

## ABSTRACTS

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**Geometric model of topology and network coverage GPON of the eHealth system in Dnepr / V. Bondarenko, N. Antipov // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 5-12: Pic. 4, tabl. 1. – Ref.: 3 title.**

**Formulation of the problem.** The Law of Ukraine «On State Financial Guarantees of Public Healthcare» introduces the state «e-health system» (eHealth) – an information and telecommunication system for the management of medical information and automation of medical reporting. **Formulating the goals of the work.** The purpose of this work is to determine the optimal geometric parameters of the mutual arrangement on the territory of the city of Dnipro of active ports OLT of the optical access network GPON for the 33 ONUs – city health facilities that make up the regional eHealth level. **GPON Network Architecture.** GPON network consists of four sites: station site; trunk; house distribution network; subscriber site. For the construction of an optical distribution network GPON uses a two-stage split scheme of optical signal with a total coefficient of 1:64. **Design of the specified GPON access network** consists of the following sequence of typical design procedures: definition of the locations of the OLT, construction of the topology of the GPON access network, the construction of the coverage, the paths of the fiber optic cable for each wick, the choice of the locations of the splitters OP, the definition of optimal separation coefficients all splitters OP, calculation of the budget of losses for each whistle. **Development of topology and coverage of the GPON access network.** According to the results of the development of the topology and coverage of the GPON access network, the following were performed: support nodes were determined; cloud boundaries are defined; clustering of cloud buildings was performed; calculation of the capacity of the main fiber optic line and fiber optic link of each attached building; a territorial map of the area is mapped with the display of the boundaries of the clouds and the zones of the support nodes. **The program of the regional administration of the telecoms operator.** The CrossProject program allows you to create, edit and edit the database of the telecommunication sites (in Excel files), look through the current form. **Prospects for further development.** In accordance with the method of optimal geometric parameters and topology and optical access to GPON, you can efficiently use it when planning for other medical information of the eHealth of regional activity / the great mity, hidden on the real functional offensive stages of eHealth.

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**Adaptation of NACA profiles of the 65<sup>th</sup> series to the modeling of blades of axial compressors of gas-turbine engine / V. Borisenko, O. Korchagina, A. Ryabova // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 13-19: Pic. 8, tabl. 1. – Ref.: 9 title.**

The method for geometric adaptation of NACA airfoils of 65th series to the modeling of axial compressor blades was proposed. The airfoils of this series are specified by a certain set of discrete points. The radius of leading edge is determined, but a radius of trailing edge unknown. Its value is taken as some part of the leading edge radius. But in both cases, it is necessary to determine the interface points of the circles of the input and output edges with curves, which describe the contours of the airfoil defined by a set of discrete points. The interpolation-approximation splines proposed by Anselon-Laurent are used for the analytical representation of the contours of the airfoil. The search for the points of linking of the circles of the leading and trailing edges with the interpolation-approximation splines proposed by Anselon-Laurent is realized numerically by solving a transcendental equation constructed as the difference between the angles of inclination of the tangent to the circle of the leading and trailing with the splines. On the basis of the proposed methods, a software code has been developed that allows, besides calculations, to visualize the graphic results on the computer monitor screen. The article provides graphical results of linking the leading and trailing edges with contours of the airfoil.

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**Development of a system of protection of information in the local network of the enterprise / S. Evdokimov, S. Ustenko // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 20-25: Pic. 3, list. 1. – Ref.: 6 title.**

Today there is a need to choose the right means to prevent information leaks and measures to ensure data from unauthorized access to it. Although, no hardware and software solutions can guarantee absolute reliability, but to minimize the risk of loss is possible only with a comprehensive approach to security issues. The article offers the possibility of using the most effective and promising architecture of DLP-system to protect information from modern threats in the network of the organization.

Based on the DLP system and the developed algorithm, a program was created to monitor Windows system events in applications defined by information security policies. The possibilities of this system in the local network of the enterprise were analyzed. Experiments have shown the high efficiency of this approach in solving the problems of restricting unauthorized access to confidential data. For it departments and information security professionals, the proposed software product allows you to look at the problem of control over actions with confidential documents, minimize deficiencies at the level of technology.

The study opens up the possibility of creating compact, high-speed and non-volatile systems of artificial intelligence. Taking into account the above, it can be noted that DLP systems are an effective tool for protecting confidential information only in integration with other security services and the relevance of integrated solutions will only increase over time.

