IV Международная научно-практическая конференция

«Фундаментальные и прикладные проблемы приборостроения, информатики, экономики и права»

Министерство образования Российской Федерации

НАУЧНЫЕ ТРУДЫ

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КНИГА «ПРИБОРОСТРОЕНИЕ»

Московская государственная академия приборостроения и информатики

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AN INTERFEROMETRICAL ANALYZER FOR THE DYNAMICS BIOLOGICAL OBJECTS DIAGNOSTICS

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Abstract - The work states the control and diagnostics of dynamics method both biological objects, and dynamics of change of a mechanical objects structure, for example, at processing materials by cutting is developed. A developed method and system allow by a method of processing of the optical information to make precision measurements and diagnostics of a dynamic objects condition.

1. INTRODUCTION

The space researches get the increasing importance for development of a economy. Thus the duration of an operating time of researches in a space vehicle is increased. The physical and psychological overloads of the organism, which arise inevitably at a long presence in the space, entail physiological changes of the biological system of the man. The maintenance of cosmonaut serviceability for successful performance of the put tasks is urgent. It is possible at the stimulation of the organism regenerative functions. Rather significant quantity of researches of the biological systems of the man, now will be carried out. However in extreme conditions monitoring and normalization of work of the space researcher for realization of expensive space researches are necessary. Therefore development of methods and means of monitoring and the stimulation of the regenerative functions biological organism in the space in the field of the space medicine and space biology is urgent.

A offered method and the offered laser system carry out processing the optical information for the control function of the behind a dynamic objects condition, which physical and mechanical characteristics change during the certain interval of the time. The action principle of the sensor optoelectronics modules on acoustooptical interactions of laser radiation with superficial and volumetric acoustic fluctuations of the objects structure .is based. Such systems allow to carry out the analysis of changes both form of a surface, and internal pressure, defects of a material. By one of the basic requirements to quality of the such control and management method and measurement sensors - opportunity of creation of the automated monitoring systems of a dynamic condition both mechanical, and biological objects.

2. THE SIGNAL PROCESSING METHOD IN MEASUREMENT

The creation methods of the intelligent hybrid complexes which allow on the basis of diagnostics of a organism condition to stimulate and to normalize functioning biological system are offered. The hybrid complex includes the block of processing of the information on the basis of microprocessors, by which of the registration sensors, devices of light coherent and noncoherent electromagnetic radiation, the constant electromagnetic flows devices are connected.

The action principle of a complex on simultaneous influence of light electromagnetic irradiations with different lengths of waves and magnetic fields is based. The simultaneous influence of the coherent light and noncoherent of the electromagnetic fields allows to raise efficiency of the stimulation functions of cosmonaut or pilot organism regeneration in the long flight at rather high overloads.

The active points and zones of the biological object most react to an external power pulse (the irritation). Mainly biological objects fall under influence of the electromagnetic fields, that exist in different physical displays (light, acoustic, electrical, and so forth signals). On this time exist nonmedicamental methods of the treatment by influence on the biological organizms, which on use of power light (coherent and noncoherent), acoustic (ultrasonic and supersonic) fields are based. The power of active points and zones represents original power «holes» «drains - sources» for external fields in organizms, or regulators of a manual of a direction and density of the flows energy. In these points the close contact of biological object to the external factors is carried out. The power system of object gets in the reaction «of inflows - drain» of energy.

So, at realization of an low-power irradiation the flows of radiation (of the sources of coherent radiation, for example, the lasers) carry out influence on power and physical and chemical emergencies of the biological object at occurrence of the reactions of free - radical oxidation in the crate structure. At absorption of light quantums of the photoacceptors there are radical forms of oxygen, that there is by the primary mechanism in operation of the versions of the low-power radiation It results in the secondary biochemical reactions with development of the biological effects in organizn system [1]. Besides it is known [2], that the low-power radiation influences on the biological organizms at support of the antioxigent effects, that causes an therapevtic efficiency of the electromagnetic coherent light fields.

