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RESEARCH AND ANALYSIS OF FUNDAMENTAL DEFINITIONS OF OPTICAL SYSTEMS IN PREVENTION OF CATASTROPHES AND FORECAST ORIENTED CONTROL OF MICROPROCESSES

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The Work has been implemented with the use of the author's method of digital analysis of the form of information.

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Urgency

The urgency of the work is in the fact that for prevention of catastrophes and forecast of catastrophic phenomena a physical-mathematical theory and a device, which make it possible to determine the component of information related to the future events, have been created. Since many catastrophic phenomena of natural and man-caused nature take place without statistic and deterministic basis, the work is of special urgency due to the discoveries intended for receiving of precise information about the future that include the methods of prevention of catastrophes.

The work implements the principles of theoretical and instrumental technologies based on the postulate of common interrelationship of all elements of reality [1]. The author of the work determined the structural-analytical method of construction of controlling systems, in which each element accomplishes the task of harmonic development of all elements of reality. The work describes the method of receiving of a substance. The method is based on the isolation of the matter by application of the mechanism of control of the area of the future events. Based on this technology it is possible to arrange single controlling impulses of the current time in the crystals in the way that provides getting the required substance at a fixed point of the future space and time.

The subject of the research:

earthquakes, industrial facilities, any reality with known or unknown parameters.

The scientific novelty of the research includes:

- the method of isolation of information about the future events is implemented for the first time in theory and in practice,
- the method of control of any object of information that takes place in the current coordinate of receipt of information about the object properties is applied for the first time;
- the principle of accurate control of the objects of reality, the characteristics of which are unknown or cannot be determined in proper time, has been implemented.

The theoretical significance of the work includes:

- fundamental definitions of optical systems;
- generalizations and consequences of the definitions;
- development of structural-analytical technologies of prevention and forecast of catastrophes and, in the first place, of the catastrophes, which threaten the entire world.

The practical significance of the research includes:

- creation of the device of prevention and prognostication of earthquakes and catastrophes of industrial facilities, and creation of a new trend in control of micro processes; the device is based on the methods of computer modeling of the digitalized form of an object,
- spread of the result to any objects of information,
- receiving of methodological principles of construction of man-made systems harmonized in relation to any environment.

Approbation and introduction of the results

Approbation and introduction of the results were implemented with the use of the author's technology of the digital analysis of the form of information isolated for any object based on the principle of common interrelations of all elements of information [2]. The author on the basis of his personal experience of precise control of irrational methods and the principles of transfer of the results of such control to material structures, described in his doctoral thesis "Applied structures of the creating field of information", received numerical data, which determine correctness of structural-analytical mechanism of work that include theoretical and practical results.

The data of monitoring of the Earth's surface by control systems from the satellites of the planet, provided by the Agency on monitoring and prognostication of the Ministry for Extraordinary Situations of Russia, served as the starting material for the digital analysis of work of the device from the point of view of correspondence to real processes.

1. Introduction

The study of the processes of reality taking into account the fact that it is possible to recognized future events in the current events makes it possible to prevent catastrophes and to control the future events. The essence of this method in the fact that the events of the future are considered from the present as controlled structures [3]. The information of the future events is revealed through the areas of passage from the future to the present. The areas of passage are built on seven coordinates: three coordinates of the space of current time, time coordinate, two coordinates of time intervals for the past and the future, a coordinate of the reaction of the object. The coordinate of the reaction of the object in general case designates the area of interaction of all objects of information,

and in particular case may designate perception of man. For the purpose of rescue of the object of information from destruction it is possible to use transformation of the interval of the future through the past with the projection of the data to the three-dimensional space of the current time. The optical systems comply with the conditions of signal registration. An element of light during the movement through the optical medium of crystals splits up to components that correspond to all areas of information. The component of light organized in the form of reflection of the future events through the interval of the past is a point, which by its properties, is infinitely removed from the crystal, however physically located in the crystal. This makes it possible to describe properties of the optical system on registration and interpretation of the events of the future. Thus, having received a fragment of the future processes in the current time, it is possible to build the material of the future in accordance with the harmonious phase of development and with the required accuracy. Being aware of the distribution of the signals from the future in the area of control of reality, it is possible to prevent catastrophes by creation of the optical system, which harmonizes all areas of information. These are exactly the light signals which are being processed, because light possesses a property of splitting up in the crystals into components of the current and future time. The physical meaning of this phenomenon in the form of a model is visible, if we examine the properties of light in the time interval $< 10''^{17}$s. Then the segment of information, which corresponds to the future for the time interval $> 10''^{17}$s , can be considered as an element, which adjoins the segment of information that corresponds to the current time.

The boundary of the contact of segments of the future and current time physically can be evaluated with crystalline system. Therefore, the light is divided by the crystalline system into the elements of the current and future time. This means that by assigning parameters of the optical system, built on the laws of crystal structure, it is possible to control a substance and to create elements of events in a required way.

2. *Fundamental definitions of optical systems*

Fundamental definitions of optical systems are determined according to three areas.

2.1. The first area is definition of informational interaction of

objects in the future for starting space and perception of the current time.

2.1.1. The statement and the data of discovery of energy of the future:

The energy of the future is determined. It consists of the energy of the pas,t which is multiplied by the space of distribution of the energy of the current time and divided by the space of distribution of the energy of the past

$$\Psi = \frac{E \cdot W}{U} \qquad (1)$$

where $\boldsymbol{\Psi}$ is the energy of the future, $\boldsymbol{E}$ is the energy of the past, $\boldsymbol{W}$ is the space of distribution of the energy of the current time, $\boldsymbol{U}$ is the space of distribution of the energy of the past.

The novelty of the definition of the energy of the future is in the fact that the segment of energy of the future objects of information, which makes it possible to determine the future from the established values, has been evolved for the first time.

The field of application of the definition can be realized in all controlling systems and systems of the optical conversion of information. The split of light in accordance with the discovery of the energy of the future is registered in the optical systems that are built on the crystals. By determining the space of crystals as W, the space of the area of measurement as U, and the energy of the elapsing light pulse as E, $\boldsymbol{\Psi}$ is deduced. The controlling forecast is established on the basis of classification of $\boldsymbol{\Psi}$ depending on the norm of events.

