



## INFORMATION TECHNOLOGIES

## INFORMATION TECHNOLOGY OF SCALING CLOUD APP WITH VARIABLE LOAD PEAKS

page 4–11

One of the main advantages of cloud computing is ability to adapt to rapid changes of user count via web app scaling that allows deploying computing resources only when there is a demand. Modern systems of web app automatic scaling run base on reactive scaling rules. Such rules perform initialization of a scaling process when some app metric, for example CPU load, reaches a critical value. This approach is efficient in general, but in case of short and intense load peaks, there can be problems in cloud app functioning during time period between starting of cloud app scaling and final deployment of computing resources. Developed information technology removes this disadvantage by forecasting of cloud app usage and deploying computing resources in advance. Forecasting of cloud app using is the core idea of proactive scaling.

Developed information technology of cloud app scaling is based on combination of reactive and proactive scaling. Comparison of cloud app efficiency shows that using of developed information technology of cloud app scaling allows increasing general web app efficiency by 8 %. This allows cutting spending on cloud application hosting and making cloud application more responsive.

**Keywords:** cloud computing, PaaS, cloud app scaling.

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## DEVELOPMENT OF A SOFTWARE SYSTEM FOR AUTOMATED FORMATION OF COMPLICATED SEARCH QUERY FOR COMPLEX STRUCTURED DATA

page 12–15

In this paper it is proposed the algorithm of formation of complicated search query for complex structured data on the basis of operators and keywords. On the basis of this algorithm it is developed software that allows automating the process of forming complicated search query for complex structured data. This approach is the basis for the software subsystem for search of bibliographic descriptions of posts of information-analytical system «ScienceLP». Using the keys and operators allows carrying out the ranking of search results by the number of matches. Next search modes are developed: «normal», «text professional» and «professional visual mode». These modes allow the user to create a search query based on an existing experience of search: without the use of keywords and operators, using keywords and operators, visually selecting operators and keywords.

**Keywords:** search algorithm, bibliographic description, keywords, search operators.

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#### SOFTWARE FOR CALCULATION OF BELT CONVEYORS AT THEIR COMPUTER-AIDED DESIGN

page 16–18

The article is devoted to developing algorithms and software for automated calculation of the main traction characteristics of the conveyor for the second option, involves designing the conveyor for installation in a particular formulation, when given the receiving capacity, operating performance, circuit tracks, production type, method of installation of the load it is determined velocity, width, type and strength of the belt, power and traction drive factor, tensioner stroke, drive starting time, force of the braking device and size of the assembly units. The basis is known calculation method. There are considered various options of the conveyor – single and double-drum, with the presence of the clamping roller or belt, with rigid kinematic coupling or connection between independent drums. It is formalized the second stage of the problem of computer-aided design of mine conveyors, using known methods approved by the State Standard. It is developed visual form to the user interface based on the example of the basic parameters of mine conveyor which is established in the programming language Delphi 7. To automate the calculation of these parameters is used programming language. The visual forms of the calculating algorithm realization of traction capacity of the conveyor drive are given.

**Keywords:** conveyor, parameters, traction factor, tilt angle, standard, calculation, method.

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#### EFFECTIVENESS ANALYSIS OF RESOURCE USAGE OF MULTISERVICE INFORMATION AND TELECOMMUNICATION NETWORK

page 19–23

The article is devoted to the task of providing the requirements for the rapid exchange of information in the information and telecommunication networks. It is conducted an analysis of the factors determining the efficiency of information and telecommunication network and the use of network resources and methods and mathematical models for control of the telecommunication networks. It is shown that modern methods of data flow control, though, provide load balancing of network resources, but does not take into account some of the factors causing the fluctuation nature of network traffic. The basic methods of controlling the distribution of traffic on the network and used mathematical models used are considered. It is shown that the efficiency of the use of network resources can be enhanced by the development and application of adaptive management. It is determined multiparameter function evaluating the performance of the network protocol. It is given the criterion of selection of the most efficient network protocol that takes into account the critical and non-critical parameters of the network, as well as the processing of information messages. As a generalized indicator of efficiency of the total processing time are selected informational messages at a fixed time interval. The mathematical optimization problem of choosing the most efficient network protocol is formulated. The results can be used in the development of management techniques for specialized multi-information telecommunication networks.