Therefore understanding of the power transformations principles in the crate structure enables creations of the functioning algorithms of the biological organizms on the macrolevel and microlevel. It is possible to explain principles of energy interaction of the biological structures with external electromagnetic fields if to use a principle of a superposition and to consider biological organizm as set of r-elements (crates), in each of which there is a reaction of absorption, transformation and generation of energy. Using the power approach of the analysis

of systems [3], we shall present, that on a contour, that is membrane of each crate, or set of crates, which create fabric sets, the flow of energy Qr circulates:

$$As = < Qr, s, L, T >, \quad (1)$$

where s – the contour area; L - a contour length of a biological crate; T - time of a cycle of circulation of energy. Then the complete energy of set of crates, as elements of a fabric and has all organizm in general, expression $Z = SQr$. Such approach allows to define power processes at fabriclevel and general levels of the biological organizm.

Process of the interaction of set of the crates with external electromagnetic fields, that act in organizm as an irradiating flow at realization of the physiotherapy procedures, or at influence of the electromagnetic fields from the environmental equipment or environment, is the dynamical process of absorption by the crates of the external power factors. The transformation of process of absorption consists in the basis of this phenomenon during circulation of energy in a biological crate. Thus the effect of indemnification of a whirlwind of circulation provides absorption of energy of a field.

3. DIAGNOSTIC PRINCIPLE OF THE OPTOELECTRONICAL SYSTEM ANALYSER

The analysis of a biological organism condition on standard cards of the distribution of active points and zones in view of correction of their arrangement in a real body of the man is made. The correction of an arrangement of zones and points is brought in to the block of processing of the information on registration of power barriers, which result of the metabolics processes occurring in the biological system. Sensitive of the sensors registration by biological system of the irradiation electromagnetic fields allow to define redistribution of power flows in the biological fabrics organism under influence of the external directed electromagnetic flows. The monitoring of the organism biological system allows to carry out an irradiation of the organism for the medical and preventive purposes, the stimulation of normal work of bodies, mental and physical organism condition of the cosmonaut.

The laser interferometrical system (Fig. 1) allows to the accuracy increase of a surface formation of a processable detail by the depth definition of the deformed layer of a material [4, 5]. The management is carried out on parameters of a surface formation (a wave length of the elastic deformations, pressure and cutting force), by the spectral density definition of a light signal on an output of the laser optoelectronic system. The depth of the deformed layer of a processable surface by the distribution laws of pressure in a material of a biological object is caused. If the pressure in area near to a point of the appendix of the mechanical pressure, the depth of a layer decreases are located. The change of pressure in a material of the forces changes, which the influence a variation of the depth change of a layer

is connected. Therefore for formation of the current signal about changes of depth of a layer it is necessary to define product of the pressure and cutting force characteristic, estimating localization of the pressure in a place of the contact.

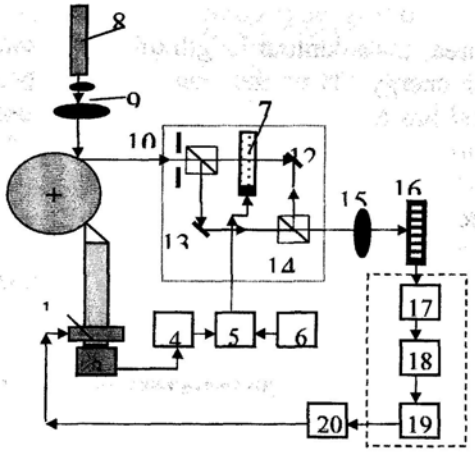

Fig. 1. A function circuit of the laser device of the diagnostics and control: 1 – the electromagnetic force, pressure sensor, 2 – the active sensor, 3 – the biological research object, 4 – the amplifier, 5 – the LFM-modulator, 6 – the basic signals generator, 7 - AOM, 8 - laser, 9 – the Cepler telescopic system, 10 – diafragme, 11, 14 – the light division cubes, 12, 13 – the reflective mirrors, 15 – the Fourier-objective, 16 - the photoregistration block, 17, 18, 19 – the microprocessor block, 20 – the executive mechanism