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**Optimization of placement of operative- rescue units with help by convex polygons in the example of the Bliznyukovskyy district of the Kharkiv region / S. Kravtsiv, O. Sobol // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 26-32: Pic. 4. – Ref.: 11 title.**

The analysis of the existing methods of distribution of operational and rescue units allowed to note that the target function is the time of heading units to the place of call, but does not take into account the consequences of emergencies and dangerous events in the areas, and also exclude other types of man-made hazards other than fire. This allows us to conclude that it is necessary to develop a method for minimizing the consequences of emergencies by optimizing the location of operational and rescue units at the level of integral risk of dangerous events.

The purpose of the work is to implement the method of optimizing the location of operational and rescue units at the level of integral risk of dangerous events on the example of Bliznyukovskyy district of Kharkiv region.

In this work 8 methods for realization of the mathematical model of distribution of operational-rescue units on the level of integral risk of emergencies and dangerous events and taking into account its features, namely: existing areas of departure of rescue units and limited resources for the creation of data units, has been developed. These methods allow for the different types of distribution of operational and rescue units taking into account the integral risk of emergencies and dangerous events, and the obtained estimates of complexity allow to determine the number of variants of division of units that need to be analyzed to find the extremum of the target function.

Numerical realization of the method of distribution of operational-rescue units according to the level of integral risk of emergencies and dangerous events is carried out on the example of Bliznyukovskyy district of Kharkiv region. This allowed the identification of settlements in the district in which new rescue units should be created and the type of these units should be defined. It should be noted that the problem was solved taking into account the target function and the limitations of the mathematical model of distribution of operational and rescue units in terms of the integral risk of emergencies and dangerous events. It was also shown the impact of limited resources on the distribution of rescue units in the Bliznyukovskyy district of the Kharkiv region.

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**Analysis of methods and models for assessment knowledge in testing systems / K. Kuzma // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 33-40: Pic. 1. – Ref.: 9 title.**

Modern methods of training and knowledge control should be based on the widespread use of automation tools that not only increase the efficiency of the information technologies used, but also create

the conditions for their further improvement. The use of statistical methods and computers in the development and testing of tests provides an opportunity to eliminate the following shortcomings of testing as: the ability to guess the correct answers; possibility of mistaken estimation; the complexity of developing scientifically based tests that contain high and stable reliability and validity indices.

The paper considers models and methods for assessing the level of knowledge in the testing systems. Their classification into two categories was executed: mathematical and classification, computational algorithms were given, advantages and disadvantages were revealed.

It was determined that the main disadvantage of «clear» tests (using a binary system to assess the correctness of the answer to each question (right or wrong)) is a evaluation of incomplete or inaccurate responses as wrong, that is, approximate, incomplete knowledge of the answer to the questions qualifies as ignorance of the answer, and this is not always justified. Applying the idea of «fuzzy» tests can improve the efficiency of the process of identifying knowledge. The practical significance of the use of statistical methods and computers in the development and applying of tests was argued.

The urgency of the problem of diagnosing the educational process does not decrease and at present, especially with the increasing trend of the introduction of computer technology into the educational process and the transfer of technical equipment teaching and controlling functions of the teacher.

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**Information-geometrical model of optimization of a power covering of wireless communication systems / A. Kulysh, V. Bondarenko // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 41-45: Pic. 8, tabl. 2. – Ref.: 5 title.**

**Raising of problem.** The estimation of power descriptions of signals in wireless communication networks has of principle meaningfulness for their planning. Known row of empiric and semiempiric models of distribution of signals of connection, which provide the estimations of level of their at different limitations [1], but none of these models provides determination of parameters of mutual spatial location of the stations of connection, optimum after the criterion of minimization of power losses of signal on the route of his distribution. **Forming of aims of work.** The purpose of this work consists in determination of optimum after the noted criterion parameters of mutual spatial location of elements of channel of transferableness of information within the framework of existent models of power coverage. **Basic material.** Within the framework of all known on this time of empiric and semiempiric models of distribution of signals in wireless communication networks the level of signal is described the nonlinear functions of kind, where. Here  $H$ ,  $h$  – accordingly heights of location of the base and mobile stations of connection;  $d$  is distance between them;  $f$  is frequency of signal. It should be noted that at the different models of power coverage of function, as well as limitation, on the value of parameters, have a different kind [1]. In the resulted terms an optimization task is formulated as an one criterion task of the nonlinear programming with limitations. For its decision a method, described in [2] and realized in the system of computer mathematics of MATLAB, was used. The optimum values of managing parameters of  $H$  are got in tables given,  $h$ ,  $d$  for the most widespread model of Okamuri-Hata [1] and a level of signal for the values of frequency is 900 Mhz and 1800 Mhz. **Conclusions and prospects of subsequent researches.** The offered method of optimization of power coverage of wireless communication networks can be effectively used for planning of mobile communication networks and determination of areas of visibility of the receiving station taking into account the power level of the accepted signal.

