Service evaluation of seasonal decomposition. To determine the seasonal component was developed algorithm seasonal decomposition data.

Allocated on the basis of the trend of moving averages. Formed seasonal component – the difference or ratio between the original and the smoothed series. Calculated seasonal component - the average of all values of a number corresponding to a given point in the seasonal range.

The developed information system allows for processing of diagnostic data in parallel and implement a comprehensive approach to the diagnosis and prediction of the state of health of the human body, by combining into a single unit process analysis and control of information and the organization of operational data exchange in a single information space. Parallel data processing mode provides high utilization of computing resources by distributing a complex task into multiple computing nodes . Services include system design and allow authors to successfully diagnose diseases.

Findings. Checking for the seasonal component using correlogram showed that in some of the time-series data present seasonal component.

Seasonal Decomposition data series showed that they present a seasonal component. Analysis of seasonal indices showed that the changes of different indicators have laws that create a whole picture of the mutual changes of these parameters.

Trends isolated by two methods. It was concluded that the method of moving averages is more suitable for smoothing the time series, as it is more sensitive to changes in time series by the fact that when it is not recorded using the previous values of the smoothed row.

Работа выполнена в рамках проекта №1957 Госзадания "Наука" Министерства образования и науки Российской Федерации.

Conclusion. Time series analysis conducted in this paper allows us to represent the behavior of blood chemistry parameters in healthy people. Seasonal decomposition was carried out data series that gives an indication of changes in the patterns of these indicators in a certain period. Also were built correlogram. All this allows us to represent some standard behavior of these indicators over time to assess the state of the sick people and to evaluate the effectiveness of the treatment.

МОДЕЛИРОВАНИЕ ЭЛЕКТРИЧЕСКОЙ АКТИВНОСТИ СЕРДЦА С ПОМОЩЬЮ ЭЛЕКТРОКАРДИОГРАФА НА НАНОЭЛЕКТРОДАХ

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COMPUTER SIMULATION CARDIAC ELECTRICAL ACTIVITY USING AN ELECTROCARDIOGRAPH ON NANOSENSORS

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Abstract. The problems related to cardiovascular diseases are considered. The method to solve some of the problems has been proposed. We also consider a two-component Aliev-Panfilov model and the algorithm of the hardware- software complexes. The obtained results are presented.

Introduction. According to World Health Organization (WHO), over 17 million people worldwide die annually from cardiovascular diseases (CVDs). Moreover, according to WHO, an estimated number of almost 23.6 million people will die from CVDs by 2030. In 2012, 1 million 232 thousand 182 people died from CVDs in Russia [1].

Electrocardiographic (ECG) method is a most common method to examine the state of a patient's cardiovascular system in various medical institutions. ECG is referred to as the method of functional diagnostics with a quantitative evaluation of the research results. The first cardiographic research was carried out by the Scottish scientist Alexander Muirhead in the late 19th century [2].

Heart electricity activity. The development of a new generation of nanosensors and computerized ECG – the apparatus of high resolution to be used in clinics and at home – is relevant for improving the diagnostics of cardiovascular diseases, including early heart diagnostics of adults, children, infants and the fetus.

To solve the problem, a numerical model of excitation propagation in the heart muscle is to be studied.

Mathematical simulation. To simulate excitation propagation, one of the simplest models of the excitable medium, a two-component Aliev-Panfilov model is suggested in [3, 4]. The model is implemented in the form of "reaction-diffusion" equations.

$$\frac{\partial u}{\partial t} = -ku \cdot (u-a) \cdot (u-1) - uv + \Delta u \,,$$

$$\frac{\partial v}{\partial t} = -\left(\varepsilon_0 + \frac{\mu_1 v}{u + \mu_2} \right) \cdot \left(v + ku \cdot (u - a - 1) \right),$$

where $u(x, y, t)$ is a dimensionless function, corresponding to the transmembrane potential, and $v(x, y, t)$ is a dimensionless function corresponding to a slow membrane recovery current. The bonds between the heart muscle cells are defined by diffusion terms of the equations, and the dynamics of a single cell is defined by nonlinear terms of the equations. After a series of experiments [5], for better concordance of the system to the properties of the heart muscle the model parameters were determined: $k = 8.0,\ \varepsilon_0 = 0.01,\ \mu_1 = 0.2,\ \mu_2 = 0.3,\ a = 0.15$.

Hardware-software complex as a solution. To implement the simulation of the excitation propagation in the heart within the concept of the cardiovascular system (CVS) assessment a hardware-software complex [HSC] is going to be developed in Laboratory No 63, Institute of Non-Destructive Testing. The algorithm of its functioning is shown in figure 1.