For direct measurement of parameters of a superficial wave cover by the extended laser beam of radiation, for example, a dynamic biological crate, the skin deformation is based. The reflected beam, modulated on a phase by the superficial waves, actions in the modified Mah-Cender interferometer. The sheet of the laser analyzer includes the sensor of dynamic pressure and cutting force or located on the cutting tool connected through the amplifier and the LFM-modulator to an electrical input of the acoustooptical modulator (AOM). AOM carries out operation of multiplication of the distribution of a light flow acting in the optical system, which parameters depend on length of an elastic wave of a material, on a transfer optical function AOM as functions of size of the dynamic cutting force or the influience biological force on the skin organizm. The LFM-modulator forms a high-frequency signal, modulated on by the signal frequency of a making cutting force or a dynamic fluctuatiions changes, that provides compression on time.

Calculating size of the depth of the deformed layer of a processable surface it is possible to determine deviations from nominal size for the given regimes of processing. Formation of managing teams on change of the operations regimes of dynamic system carries out the computing block of a video signal processing of

the laser analyzer optical system. At excess of an allowable level the managin block forms on the regimes change.

Diagnostics of the current condition of the biological system through complex sensors, which register the power characteristics of the organism activ points and zones, and also change of the electromagnetic fields, which organisn radiate during ability to live is carried out. A complex of the physical dat parameters of each researcher in a database for comparison with the curren condition organism are brought.

Biological organizms during the physical existence contacting with externa power fields of a different origin. The interaction of these fields with own fields o biological object results in the certain power transformations on a crate level. The consequences of the power transformations in the biological objects system o braking of the active functions of each crate are excitation. Thus, the processes o the power interactions, of the biological crate structures for complex treatment o diseases are fund.

The miniature size of an offered optoelectronical complex allows to use it in structure of systems of the flying devices at long flights, space researches. The block of processing of the information is created on the basis of the portable personal computer.

The registration sensors [6] of the power transformations of the biological system for creating on the basis of toroidal induction coils of electromagnetic radiation, which are connected through devices of transformation of analog signals to the block of processing of the information for comparison with registration by the organism data in the beginning of flight at the normal physical and psychological loadings are offered.

An opportunity thus to normalize a condition of the biological system during the long period of time for the maintenance of normal ability to work is provided.

The algorithms of an irradiation of the active points and zones organism by the directed electromagnetic flows are offered depending on a diagnosed condition, which on accounts of an arrangement of active points and zones on cards in view of registered power barriers in active zones as power extreme zones, and with account dose of the directed radiation are based.

The developed algorithms [6] of an irradiation of the organism take into account all changes, which occur under influence of the external influences of an environment. In particular it at stimulation of the regenerative functions is urgent.

The offered intelligent hybrid optoelectronical complex for the monitoring and the algorithms of its functioning allow to raise increasean overall performance cosmonaut during all time of the flight due to adaptive mode of operations of a intelligent hybrid complex.

4. CONCLUSION

On the basis of results of the carried out researches it is possible to do the following conclusion:

1. The combined method of the optical and electromagnetic signals processing which allows to diagnose superficial and volumetric changes of a dynamic biological objects structure in a real time scale is developed.

2. The offered system of the hybrid interferometrical laser analyzer allows to increase accuracy of measurements of dynamic deformations of the materials biological structure.

3. The offered types of primary sensors allow rather effectively to register dynamic signals from microstructure of crates biological organizm for the complete analysis of a organizm condition

4. The algorithms of an irradiation of active points and zones of the organizm allow to stimulate регенеративные of the function and serviceability of the organizm

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