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**Microprocessor system for control of the test vibrostand / V. Melnik // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 46-49: Pic. 1. – Ref.: 6 title.**

The article deals with the control system of the vibrostand, which includes a microprocessor, an actuator and vibration sensors. Typically, such devices include digital-to-analog and analog-to-digital converters and amplifiers.

Managing the vibrater with a microprocessor gives a number of advantages over the control of the signal generator: the ability to task any form of control signal, high accuracy of the output signal, the ability to use service tools in the software, to analyze and visualize the data on the system.

The software of the system consists of signal sampling modules, its accumulation in the memory buffer, digital signal processing by skeletons, which implement communication with the microcontroller with external devices. The article selects the hardware and software of the microprocessor of the Arduino

type on the basis of efficient algorithms for receiving the spectrum of the signal and appropriate software for signal processing was created. The software is run in C++ in the Arduino IDE environment.

The developed device for communication with the vibrostand provides implementation of the control and control algorithm for the low frequency vibrational area. In this case, a single-channel communication device was designed and manufactured, which easily connects to most existing microprocessors of the Arduino series via the COM port. A software package for forming and issuing control signals on the vibration stand is also developed, which is accompanied by a user-friendly interface.

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**Methods to minimize distortion of the disturbance profile when measuring the pulse pressure in liquid media / V. Pozdeev, O. Melnik // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 50-54. – Ref.: 6 title.**

The work is devoted to the development of methods for minimizing distortions of the perturbation profile when measuring the pulse pressure in liquid media to eliminate errors in the measurement results during further data processing. In this regard, a spherical sensor is the simplest object of modeling, and the combination of metrological advantages with the possibility of an analytical description of the sensor should be considered a significant advantage. Based on the analysis of the characteristic features of pulsed hydrodynamic measurements, methods have been proposed for minimizing distortions of the perturbation profile when measuring pulsed pressure in liquid media. The problems of reducing measurement errors by the optimal choice of the parameters of the measuring path and the problem of regularization of the obtained solutions of the inverse problem are considered. The application of the proposed methods and the recommendations given will ensure the stability and reliability of the indications of the equipment as part of the information-measuring complexes for monitoring high-speed processes in pulsed technologies.

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**Determination of singular points of a discrete disordered vector field in a two-dimensional space / Ye. Pugachov, V. Chernyak // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 55-62: Pic. 8, tabl. 1. – Ref.: 3 title.**

Let the vector field  $A$  given continuum and it is continuous at all points of a plane section, except for some. The points of the region in which the field is indeterminate or discontinuous, as well as the points in which the field vectors are zero, are called special points of the field  $A$ . The definition of singular points of a continually given vector field implies the solution of the equations in which it is given. The differential equations on the plane are studied relatively well, although the exact solution of a particular equation can be a complex (or even insoluble) problem. The transition to multidimensional spaces complicates the solution of nonlinear equations (even in 3-dimensional space). The goal is to develop a method for determining the coordinates of singular points of a discrete representation on a uneven grid of a vector field in a two-dimensional space and to estimate its accuracy on the example of different vector fields given continually.

There are three ways to define specific points, of which the third is a continuation of the two previous ones. First, we arrange the set of points - we perform the triangulation of Delone, as a result, we divide the set into elementary cells (triangles) and establish adjacent vertices of the set of points. After that we define the special points. In the first and second methods, we define them as points in which the coordinates of the field vectors ( $A_x, A_y$ ) are close to zero. To do this, in the first method, alternately, through each cell, we carry two planes (in the second method, the second-order surfaces), in which the third coordinates are the coordinates of the vectors ( $A_x, A_y$ ), and we seek the point of their intersection with the plane of the zero-level. This point will be a special point, provided that its projection will be inside the corresponding cell.

In the third method, a particular point is defined as a point near the edge for which the coordinates of the field vectors are as close as possible to zero. A comparison of the results of using this method with the coordinates of singular points, found analytically is done.

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**Information technology in the process of learning jewelry design / O. Savielieva, I. Artemieva, S. Aleksandriiska // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 63-69: Pic. 8. – Ref.: 7 title.**

The production of jewelry begins with the development of a sketch. Although modern technology allows you to make very complex shapes, but for this 3D-modeler you need to have a good idea of the technology of making jewelry.