2.2. The second area is the definition of the energy of the past.

2.2.1 The statement and the data of definition of the energy of the past:

The energy of the past is determined in the form of product of energy of the current time (energy of present) and the functions of crossing of energies of the future and the past.

$$E = E_{\text{н}} \cdot F \qquad (2)$$

where E is the energy of the present, F is the function of the crossing of energies of the future and the past.

The novelty of the definition of the energy of the past is in discovery of unknown before phenomena of reality, which make it

possible to determine energies of all times in one area.

The field of application of the definition of the energy of the past is realized in the systems of recognition of signals from the objects located in any reality including the reality with unknown structure. In the conceptual direction for the infinite values, F is identified with *Ψ*. Recognition of the signal in the structure of crystal optical systems is realized by fixation of *F* in the areas of interaction of the signal between the crystals.

2.3 The third area is the definition of general reality.

2.3.1. The statement and the data of the definition of general reality:

The general reality for all processes is determined that is transformation of impulse of any event into the current time (into the events of the present) at the area of intersection of the future with the past. Based on this the reality of any process is transformed in the area of the remote and single content into reproducible medium. This means that any process is as single, as it frequently repeats in the area of transformation of energies into the present (into the events of the current time). Therefore, any element of the reality in the phase of transformation is indestructible and repeatable at any conditions of internal and external medium. This means that any element of the reality can be restored. Thus, the pulse of the event of the future contains the solution on the method of prevention of catastrophes. In the formalized form the formulas of the discovery are as follows:

$$W = \frac{\Psi \cdot W1(W)}{E_{\text{н}}}, \qquad (3)$$

where ***W*** is the general reality, ***W1*** is the function of the general reality for the fixed phenomena of the dynamics of any medium.

The novelty of the definition of the general reality is in that that the functional medium that makes it possible to transform and describe any processes of reality from one point is determined for the first time.

The field of application of the definition of the general reality in the optical - conductor systems makes it possible to separate the transforming pulse of any medium and to control reality. In general case the discovery determines all phenomena of the reality.

3. The consequences and generalization of the definitions

The consequences of fundamental definitions of optical systems is that the laws of controlling optical pulse are realization in practice.

The first law is as follows: the optical systems on the crystalline basis are reproducible as reflection of the future events through the picosecond interval of the past.

The second law includes the movement of the optical signal both in the direction of the fixing systems, and into the medium of undeterminable properties. Based on this it is possible to determine the informational constant, which determines the control of media of unknown structure.

The third law is as follows: the acceptance of the area of projection of the future on the present as the basis of the difference of the pulse for different media determines the structure of the device, which harmonizes all systems.

The fourth law is as follows: the system determined by the optical signal is always determinable for the processes of the infinite series. The conclusion of the fourth law is that all processes of the reality are described in each of its areas. Thus the world reacts to the changes when these changes haven't been available any more in the world. There is the eternity only, which contains itself. The further conclusion is that the eternity of the crystal is the reflection of the current reality.

The mechanism of connection of the formal apparatus of the discovery with the reproducible phenomena of external and internal medium is determined by the generalization of the fundamental definitions of the optical systems. The generalization of the discovery the energy of the future makes it possible to determine the future in the reflection of the segment of the future events at the medium, which has significant temperature differentials or the form of a crystalline system. Detailing of the phenomena of reality with the simultaneous generalization of the controlling medium brings to the systems of wave synthesis. The essence of the system of the wave synthesis in the description of the processes of the reality is in the fact that the reality is considered as periodical intersection of the stationary areas with the dynamic ones. Synthesis of the dynamic wave of the reality with the stationary one originates in the intersection area. The infinite functioning of the stationery area is achieved by revealing of the

dynamic phase in the stationary area. The similar process in the crystals makes it possible by solution of the inverse problem to obtain from the stationery medium (from the crystal) the dynamic component of wave synthesis, i.e., the phase of time. The theory of wave synthesis in the description of reality is formally expressed as follows:

$$T = Y \cdot S, \qquad (4)$$

where $\boldsymbol{T}$ is time, $\boldsymbol{Y}$ is the wave of the dynamic phase of reality, $\boldsymbol{S}$ is the steady phase of reality.

In a certain case the wave synthesis of reality can be presented as an infinite wave, which periodically passes stationary areas and creates new phases of reality from the processes of intersection. The fixation of the component of the dynamic phase in the steady one makes it possible to make the steady phase being independent on time, actually eternal. Therefore, the object created for such area is eternal, and it means it is always restorable [4]. Considering earthquakes from the indicated position, is possible through the reflections at the crystal sides to find the criterion of restorability of the medium of measurement according to time. This criterion makes it possible to determine exactly the time of occurrence of an earthquake. For man the theory of wave synthesis proves immortality. For realization of the immortality it is necessary in accordance with the theory of wave synthesis to transfer the area of reproduction of the steady phase of reality $\boldsymbol{S}$ into the wave of the dynamic phase of reality $\boldsymbol{Y}$. Reproduction of genes from the thought-forms of man is one of the indicators of such transfer. Therefore, potentially eternal system "man" interacts with the system of crystals in the area of reproduction of the steady phase in the systems of optical recognition and control of earthquakes. Such interaction both forecasts the earthquake and harmoniously decreases its force. The earthquake of just reduced force is registered. It means that the device for the forecast of earthquakes built on the optical medium possesses the function of harmonious decrease or complete prevention of the earthquake. At the same time the information about the earthquake is not reproduces anywhere and even increases the service life of the device. The potential eternity of man in this case really reproduces the service life of the device. The eternal gives birth to the eternal. In the generalized sense all reproduced by man devices and mechanisms have to comply with the described conditions. Hence, according to

the principle of reverse connection these devices and mechanisms will be always creative for man and under no conditions they will destroy man or environment. In order to construct such technical equipment it is necessary to transfer the laws of distribution of optical signals into construction and principles of functioning of engineering systems.