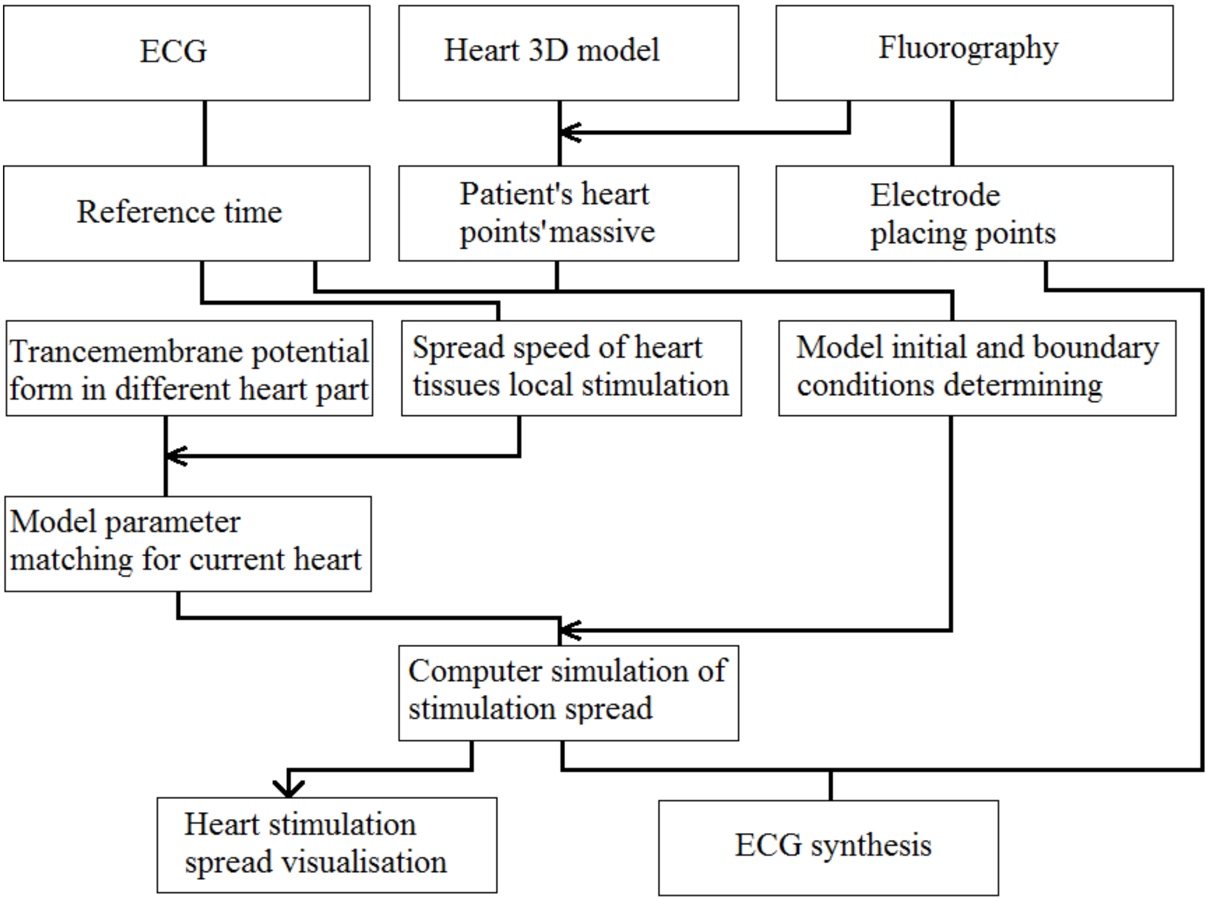

Fig. 1. The algorithm for simulation of excitation propagation in the heart.

According to the algorithm, at first, the initial and boundary conditions of the model are assigned basing on the cardiographic information analysis. After that, the model parameters are determined for various compartments of the heart, and the excitation propagation is simulated. The simulation results are used to visualize excitation propagation on the heart surface.

Conclusion. The model of the cardiac electrical activity makes possible to determine the "electrical portrait" of the patient's heart within the cardiac cycle, which enables to identify the diagnostic features in the analysis of indirect parameters determined by simulating the electrical processes in the heart and ECG output data from nanosensors.

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КОМПЬЮТЕРНАЯ ПСИХОДИАГНОСТИКА

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COMPUTER PSYCHODAIGNOSIS

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Substantiated the thesis that computer psychodiagnosis formed in independent field of research, with the aim of creating a psychodiagnostic tools for the development of methods to work with experimental psychological information.

В самом общем виде психодиагностика – эта наука и практика постановки психологического диагноза. Психологический диагноз (от греч. – «распознание») (ПД) – конечный результат деятельности психолога, направленный на выяснение сущности индивидуально-психологических особенностей личности с целью оценки их актуального состояния, прогноза дальнейшего развития и разработки рекомендаций, определяемых задачей психодиагностического обследования. [3]

Предмет психологического диагноза (ПД) – установление индивидуально-психологических различий в норме и в патологии. Важнейшим элементом психологического диагноза является выяснение в каждом отдельном случае того, почему данные проявления обнаруживаются в поведении обследуемого, каковы их причины и следствия.

Принципы разработки психодиагностических средств и их конкретное воплощение в диагностических методиках, включая их методологическое и теоретическое обоснование, входят в предмет общей психодиагностики. [1]

Стремительный рост технического и программного обеспечения компьютеров, развитие новых информационных технологий открывает широкую перспективу для проведения исследований в области психологической диагностики.

В настоящее время использование компьютерных технологий в психодиагностике оформилось в самостоятельную область исследований, получившую название компьютерной психодиагностики, целью которой являются создание психодиагностического инструментария, в том числе компьютерных версий психодиагностических методик, а также разработка принципиально новых видов экспериментов и методов работы с экспериментально-психологической информацией.

В свою очередь развитие компьютерных технологий, информационных технологий анализа данных и инженерии знаний способствовало появлению принципиально новых возможностей и возникновению качественных эффектов в области психодиагностики. Если раньше компьютер не являлся необходимым условием проведения психодиагностического эксперимента, то уже в настоящее время имеется существенное число психодиагностических методик, центральным звеном которых является компьютер. В