The creation of jewelry products is considerably facilitated by the use of CAD / CAM systems, which allow obtaining a three-dimensional model, which will be used to make a master-model. The three-dimensional jewelry modeling allows you to realize any, even the most complicated and unusual idea of an artist.

The British company Delcam plc (in 2015 united with Autodesk) is a world leader in the development and sales of CAD / CAM systems designed for 3D design, production and quality control of products and technology of complex shape.

With ArtCAM JewelSmith you can transform the artist's sketch on three-dimensional models of jewelry with photorealistic rendering on the computer screen, virtually work on several product variants, determine the final dimensions, taking into account the shrinkage, and finally submit to the customer for approval a three-dimensional design of the product prior to its production .

The purpose of this research is to study the advanced modern computer technologies of designing, modeling and manufacturing of jewelry, an example of the use of modern CAD ArtCAM JewelSmith for teaching students of high school design jewelry is given.

The process of 3d modeling of jewelry usually occurs as follows: a drawn sketch or photo is sent to a 3D modeler, which, using special computer programs, such as the ArtCAM JewelSmith system, creates a three-dimensional decoration model.

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**Linearization of the contours of the regions recognized by neural networks on images / I. Ustenko, A. Ustenko, S. Ustenko // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 70-74: Pic. 3, list. 1. – Ref.: 8 title.**

In this paper, a method is proposed for linearizing the contours of image areas that can be obtained after recognition by neural networks. The need for the method is due to the fact that the contours are described by a large number of points, usually located in increments of 1-5 pixels, which is redundant in many tasks, for example, if you need to find rectangular or contours consisting of straight sections in the images. The developed method is implemented in the C++ programming language in the form of the lineSegment method.

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**Performance assessment of the channel stack level of TCP/IP protocols / O. Khoshaba // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 75-79: Pic. 1, tabl. 2. – Ref.: 9 title.**

**Formulation of the problem.** The study of the performance of computing systems (CS) and the construction of mathematical models contribute to the development of many disciplines, including information security, designing reliable and fault-tolerant systems, developing and testing software systems, high-load and distributed systems, and many other applied knowledge. In this regard, important issues in the field of grade performance are the improvement of indicators, the development of new methods and mathematical models for assessing the states of research objects, the study of the qualitative and quantitative characteristics of distributed computing and information resources and many other issues.

**Formulation of the task.** In this work, it is necessary to perform a study of the data link layer of the TCP / IP protocol stack using a qualitative assessment of the performance of the software tools based on synchronous and asynchronous requests to the computer network server.

**Determination of grade performance quality estimates.** In this paper, we use the definition of a qualitative assessment regarding the developed criteria for the productivity of grade, which are based on the definition of the three states of the object of study. These criteria include the presence of a request

queue (Qu) and presence of errors (Err). Based on them, calculations of quantitative indicators of grade performance are also performed.

It should also be noted that such an important characteristic of the transfer of requests as synchrony / asynchrony allows you to create the conditions of belonging of the object of study to the states in question. By definition, if the time period between the transmitted requests is less than the processing time, such requests are called asynchronous. If the time period between the transmitted requests is greater than or equal to the time of their processing, then such requests are called synchronous.

In this case, asynchronous transfer of requests in the workbench, as a rule, is characterized by the total number of requests sent, the speed of forming requests, the total execution time (processing) of requests and the state of the object of study for which requests are sent. Synchronous requests are characterized only by the total number of requests sent.

It is also considered that the queue or errors, the results of which is the speed of transmission or processing of requests are not encountered during synchronous data transfer. Therefore, synchronous request transmissions correspond to the S1 state (low load).

Asynchronous requests contribute to the transition of the object of study from the state S1 to S2 or S3. However, asynchronous requests can occur in the S1 state only when the utilization of requests is less than 1. When this indicator is exceeded, a queue of requests to the object of study is formed. In this case, the object of study passes from state S1 to S2. Therefore, we can conclude that:

- synchronous requests and the absence of a queue to the object of study are a necessary and sufficient condition for the state S1;
- asynchronous requests and the queue to the object of study are a necessary and sufficient condition for the state S2;
- asynchronous requests and the presence of errors during their processing are a necessary and sufficient condition for the S3 state.

