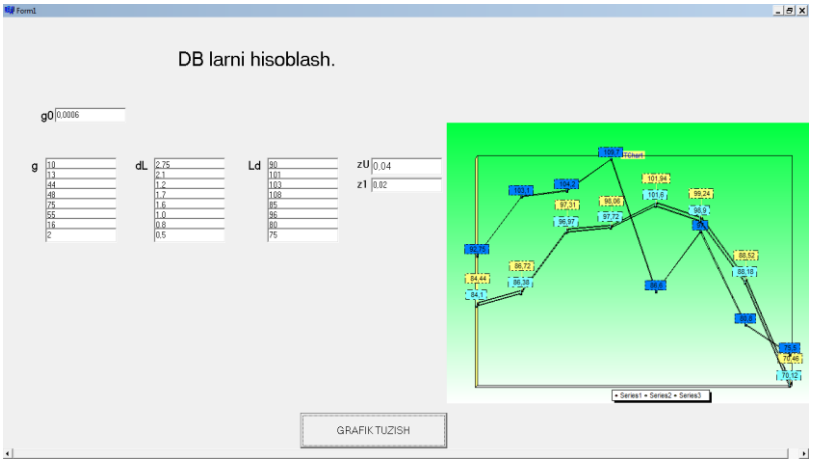
The most effective way to combat vibration disease is to remotely control vibrating machines and mechanisms or to fully automate high-vibration (manufacturing) processes.

When using mechanized, electric and pneumatic hand tools, various anti-vibration handles, gloves, etc. are used to protect against vibration. In addition to technical measures to reduce vibration, preventive measures are taken to prevent vibration. To do this, people under the age of 18 who have undergone a medical examination and training are allowed to work on vibrating weapons and equipment.

During the design of technological processes, it is necessary to try to eliminate or sharply reduce machine mechanisms with sharp impact processes and sharp accelerations and decelerations as a result of the influence of dynamic forces [2].

Results

Replacing roller bearings with sliding bearings also gives good results as a means of reducing vibration. Low-frequency vibrations in machines such as pumps and fans are caused by the disproportion of their rotating parts. Because these machines rotate at high speeds, even a small disproportion can cause a large vibration. Below is a modern virtual method of determining local vibration parameters (Picture-1).



Picture-1. A modern virtual method of determining local vibration parameters

Conclusion

Thus, regardless of the scope of work of modern specialists, a wide range of knowledge in computer science, sufficient skills in modern computing and information communication systems, office equipment and their use, as well as the basics of new information technology and its future, must incorporate knowledge of its development

[3-5]. Using a programming system, the dB vibration of the resonant frequency level is determined, to what extent the vibration frequency is reduced.

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