4. The researches and the analytical systems of the optical media in realization of prevention of earthquakes and the catastrophes

Researches of optical media in the direction of the section of phases of optical pulse are implemented according to the principle of minimization of resistance of medium along the trajectory of the pulse. In the particular case this means the definition of the movement vector with minimal absorption coefficient. In the system of common connections according to which each object interacts with all other objects, including the objects of the future and the past, the optical element of the current time divides the light pulse into three phases of time. In accordance with the theory of wave synthesis the current time can be considered as a dynamic wave, the time of the past as a static area, the time of the future as the synthesized phase of reality, which is built by fixation of the static area in the dynamic wave. Creation of a known substance takes place through the static area and of an unknown substance in the initial period of synthesis of the future reality. The event-related part for optical systems, which corresponds to the time for the past, is determined as the optical medium of fixed characteristics (for example, crystal) for the current time by the light pulse, for the future by the synthesized area, which appears from interaction of the light pulse and the crystal. In accordance with the described distribution the formula of energy of the future is $\Psi = E \cdot W/U$ indicates that the events of the future, based on the energy of the future Ψ, are determined by the fixed value of the elapsing light pulse E under conditions when U indicates the space of the optical system, and W the space of the optical system and areas of measurement. Taking into account that according to the formula of the energy of the past $E = E_p \cdot F$, the energy of the present E_p is determined by the current (changeable) value of the light pulse, is possible to find function F in the form of the projection of the areas of measurement on the analytical system of

optical media. The analytical system of optical media is located in space ***P***, which contains optical medium with fixed properties and optical medium, which contains changing areas of intersection and reflection of light pulses. Using the fact that according to the formula of the general reality $W = \Psi \cdot W1(W)/E_P$ it is possible to determine characteristics of phenomena from one point, it is possible to find $W1(W)$ for space ***P*** in the form of projection of the areas of measurement on ***P***. When ***W*** is taken into account in the method of measurement, the optical medium firstly creatively and harmoniously re-determines the reality for decrease of the force of the earthquake or prevention of the earthquake, and then determines the parameters of the earthquake. In the general case, using the expression for ***W***, it is possible to transform for decrease or prevention information about any catastrophes. According to the law of common connections between all phenomena of reality, the results received for the optical systems, can be transferred into any media, which have similar functions. Hence, measurements and prevention of catastrophic phenomena of reality can be implemented from any point of the reality. If the controlling forecast of the phenomena of reality, which includes the decrease or prevention of catastrophes, is built by means of the device on the basis of the optical system, the functions of the device are determined by the criteria of light pulses.

5. Structural-analytical devices of prevention of earthquakes and catastrophes.

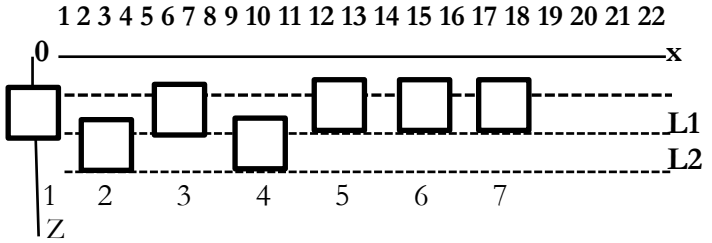
The structure of the optical systems produced in this work provides harmonious forecast and prevention of catastrophes, it is possible to build devices, the use of which does not entail any negative consequences after being applied in any time or space [5]. When the catastrophe is prevented or its force is reduced by such devices it will happen nowhere. Construction of any equipment and creation of any objects should be based on this principle. Such equipment is safe the producer and environment.

Crystalline module of the forecast of earthquakes and catastrophes. Functions of the module on creation of substance

It is possible to forecast earthquakes within seven days interval by the usage of the oriented crystals. The scheme of location of the rock crystal, which includes such chemical components as

quartz, is trigonal, its hardness is 7,0, specific weight is 2,65, refraction is 1,54-1,55, double refraction is 0,009, in projections on the coordinate planes is as follows:

according to area ZOX (OX is horizontal axis, OZ is vertical axis):



The diagram shows the location of the crystals. Each crystal is a cube with a 3 cm length side. The cubs are located on plane ZOX. One side of cubes 1, 3, 5, 6, 7 is located on straight line L1 and one side of cubes 2 and 4 are on straight line L2. The distance between straight lines L1 and L2 is 1.5 cm and they are parallel to axis OX. The distance between crystals 4 and 5 is 2 cm, and between the rest crystals there is 1 cm. The crystals are located in a transparent sphere. The characteristics of the crystals and the sphere must satisfy conditions of separation of light impulse from the map of the area based on two projections. The separation condition of light impulse includes the principle of strengthening of its projections due to reflected from the surfaces signals. The principle of this device is based on the following: when the light is converted in a special optical medium isolation of the light volume form, which corresponds to the future events, takes place. The arrangement of the crystals is chosen in such a way that it would realize prevention of earthquakes and catastrophes with the realization of harmonization of creative development of the future in plus-minus infinity. Normalization of the output radiation takes place in correspondence with the fact that according to the formula of the general reality the intersection of the light components with the harmonic level of the crystals causes normalization in the processes of reality. This device it is built with realization of the concept of creative properties of any technical device. The output characteristics of light make it possible to obtain information about the time and the earthquake intensity for the period of seven future days. If the instrument comprises crystalline cubes made of the

rock crystal, the surfaces of these cubes must be maximally flat, with the machining accuracy up to micrometer. Absorption by the surface of monochromatic wave of length $4,3 \cdot 10^{-7}$ within a nanosecond impulse must be equal to 0,5 with the reflection coefficient of the map of the area, equal to 0,62. It is necessary to change surface properties over the periods of time that correspond to the service life of the instrument. The service life of this device is nine months. The service life of the device can be repeatedly increased by adding to the device of an external optical lens. The change of the lens position should be calculated every five months after the first nine months of operation of the device. After the first three five-month periods four-month periods are calculated three times and so on up to ten day periods. Later on the form of the lens should be changed. Recording of the output parameters is done by the measurement of light characteristics from the side of the sphere reverse with respect to the map or the area. With the change of characteristics of light by more than to 25% in a millisecond earthquake magnitude 3 should be profiled in 14 days from the moment of registration at the measured section. The epicenter of the earthquake is determined by scanning of the segments of the measured section. In the epicenter the characteristics of light for the indicated case change by 32% in a millisecond.