**Determining estimates of grade performance indicators on the example of studying the data link layer of the TCP/IP protocol stack.** To investigate the performance of the data link layer of the TCP/IP protocol stack in the corporate network, the following task is posed: to determine the qualitative estimates of the grade performance using software tools that generate synchronous and asynchronous standard requests for transmitting frame length data (64 bytes) to the computer network server.

The solution to this problem is reduced to the analysis of software tools for testing the data link layer of the TCP/IP protocol stack. After analyzing the tools for studying the data link layer of the TCP/IP protocol stack, two utilities are defined: ping – for performing synchronous requests, nping – for performing asynchronous requests.

When conducting a series of experiments, the parameters of the commands for performing synchronous requests are defined, which are as follows:

```
$ ping -c 100 coll
```

To perform asynchronous requests, the following parameters were used:

```
$ nping -rate = 1000 -c 100 coll
```

```
$ nping -rate = 1100 -c 100 coll
```

where the rate parameter corresponds to the speed of requests; parameter c corresponded to the total number of requests.

After statistical data processing, they are analyzed and quality estimates of the performance of the data link layer in the TCP/IP protocol stack are obtained according to the described rules and criteria.

In the course of data analysis, attention was drawn to the increase in the variance and the standard deviation of the query processing time, which were observed with increasing states of the object of study from S1 to S3.

### **Conclusions**

The performance study of the data link layer of the TCP/IP protocol stack showed the effectiveness of using qualitative assessments. The results of the use of standard and common software tools that generate synchronous and asynchronous requests allowed us to determine the state of the data link layer of the TCP/IP protocol stack, depending on the load effects.

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**A software system for creation and storage EAV data structures / M. Shcherbyna, A. Okhrymenko, S. Kuznichenko // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019. – P. 80-87: Pic. 5, tabl. 5. – Ref.: 12 title.**

Development of the software product (SP) is often a complex process, which often requires a partial, and sometimes a complete, restructuring of the software (SW). As a solution to the problem, you can consider developing of the SW that allows you to quickly create a prototype of a future information system with a variable metadata structure. A similar alternative approach to the organization of the DB is the adapted vertical data model "Entity-attribute-value model" (EAV). The EAV model is a data model that allows you to describe the entities in which the number of attributes (properties, parameters) that characterize them is potentially huge, but the amount that can actually be used in a particular entity is relatively small. Currently, there are only developments of the SW for storing EAV structures for the Yii2 framework that were not completed to the ready version of the SP, so the actual task is to create similar an open source software.

The goal of the work is to develop a universal system for creating and storing data with a flexible dynamic changing structure designed to work with the Yii2 framework. The configuration of the entities that can be stored by the system may differ from schematics to schematics, from project to project, they can be easily configured with the help of the WYSIWYG editor.

For implementation of the SW were used MySQL DBMS and frameworks AngularJS and Yii2. The RESTful approach was used to interact with the front end and backend. The basis is the structuring of queries and responses using the JSON format. The system is an analog of the SP for implementation in the OSS and BSS field, so it is possible to integrate it into other systems using the RESTful API.

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**Software implementation of the aggregator of social networks / M. Yakovenko, A. Okhrymenko, S. Kuznichenko // Geometric modeling and information technologies. – 2019. – № 1 (7), April 2019 – P. 88-94: Pic. 7. – Ref.: 8 title.**

An aggregator of social networks is a software product or service that collects information from different social networks in one source. Most aggregators use REST APIs of social networks that determine the level of access to functions and resources when using these protocols. The main functions provided by the social network aggregator: collecting, processing, grouping, analyzing, and issuing information according to the user's request.

The purpose of the work is to develop a service for administering social networks to keep track of user's accounts, as well as to ensure that they work with them and receive information from them.

The C# programming language and the Windows Presentation Foundation (WPF) technology were chosen to develop the service. SQLite is used as DBMS. The development platform was chosen Universal Windows Platform (UWP). The UWP application can run on multiple devices, including Windows PCs, tablets, and smartphones. Some UWP applications may work on other types of Microsoft devices, including Xbox, HoloLens, and IoT devices. The development used the architecture of the network protocols REST or RESTful API.

The service supports e-mail and the following set of social networks: «VKontakte», «Facebook», «Twitter», «Google+», «Linkedin» and «Tumblr». The user can set up an account, authorize, specify how he wants to perform posts: private messages on the «wall», in a group, records on his behalf or on behalf of the group, and so on. These settings are unique to each social network. The service provides the user with access to the entire history of publications, which can be filtered by different criteria and control their status. The developed service has the ability to flexible settings for publishing content in social networks and continuously update according to the wishes of user's.