**Keywords:** information and telecommunication network, adaptive management, efficiency criteria.

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### DEGRADATION PROCESS SIMULATION OF COMPUTER COMPONENTS OF DISCRETE DEVICES

page 23–26

Formation and research of the materials with predetermined properties is one of the leaders in the research field of physical

degradation. During the process of creating computer components we have to combine different types of homogeneous materials. Through a combination of these materials it is obtained composite materials, for which the important problem is durability and reliability.

The process of material degradation of discrete device is «slowly» in relation to the depreciation time of the device. Physical degradation of computer components leads to malfunction of discrete devices. Preliminary simulation of the physical change of the material under certain boundary conditions allows pre-assess the risks in the process of creating discrete device, and in the process of checking reliability. The combination zones of two different materials are attended in the article. Physical and chemical processes that cause the appearance of interphase entities have different origins. Hence the need for a model development of specific class of problems in mechanics of interfacial interaction is occurred.

It is simulated the physical behavior of materials of computer components of discrete devices and investigated the conditions of their degradation. The material behavior is conducted in the environment Matlab, simulating the behavior of the stress function from values of which is depended a strength (brittleness) of the material. Process simulation allows carrying out preliminary assessment of the behavior of composite components of discrete device that accelerates the research process of degradation over time.

The brittleness of the material causes a malfunction of the device due to improper current flow in the n-p-n transitions and reduces their reliability.

**Keywords:** reliability, discrete device, composite material, analysis, simulation, physical degradation.

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### IMPROVING THE EFFICIENCY OF MULTI-CHANNEL VOICE RECOGNITION SYSTEM

page 26–31

The use of methods of noisy signal treatment in voice recognition is discussed and some of the research results in this area are given. The main aim of the study is improving the effectiveness of recognition system of voice commands in a difficult acoustic environment by improving the signal/noise ratio due to the use of the spatial separation of signals using multiple directional microphones and digital signal processing on the basis of adaptive interference cancellation. The use of modern methods of language voice recognition together with the adaptive compensation method for processing a noisy signal can improve the accuracy of voice recognition. The algorithmic and structural approaches to solving the problems of sound processing, resulting in difficult acoustic conditions for further recognition of voice commands are discussed in the article. The presented method allows increasing the accuracy of the definition of basic and auxiliary channels of multi-channel voice recognition system to increase the efficiency of adaptive compensation. The method and the algorithm are designed to automatically determine the most appropriate channel for base and support channels in accordance with the method of adaptive interference cancellation. We propose to use proximity measure between the received signal and the standard obtained at command recognition on the basis of non-linear time alignment as a criterion for determining the base channel. The research results can be applied to voice recognition in the voice control systems of equipment and vehicles.

**Keywords:** voice recognition, adaptive compensation, proximity measure.

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### THE INTEGRATED ENVIRONMENT SELECTION AND PROTOTYPE CREATION OF THERMAL MONITORING SOFTWARE

page 32–40

The components of information technology in the technological and technical auditing and monitoring of municipal buildings are investigated. The integrated environment is chosen and software prototype of subsystems of thermal monitoring software is created. The subsystem is aimed at the analysis and processing of heterogeneous data on energy efficiency of municipal property and performs decision support and cost calculations of energy-saving measures.

The study was carried out as follows:

1. The selected programming language is Java.
2. The selected development environment is NetBeans. NetBeans IDE is integrated development environment written in Java. NetBeans program can run on platforms Windows, Linux, Mac OS and other platforms that support Java virtual machine (JVM), supports the development of programming languages Java, C/C++, PHP, JavaScript and others.
3. The prototype of subsystems of thermal monitoring software is developed and described.

These researches may help management of housing and communal services, economics and financial management of city councils to analyze and make ODA decisions to initiate energy saving projects.

**Keywords:** information technology, integrated environment, prototype of subsystem, thermal monitoring, energy efficiency.

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**CHOOSING THE OPTIMAL NUMBER OF GENERATIONS IN THE GENETIC ALGORITHMS WITH BINARY-REAL SOLUTIONS CODING**

page 40–45

This work is devoted to the problem of choosing the optimal stopping criterion in the transition from the binary coding to the real number coding in genetic algorithms with binary-real representation of solutions in the chromosomes. The main criteria for stopping the modern genetic algorithms based on the phenotype or genotype of individuals are considered. Their advantages and disadvantages are presented.

The main purpose of research is to develop a new intermediate stopping criterion of genetic algorithm with binary-real coding. The developed criteria based on the fact that the values of best chromosomes change within a certain low threshold for some generations. New intermediate stopping criterion allows the efficient spending computing resources using genetic algorithms with binary-real coding.