For production facilities the scheme of functioning of the entire operations is measured. With the change of light characteristics by more than 14% in a millisecond at the measured section deviations from the norm in 14 days from the moment of registration should be profiled. Description of the process, which might have deviations from the norm, is achieved by the increase of the scale of the localized section of the scheme and by the next measurement. Characteristics of light in the element of the scheme, which is the reason of the deviations from the norm, change by 32% in a millisecond.

In the general case, schematizing any phenomenon of the reality, it is possible to obtain the controlling forecast of events, measuring by this device the schemes, which correspond to the reality. Since in the control of the event, a need of creating a substance with the assigned characteristics (for example, urgent restoration of microprocessor in the falling aircraft) can arise, it is possible to orient the device toward this process after arranging the scheme of the substance (the scheme of the microprocessor for the

indicated example) above the third crystal of the module. The use of the mechanism of creation of the required substance by application of the principles existing in the crystalline module makes it possible to create new ecologically safe productions.

Calculation of characteristics of the device and the surfaces of measurement for some processes is implemented according to one method, and in other processes a new method is developed for each calculation. In specific cases, when schematization of the phenomenon does not completely reflect necessary for the measurement parameters of the phenomenon (for example, for galloping, microprocessors or some catastrophes of global nature), the irrational capabilities of definition of the constructive data of the device are used. Due to the fact that schematically it is possible to describe any phenomenon of the reality, including unknown one, this device makes it possible to determine, with simultaneous prophylaxis, catastrophic processes from the unknown areas of the reality.

6. The optical systems in the control of microprocessors

In accordance with the theory of wave synthesis, the control of micro processes in the optical system takes place in the field of synthesis. Application of fundamental definitions of optical systems in microelectronics takes place on multicomponent basis. Each of the components can be determined by several parameters. The parameters, which determine the components, are also interconnected. According to the laws of quantum mechanics elementary volume $d\tau_p$ and pulse P of the space of quantum states contain

$$dZ = 2\left(\frac{d\tau_p}{h^3}\right),$$

where $d\tau_p = dp_x \cdot dp_y \cdot dp_z$; h^3 - is Planck's constant cubed.

Considering that isoenergic surfaces in P- space are spheres, it is possible on the basis of the theory of wave synthesis to control the number of quantum states $N(E)$, by the method of transformation of the form of information, which corresponds to the effective mass of the electron near the bottom of the zone of conductivity m_n, into the optical system pulse that controls it. For this the

necessary parameters of conversions are placed above the fourth crystal. This technology can direct the methods of development and production of molecular devices towards complete ecological safety.

7. Conclusions

On the basis of the fundamental definitions of optical systems data for construction of the device of prophylactic forecast of catastrophes have been received. The catastrophe forecast device, built on the basis of the analysis of luminous fluxes, has the functions of harmonious decrease or prevention of catastrophes. Such device implements correction for the maximum decrease of parameters of the catastrophe and defines characteristics of the phenomenon. According to the law of universal connections such instrumental-analytical structures are not dangerous for man and environment, since they are realized on the safe characteristics of light. By use of the controlling component of the optical system, it is possible to create the required reality. Fundamental definitions of the optical systems have the following expressions:

$$\Psi = \frac{E \cdot W}{U},$$

Where Ψ is the energy of the future, E is the energy of the past, W is the space of distribution of the energy of the current time, U is the space of distribution the energy of the past;

$$\mathrm{E} = \mathrm{E_н} \cdot \mathrm{F},$$

where E_H is the energy of the present, F is the function of intersection of the energies of the future and the past

$$W = \frac{\Psi \cdot W(1)}{E_{\mathrm{н}}},$$

where W is the general reality, $W1$ is the function of the general reality for the fixed phenomena of dynamics of any medium.

The novelty of the definition of the general reality is lies in the fact that functional medium is determined for the first time, which makes it possible to transform and describe any processes of reality

from one point.

The field of application of the definition of the general reality in optical-conductor systems makes it possible to separate a transforming pulse of any medium and to control reality. In the general case the discovery determines all the phenomena of the reality.

The consequences of the fundamental definitions of optical systems are that that the laws of the controlling optical pulse are realized in practice.

The first law lies in the fact that the optical systems on the crystalline basis are reproducible as reflection of the future events through the picosecond interval of the past.

The second law lies in the motion of the optical signal both in the direction of the fixing systems and into the medium of indeterminable properties. In connection with this it is possible to isolate information constant, which determines control of the unknown by structure media.

The third law lies in the fact that the adoption of the region of projection of the future on the present as the basis of the pulse difference for different media determines the structure of the device, which harmonizes all systems.

The fourth law lies in the fact that the system determined by the optical signal is always determinable for the processes of the infinite series. The conclusion of the fourth law is as follows: all the processes of the reality are described in each of its fields. The theory of wave synthesis has been received. The theory of wave synthesis in the description of the reality is formally expressed in the following way: $\boldsymbol{T = YS,}$

where T is time, Y is the wave of the dynamic phase of reality, S is the steady phase of reality.

Studies of optical media in the direction of division of the phases of optical impulse are implemented according to the principle of minimization of resistance of the medium along the trajectory of the pulse.

Using received in this work the structure of optical systems, which makes it possible to harmoniously forecast and prevent catastrophes, it is possible to build devices, the use of which does not result in any negative consequences in any time or space. Any catastrophe prevented or reduced in force by such devices will realize nowhere. Any equipment and any created objects must be built according to this principle of harmonization. This equipment

is safe for the producer and environment. The crystalline module for the forecast of earthquakes is built based on this principle.

