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DIAGNOSTICS OF BIOLOGICAL OBJECTS BY INFRARED RADIATION

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Keywords: infrared radiation, infrared, laser beam, biological object, electromagnetic radiation.
Abstract. Diagnostics of biological objects with the help of infrared radiation is intended for the implementation of the computer medical introscopy method. A biological object is affected by a scanning infrared laser beam from an electromagnetic source. Radiation that has passed through a biological object is measured by radiation receivers. Mathematical processing of measurement results and their display is carried out with the help of a computer by an information processing unit. Refocusing of laser radiation is carried out with the help of tunable optics with a forcibly variable curvature of the radiation tuning element. The use of near-infrared radiation in tunable optics with variable curvature allows you to focus the laser beam inside a biological object without using complex optical devices.

ДИАГНОСТИКА БИОЛОГИЧЕСКИХ ОБЪЕКТОВ С ПОМОЩЬЮ ИК-ИЗЛУЧЕНИЯ

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Ключевые слова: ИК-излучение, ИК-диапазон, лазерный луч, биологический объект, электромагнитное излучение.
Аннотация. Для осуществления метода компьютерной медицинской интроскопии предназначена диагностика биологических объектов с помощью ИК-излучения. На биологический объект воздействуют сканирующим лучом лазера ближнего ИК-диапазона от источника электромагнитного излучения. Прошедшее сквозь биологический объект излучение измеряется приемниками излучения. Математическая обработка результатов измерений и их отображение осуществляется с помощью компьютера блоком обработки информации. Перефокусировку лазерного излучения проводят с помощью перестраиваемой оптики с принудительно изменяемой кривизной перестраивающего излучение элемента. Использование излучения ближнего ИК-диапазона в перестраиваемой оптике с изменяемой кривизной позволяет фокусировать лазерный луч внутри биологического объекта без использования сложных оптических устройств.

The method of computer medical introscopy is aimed at solving the problem of improving diagnostic methods and therapeutic effects.

The technical result is achieved by the fact that in the method of computer medical introscopy, a biological object is scanned with a near-IR laser beam, the radiation transmitted through the biological object is measured using radiation detectors, mathematical results are measured using a computer and displayed on the display. The peculiarity of the method lies in the fact that with the help of a tomograph in the process of impacting a biological object, laser radiation is refocused using tunable optics with a forcibly variable curvature of the element that tunes the radiation.

The possibility of exposure to a biological object with a focused laser beam, as well as the possibility of refocusing the laser beam to the required depth, provides more detailed information about the features of the test organ. In addition, the possibility of focusing the laser beam allows a therapeutic effect on the affected organ, provided that the same set of equipment is used.

The laser beam forming system is made in the form of tunable optics with a forcibly variable curvature of the radiation tuning element, the control unit and the drive. In particular, the specified tunable optics with a forcibly variable curvature of the radiation tunable element is designed as a mirror.

The laser beam forming system is designed as a tunable optics with a force-changing curvature of the radiation-modulating element and the control unit, which allows, on the one hand, to scan the parallel laser beam and thereby achieve the scanning effect of the investigated layer of a biological object without using a complex optical system. If necessary, the implementation of this operation tunable optics can be made in the form of a mirror, which is given a convex shape. On the other hand, with the help of the same mirror, a parallel laser beam can be focused on the required depth of the layer under study inside a biological object. For this, the mirror is given a concave shape using the control unit. In addition, a change in the radius of curvature of the mirror allows the required refocusing of the laser beam.

The use of a mirror as an optical scheme for the formation of a laser beam also makes it possible to constructively simplify the entire system and increase its reliability.

The method is implemented as follows. Laser radiation enters the body under study, containing the object of detailed research. The radiation transmitted directly through the object, as well as scattered, but released from the body, is recorded by the receivers. By changing the direction of the original laser beam and making appropriate measurements of the radiation emitted from the body, as a result of appropriate mathematical processing of the received signals, it is possible to reconstruct the structure of the object and visualize the resulting two-dimensional and three-dimensional picture on the display screen. When carrying out diagnostic effects on the object of study by laser radiation, focusing and repeated refocusing of the beam are performed. When conducting therapeutic effects of laser radiation produce multiple effects on the affected organ with a beam focused at a certain point.

For a sequential fan-shaped scanning of a test object by a laser beam, a laser beam forming system creates a flat beam whose thickness corresponds to the thickness of the layer being diagnosed and the width of the beam exceeds its thickness. The beam, reflected from a convex mirror with a one-dimensional curvature, diverges from the required angle of opening. To realize the focusing of the laser radiation at the desired depth of the object, a flat laser beam is directed onto a flexible concave mirror, the curvature of which is controlled by the control unit.

Thus, the implementation of the method allows to increase the reliability of laser medical tomographs, as well as to produce both diagnostic and therapeutic effects of focused laser radiation.

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