A comparative efficiency analysis of the new stopping criterion of the transition from one type of coding to another in the optimization of complex multi-extremal function is conducted. Efficiency analysis allowed forming recommendations for the selection of the threshold values in the calculation of a new stopping criterion. The same analysis showed inefficient use of population convergence criterion as an intermediate stopping criterion. The advantages of the new criterion above the criteria based on the fact that the value of the best chromosomes is constantly for several generations are presented.

**Keywords:** genetic algorithm, binary-real coding, stopping criterion, optimization.

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**RESEARCH OF SOFTWARE PACKAGE MODULES FOR IDENTIFICATION OF DYNAMIC OBJECTS**

page 45–49

There were researched the packages of software modules for dynamics objects identifying, that were make ability of saving in opposite of simple software modules for automatic forming of applications. The article shows the place of the packages of software modules for checking of dynamics objects identifying on stationary condition and also the ability of using for many times adaptively identifying systems. The package of software module consists of the package core, data base and models, which can be changed according to subjects. The input for software module is the task of identifying of some dynamic object with static information about this object with the time interval. The output is identified dynamic object model and forecast the behavior of this object for the future. The process of creating packages of software modules for dynamics objects identifying should be connected to the subject area, but because of modularity it can be possible to use separated software packages of modules with different subject areas.

**Keywords:** packages of software modules, identification, dynamic objects, modeling, management, system, model parameters.

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# MATHEMATICAL MODELING

## COMPUTER SIMULATION OF THE INTERPHASE INTERACTION IN METAL ALLOYS

page 50–53

In this article we propose a mesoscopic model of the interphase interaction in binary metal alloys. The difference of partial molar volumes of the components of alloy was taken into account during the mathematical model building. The simulated sample is represented as a two-dimensional region, divided into square cells of nanometric size that are characterized by the value of concentration and belonging to the phase. Intermediate phase of alloy can include arbitrary forms. The proposed mesoscopic model provides a phase cells change and the implementation of the law of conservation of matter. Software implementation of the developed model is executed. The results of computer simulation are compared with the results of laboratory experiments interphase interaction in a binary metal alloy Mg-Al. The obtained computer model allows a numerical study of the evolution of the phase composition of alloy in the process of diffusion interaction.

**Keywords:** computer simulation, mesoscopic model, interphase interaction, intermetallic phase.

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## TAKING INTO ACCOUNT TYPE I AND II ERRORS OF SWITCHING DEVICE FOR SYSTEM WITH HOT REDUNDANCY

page 54–59

One of the ways to improve the reliability of technical systems is the use of hot redundancy. Switching between the main and reserve elements makes switching device. When analyzing the reliability of such systems it is important to consider the impact of switching device on the reliability of the system. This influence is evident in the mistakes of the first and second kind that is the wrong switch or switching time of admission. Both errors reduce reliability of the system and lead to underutilization of resources. It is proposed a model of reliability of duplicated system with hot redundancy and imperfect switching device to determine the likelihood of its success. The peculiarity of the model is that it adequately takes into account type I and II errors for the switching device. Reliability of the system is described mathematically by the  $k$ -terminal dynamic fault tree, and the probability determined by the characteristics of homogeneous Markov model. It is quantitatively shown how increasing options that meet these errors, reduces the probability of failure of the system.

**Keywords:** reliability model, dynamic fault tree, hot redundancy, switching device.

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### DESCRIPTION OF THE PHYSICAL PROCESSES OCCURRING DURING CRYSTALLIZATION OF CONTINUOUS CASTING

page 60–65

The article describes the processes occurring in the continuous casting of steel. It is considered a cascade method of producing a continuous cast ingot. It is given the scheme of the cascade method of continuous casting ingot, as well as the formula for calculating the depth of the liquid pool. It allows calculating not only the depth of the liquid pool, and a length of the described zones and multilevel installation height. It is given the mathematical model of an intensification of crystallization process by freezing metal on a continuous crystallized ingot. The proposed technology of producing large continuous ingots based on the proposed mathematical model can increase the speed of metal casting, reduce the overall weight and dimensions characteristics of continuous casting machine, improve the ingot quality and reduce the crystallization and the resulting depth of the liquid pool.

**Keywords:** crystallization, buffer zone, solidified skin, casting mold, continuous ingot, two-phase zone.

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