In the general case, by schematizing any phenomenon of the reality, it is possible to receive the controlling forecast of events, by measuring the diagrams of corresponding reality with this device. For a number of the processes of the reality (for example, galloping micro processes or some catastrophes of global nature) the calculation of parameters of the device is implemented by application of sensory possibilities taking into account understanding of the laws of universal connections. The irrational approach in the calculation of parameters of the device makes it possible to receive the functions of the device on analysis and definition of unknown properties of the reality.

Attachment

Methods of quantitative calculation of the crystalline module of prophylactic forecast of earthquakes and catastrophes

Introduction

For receiving of quantitative calculation it is necessary to examine the entire process of work of the device and to establish boundary and initial conditions for all intermediate cycles of the process. By dividing the task into the process of passage of light through the device and the process of measuring of the output characteristics it is possible to establish that the measurement of temperature in the region of the crystal is one of the sources of receiving of output information. By application of the theory of wave synthesis it turns out that the area of the static wave of reality in the calculations can be added with the area of the dynamic wave of reality, and required for the measurement characteristics can be deduced from the area of reproduction of reality. In this exact case by designating as the area of the static wave of reality ***S*** irradiation emanating from the area of measurement, laser irradiation located from the direction of the object of measurement and fastened to the device can be used as the dynamic wave of reality ***Y***. Then the time of the earthquake T in accordance with the fixed scale can be determined, taking into account the impact of the laser irradiation on the area of the measurement of the output parameters of the device. The laser irradiation in accordance with the theory of wave synthesis strengthens the informative parameters of the received luminous irradiation.

The process of impact of laser irradiation on the construction material of the product must be oriented depending on the characteristics of irradiation from the measured object.

Examination of the process of impact is necessary, in the first place, for substantiation of the used construction materials in the product and issue of recommendations on further projection. The complexity of the examination is caused by dependence of nature of the process that takes place on thermophysical characteristics of the material and energy characteristics of the laser irradiation. For each specific case of interaction of the laser irradiation with the material a well-defined mathematical model of the process, which

describes the real physical process with the assumptions that do not violate the conformity of the model to the real physical process, must be built. Numerous original articles, surveys and monographs include mainly solutions of particular problems with a number of limitations, typical for this model of interaction. Therefore, the need for construction of mathematical models of interaction with concrete materials appeared. The construction of mathematical model, which accurately enough describes the physical process, in my view, must be accompanied by experiments. Based on this, experiment-calculated method of solution of problem, for which digital simulation that makes it possible to transfer objects of information into geometric form was applied, was used.

Thus, the device is a crystalline module with the first crystal directed towards the measured object, and a thermocouple that is fastened to the wall of the last crystal. The measurement of the output characteristics through the thermocouple is one of the sources of information. The advantages of this source are in the increased interference protection. The use of the laser irradiation by the application of the theory of wave synthesis also solves the problem of stability of the outgoing from the measured object signal. Since the outgoing from the measured object irradiation for the alternate measurement of characteristics through the thermocouple is a particular task of the process of laser irradiation, it is apparent that calculation of the process of laser irradiation is the basic one.

1. The interaction of continuous laser irradiation with the materials

1.1. Heat conduction in the uniform layer of the substance

The thermal state of the irradiated material and the nature of the physical processes are determined by the energy characteristics of the laser irradiation: the density of the stream, and the time of the impact of laser irradiation, three-dimensional distribution of the intensity over the beam and its geometric parameters, thermophysical characteristics of the irradiated material.

The energy of the laser irradiation E, which is concentrated on the surface of the irradiated material, is distributed in the following way:

$$E = E_{refl} + E_{abs} + E_{let}$$

where E is the energy, which is specularly and diffusely reflected by the irradiated surface; E_{abs} is energy of the laser irradiation absorbed by the material, E_{let} - is energy of the laser irradiation let trough by the material (for the transparent materials). Only absorbed part of the energy was considered.

Heating of materials in the work is calculated with the help of the classical theory of thermal conductivity.

Substantiation of this approach is as follows: the luminous energy instantly transfers into heat in that point where the light was absorbed. The energy is distributed so rapidly, that the local equilibrium exists within the entire period of the impact. Therefore it is possible to use the concept of temperature and usual equations for the heat flux.

In practically interesting cases we can consider the task as one-dimensional. This is possible when the transverse dimensions of the laser beam are great in comparison with the depth, to which the heat is conducted within the time of impact of laser irradiation, and when for calculation of the heat conduction in other directions it is possible to use the model of heat conduction in a heterogeneous layer of substance, which is described below. For refining of the characteristics of the spatial distribution of irradiation it is possible to use the principle of integration of distributed temperatures, what however, is not necessary, since by use of the theory of wave synthesis it is possible to obtain the necessary number of refinements at any point of the process according to the stated in the introduction method of static and dynamic phase of reality, which is based on the fundamental discoveries of optical systems. Distribution of the intensity of the laser irradiation in the beam will be considered as uniform cylindrical. The coefficient of absorption of laser irradiation A we will be considered as depending on temperature. Differential equation, which describes heat conduction in homogeneous layer of substance, take the form:

$$\frac{\partial T}{\partial \tau} = a \cdot \frac{\partial^2 T}{\partial x^2}, \qquad (1)$$

$$0 \le x \le l,$$

$$0 \le \tau < \infty,$$

where T is temperature; τ is time; x is space; $a \cdot \frac{k}{C \cdot \rho}$ is the coefficient of temperature conductivity; k is the coefficient of heat

conductivity; C is specific heat capacity; ϱ is density; *l* is thickness of the substance layer.

The initial condition is:

$$\boldsymbol{T}\big|_{\tau=0} = \boldsymbol{T}_0 .$$

The boundary condition on the irradiated surface is

$$K\frac{\partial T}{\partial x}\Big|_{x=0} = \varepsilon b(T_{\text{п}}^4 - T_c^4) + \alpha(t_{\text{п}} - t_c) - \\ -\rho \cdot A_\lambda(T), \qquad (3)$$

ε is the coefficient of irradiation; *b* is the constant of Stefan-Boltzmann, T_s is the absolute temperature of the surface of the body, T_m is the absolute temperature of the medium; $a = \frac{N_u \cdot \lambda}{l_1} -$ is the coefficient of heat transfer, where *Nu* is Nusselt number; λ is the coefficient of the thermal conductivity of the cooling media; l_1 is the specific size of a single area; t_s is the temperature of the surface of the body; t_m is the temperature of the cooling media.

$Nu = 0{,}57 \cdot R_l^{0,5} -$ at laminar flow regime of the cooling media;

$Nu = 0{,}32 \cdot R_l^{0,8} -$ at turbulent flow regime of the cooling media;

$R_l = \frac{\nu \cdot l_1}{\nu}$ is Reynolds number (when $R_l < 5 \cdot 10^5$ the flow regime of the cooling media will be laminar),

where *v* is kinematic viscosity of the cooling media; ρ is density of the flow of laser irradiation.

The boundary condition on the rear surface (when $R_l < 5 \cdot 10^5$ the flow regime of the cooling media will be laminar)

where *v* is kinematic viscosity of the cooling media; ρ is density of the flow of laser irradiation.

The boundary condition on the rear surface

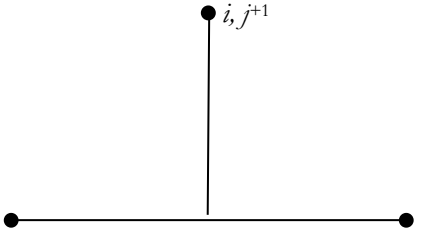
$$K\frac{\partial T}{\partial x}\Big|_{x=1} = -\varepsilon b\left(T_{\text{п}}^4 - T_c^4\right) + \alpha\left(t_{\text{п}} - t_c\right). \quad (4)$$

The boundary condition involving thermal protection on the rear surface:

$$K\frac{\partial T}{\partial x}\Big|_{x=1} = 0 . \qquad (4^*)$$

The system, which consists of the differential equation of thermal conductivity (1), initial conditions (2) and boundary conditions (3), (4) or (4*), is a mathematical model of the process of interaction of laser irradiation with the material. This nonlinear task is quite difficult even for solution by numerical methods. Since the summands, which contain the fourth degrees of temperatures, strongly influence the stability of difference schemes and control of convergence of the scheme requires much more machine time.

For the numerical solution of the task we will use the net point method according to the explicit difference scheme of the 1st order.



In the area

$0 \le x \le l$,

$0 \le \tau \le \tau_0$,

where τ_0 is the time of the impact of the laser irradiation on the material, let us introduce the net:

$$x_i = i \cdot h; i = 0 \div M; h = \frac{l}{M};$$

$$\tau_j = j \cdot \Delta\tau;\ j = 0 \div N; \Delta\tau = \frac{\tau_0}{N};$$

where h is the increase of the space coordinate; $\Delta\tau$ is the increase of the space interval; M is the number of blocks of three-dimensional spacing; N is the number of blocks of timer spacing.

Then the finite-difference approximation of equation (1) is written down in the form:

$$\frac{T_{i,j+1} - T_{i,j}}{\Delta\tau} = a\frac{T_{i+1,j} - 2T_{i,j} + T_{i-1,j}}{h^2}$$

Let $\omega = \Delta\tau \cdot \frac{a}{h^2}$, then

$$T_{i,j+1} = (1 - 2 \cdot \omega) T_{i,j} + \omega \cdot (T_{i+1,j} + T_{i-1,j}). \quad \textbf{(5)}$$

The finite-difference approximation of equation (2) takes the form:

$$T_{i,0} = T_0, \quad \textbf{(6)}$$

The finite-difference approximation of equation (3) will be written down in the form:

$$T_{1,j+1} = T_{1,j} - Q_1 \cdot T_{1,j} + Q_2 \cdot T^4_{1,j} + Q_3 \cdot T_{2,j} + + Q_0 + Q, \quad \textbf{(7)}$$

where $Q_1 = G \cdot \left(\frac{k}{h} + \frac{Nu \cdot \lambda}{l_1} \right)$; $Q_2 = G \cdot \varepsilon \cdot b$;

$Q_3 = G \cdot k/h$; $Q = G\left(\varepsilon \cdot b \cdot T_0^4 + \frac{\mathrm{Nu} \cdot \lambda}{l_1} \cdot T_0 \right)$;

$Q_0 = \rho \cdot A(T) \cdot G$; $G = 2 \cdot \Delta\tau / k \cdot h$.

The finite-difference approximation of equation (4) takes the form:

$$T_{M,j+1} = T_{M,j} + Q_1 \cdot T_{M,j} + Q_2 \cdot T^4_{M,j} - Q_3 \cdot T_{M-1,j} - Q, \quad \textbf{(8)}$$

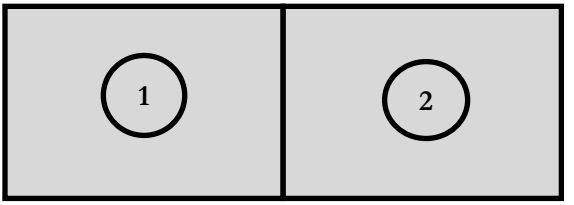
of equation (4*):

$$T_{M,j+1} = T_{M,j} + \frac{2 \cdot \Delta\tau}{h^2}\left(T_{M-1,j} - T_{M,j}\right). \quad \textbf{(8*)}$$

It is possible to ensure convergence of the constructed difference scheme by varying ω. In this case it is necessary to find the optimum from the point of view of savings of machine time value of ω, which ensures convergence of this difference scheme. It is desirable to determine the value of ω in each specific case, depending on the thickness of material, time of impact of laser irradiation, and thermophysical properties of materials.

1.2. Heat conduction in the heterogeneous layer of substance

In the device intermediate between the crystals medium determines distribution of calculation method to the laminates, which characterize heterogeneity in line with different directions. The diagram of such materials is given in Fig. 1.



The differential equation, which describes the process of heat conduction in layer 1, takes the form:

$$\frac{\partial T_1}{\partial \tau} = a_1 \cdot \frac{\partial^2 T_1}{\partial x^2} \qquad (9)$$

$0 \le x \le l$,

$0 \le t < \infty$.

For layer 2 we have:

$$\frac{\partial T_2}{\partial \tau} = a_2 \cdot \frac{\partial^2 T_2}{\partial x^2}, \qquad (10)$$

$l < x \le L$,

$0 \le \tau < \infty$.

The initial conditions are

$T_1|_{\tau=0} = T_1^0$;

$T_2|_{\tau=0} = T_2^0$.

Boundary conditions on the irradiated and back surface of the material are analogous to boundary conditions in p. 1. Boundary conditions in the area of contact of the layers under condition of ideality of the thermal contact take the form:

$$T_1|_{x=0} = T_2|_{x=0}, \qquad (11)$$

$$K_1 \frac{\partial T_1}{\partial x}\bigg|_{x=1} = K_2 \cdot \frac{\partial T_2}{\partial x}\bigg|_{x=1} \qquad (12)$$

The finite-difference approximation of equation (11):

$$T1_{i,j} = T2_{i,j}. \qquad (14)$$

The finite-difference approximation of equation (12):

$$T1_{i,j+1} = Q_4 \cdot T1_{i-1,j} + Q_5 \cdot T1_{i,j} - Q_9 \cdot T2_{i+1,j}, \qquad (15)$$

where $Q_4 = \frac{K_1}{K_2 - K_1} \cdot \frac{\Delta\tau}{h^2}$;

$$Q_5 = (h^2 - \Delta\tau) \cdot K_2 - (h^2 + \Delta\tau) \cdot K_1;$$

$$Q_9 = \frac{K_2}{K_2 - K_1} \cdot \frac{\Delta\tau}{h^2}.$$

It is easy to transfer the received result to the multilayer model of the material.

The cyclic calculations on the received finite-difference formulas describe the process of non-stationary thermal conductivity in the material. Preliminarily in accordance with the initial conditions the initial designation is done:

$$Tn|_{\tau=0} = Tn^0, \; N = 1, 2 \ldots,$$

where N the number of layers of the material.

Furthermore, the dependence of the coefficient of absorption of material on the temperature of the surface should be taken into consideration. The coefficient of absorption will be determined in accordance with the experimental data. The constructed mathematical model is applicable prior to the beginning of melting of the material.

2. The impact of pulse-periodic laser irradiation on construction materials

For increase of the resource of the device and decrease of requirements for the working of the surface of crystals it is possible to use pulse-periodic laser irradiation.

When constructing the mathematical model of the process of interaction of pulse-periodic laser irradiation with the material, first of all a possibility of replacing of the pulse-periodic irradiation with quasi-continuous one should be considered.

Let τ_1 be the space between pulses; τ_0 is the duration of a pulse, $\tau_n = \tau_0 + \tau_1$ is the period of repetition of pulses.

If τ is the time of irradiation effect, then conditions of

replacement for quasi-continuous process take the form:

$$\tau_n \langle\langle \sqrt{\tau_0 \tau} \ . \qquad \textbf{(16)}$$

If condition (16) is not satisfied, i.e., the pulse-periodic process of the impact of laser irradiation on the material is not approximated by quasi-continuous one, then definition of the components of pulse-periodic process should be considered. At the initial moment of time after termination of the pulse impact the isotherm with fixed temperature advances deep into the material, and then, after reaching a certain depth backspacing of this isotherm takes place. The position of the isotherm by the beginning of the next pulse makes it possible to determine the depth of warming up of the material. Thus, the solution, received for continuous impact of laser irradiation is generalized in case of the pulse-periodic nature of laser irradiation where the duration of pulse τ_0 is taken as the time of the impact process.

In the cyclic calculations during the quantitative realization of finite-difference equations the regime of cooling is assigned by exclusion of term $\rho \cdot A(\tau) \cdot S(Q_0)$ from equation (7) for the period τ_1 (corresponding to the interval between the pulses), and received after lapse of time τ_1 totality of temperatures in the calculated units is accepted as initial for the regime of heating. The regime of heating is assigned by inclusion in equation (7) of term Q_0 for the period of impulse impact τ_0.

With the description of impact of millisecond laser pulses with the radiation flux density up to 10 W/cm^2 on the optical surfaces one should consider that:

- energy losses for over-irradiation and due to convection with the heated surface can be taken into account by the use of the model of conditionally mobile boundary of the absorbing surface;
- the thermophysical formulation of the problem in accordance with the theory of wave synthesis, which describes interaction of laser irradiation with the irradiation of the source and material, is valid only for the densities of the flow, which does not cause changes of the optical characteristics of the device till the end of the useful life.

3. Conduction of experimental work

The use of the results of experimental works, conducted with the experimental installation, was implemented for correction of the conversion coefficients of the objects of information into geometric forms. Then functional parameters of forms were established and simulation, directed toward forecasting of real earthquakes was conducted. The measurement of the outgoing information can be implemented through the thermocouple, the indicators of optical signals, etc.

The purpose of conduction of experimental works at the experimental installation is definition of the dependence of temperature of the back surface of the irradiated sample of the material on the time of the impact of laser irradiation with the given density ρ.

The following means were used for conduction of the experiments:

1. Installation for heat treatment 02TΛ-3600-004 (experimental installation - EI).
2. Thermocouple of type TT -243 (sensor - S)
3. Lengthening thermocouple wires of copper-titanium-nickel- copper type (CT-NC).
4. Digital millivoltmeter -300 (means of information presentation MIP).

The block diagram of the experimental works is presented in Fig. 2.

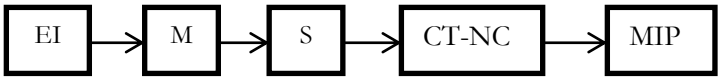


Fig. 2

M is the sample of the examined material.

The scheme of the experimental installation with the tested specimen and the means of measurement is presented in Fig. 3

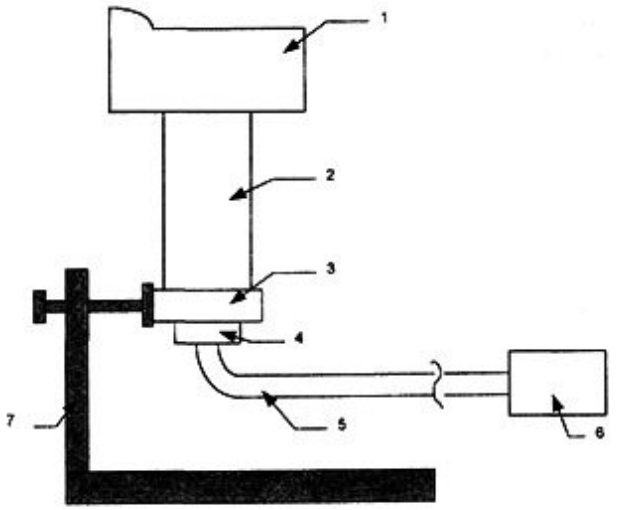
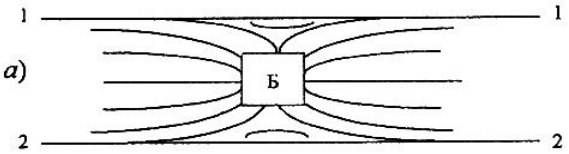


Fig. 3

1 - ЭУ; 2 - ray; 3 - the sample of the material; 4 - sensor;
5 - thermocouple wires; 6 - voltmeter;
7- clamp for fastening of the sample of the material

Laser beam 2 with a certain density of flow ρ is generated in installation 1. Ray 2 meets on its way the sample of material 3 fixed on the clamp 7. Thermocouple 5 is fastened to the back surface of sample 3.Thermocouple wires connect thermocouple 5 with voltmeter 7. The meterage of the voltmeter is registered within certain time intervals. Then with the help of a special table they are converted into temperatures, which correspond to certain moments of time.

The basic sources of faults during the measurement of temperatures are the deterioration of uniformity of the layer of material resulted from introduction into it of thermoelectric converter, as well as discharge of heat through its wires. The character of testing of the temperature field with the fulfillment of groove for positioning of the temperature sensor is shown in fig of 4a, b.



а - isotherms, 6 – temperature at the surfaces 1 — 1 и 2 — 2.

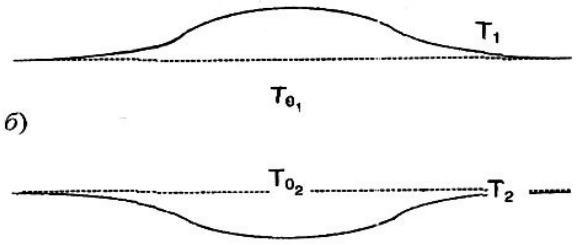


Fig. 4

а - isotherms, 6 – temperature at the surfaces 1 — 1 и 2 — 2.

Actually it is impossible to determine accurately the place of the contact of the joint of thermoelectric converter with the surface of the groove, therefore there is an ambiguity in the measurement of temperature in interval $dT = T_A - T_Б$. The summary error of the measurements made 4%.

Graphing of dependence of temperature of back surface on time was implemented in the following way:

1) results received with gross errors in measurements were excluded as not accounted from the results of the series of experiments, carried out with the equivalent conditions,

2) from the remained results, to be more exact, based on the results of the experiments, in which the error of measurement referred to the class of systematic ones, the family of curves, which expressed the dependence of the back surface temperature of the material on time, were built.

3) average statistical curve, which characterizes the dependence of temperature on time, was determined for each family of curves, corresponding to each specific case of interaction.

After receiving of the graph of dependence of temperature of the back surface of the sample on time, numerical calculation of

the task of reverse mathematical model was implemented. If the results of the experiments differed by more than 9% from the results of the numerical calculation, the value of the absorption coefficient was corrected. Thus, it is possible to find the dependences of coefficient of absorption A on the temperature for each of the materials being examined.

The use of dependences of coefficients of absorption on the temperature for these materials makes it possible with sufficient for the engineering calculations accuracy (to 9%), using only the mathematical model, to determine the temperature fields of the examined materials. With the description of the process of interaction of laser irradiation with the construction materials in the vacuum the mathematical model is simplified, since term $a(t_{\text{п}} - t_{\text{с}})$ that characterizes heat transfer, is excluded from equation (3).

For preventive forecast of earthquakes the map of the area is the source of radiation. For the preventive forecast of catastrophes at production facilities the irradiation source is the scheme of production facility with description of technological cycles (in this case the device registers changes at the exact section of the scheme). The action of the device can be applied to any objects of reality, including objects with the unknown properties. For this purpose the coefficient of thermal diffusivity should be accepted as the static phase of reality, and the coefficient of irradiation as the dynamic phase of the reality.

Conclusion

1. The experimental-design method of solution of nonlinear problems about the impact of continuous or impulse-periodical laser irradiation for preventive forecast of earthquakes, catastrophes of production facilities, and forecast oriented control of microprocessors is built and substantiated by the application of theory of wave synthesis and fundamental discoveries of optical systems. The solution is applicable for cases of any catastrophes, including catastrophes from the media with the unknown properties

2. Formulas (5), (6), (7), (8), (8*), (14) and (15), which make it possible to quantitatively realize the constructed mathematical model, are received in the final form.

The algorithm of calculation of temperature fields based on the received finite-difference formulas, as well as the ways of

optimization of algorithm from the point of view of savings of the machine time are shown.

The results of the use of the theory of wave synthesis and fundamental discoveries of optical systems, which make it possible with sufficient for the engineering calculations accuracy to describe real physical process both in the gaseous medium and in the vacuum, are received.

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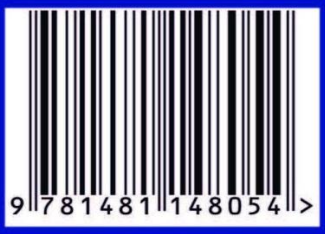
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