

SUMMARIES

Vinogradova E. M., Krivskaya K. A. **Mathematical modeling of triode electron-optical system with modulator on the basis of field tip.**

The problem of field emission cathode mathematical modeling is considered. The beam formation and control system on the base of the immersion and electrostatic lenses are extensively applied in various domains of instrument engineering. Nowadays methods of the low-energy beams focusing in micro- and nanoelectronics are under investigation. For example, these beams are applied for surface diagnostics. The electron-optical system is a sophisticated structure, and its parameter determination requires long preliminary computation. The theoretical model development allows to reduce it to some rigorous mathematical problems. For electron-optical systems representing the systems of beam forming and control in electron guns with field emission electron cathodes, the main difficulty in their characteristics computation is that the field emitter curvature radius differs from electrode dimensions by few orders of magnitude. In this paper the physical model of the rotationally symmetrical triode electron-optical system with the field tip and modulator is considered. The solution of Laplace equation for the electrostatic potential distribution is presented for the triode system: the tip as a field emission cathode of the special shape — “sphere-on-spindle” on the spherical substrate (anode) and the spherical segment as a modulator. The overlapping subregion method to find the unknown coefficients for the potential distribution is used. So the initial value-boundary problem is reduced to the system of the linear algebraic equations. The potential distribution is calculated for the whole region of the system.

Key words: field tip, field emission, electrostatic lenses, electron-optical systems potential distribution.

Gormin A. A., Kashtanov Y. N. **Variance reduction for option pricing.**

Monte Carlo method is applied to estimating options with several parameters in the case of a diffusion model. An option contract has an underlying asset. The price of the underlying asset is a stochastic process. An option contract has a number of parameters like a strike price, an expiration date and others. We are usually interested in several prices of options on one underlying asset with different values of parameters. We consider a number of estimators and the methods of important sampling and control variates are applied to minimization of the weighed sum of their variances (weighed variance). Estimators with the minimal weighed variance are pointed out. Optimal estimators are approximated for particular options. The efficiency of these estimators in variance reduction is demonstrated in numerical examples. The influence of weights on variance reduction of particular estimators is also shown.

Key words: weighted variance minimization, variance reduction, importance sampling, control variates, diffusion model.

Demyanov I. S. **A modification of the Novikoff method in identification problems.**

The problem of identification of two sets of points in the finite dimensional space by means of visual learning is considered. In the process of Visual learning the student is shown elements (points) of the sets and is informed to which of the sets they belong. The student’s problem is to learn how to identify other points. To do this it is necessary to construct some identification rule (IR). Usually an IR is given in the form of a functional whose values allow to identify the points. One of the simplest and widely used classes of IRs is the class of linear functionals. Then the identification problem is reduced to the one of constructing a hyperplane separating the sets under consideration. In the paper the case where the sets cannot be separated by a hyperplane is discussed in detail. Then it is possible to state the problem of constructing a separating hyperplane with some error.

One such a case is studied in the paper and a method of constructing an "almost" separating hyperplane is proposed. The method is a modification of the Novikoff method in Learning Theory for the case of strictly separable sets. The method is effective if the bulk of the points can be strictly separated by a hyperplane.

Key words: identification problem, Novikoff method, theory of learning.

Ermolaeva N. N., Kurbatova G. I. Mathematical model of expanding liquid shell.

The mathematical model of an isothermal expanding process of a liquid shell in the state of weightlessness in spherically symmetric case for incompressible Newton's liquid meeting supplementary requirement of hardening at the certain time is dealt with. The solution of model equations is expressed in the form of dependence from internal shell radius behaviour. is obtained. Function $R(t)$ satisfies a time independent nonlinear ordinary differential equation. Various computational algorithms of this equation solution are suggested based on implicit schemes, schemes of predictor – corrector type and modified explicit scheme. The results of numerical calculations on algorithms suggested are presented. The conclusion about computational algorithm advantage based on an explicit modified scheme is grounded. The analytical solution of a hydrodynamic problem of calculation of speed and pressure fields in an expanding liquid shell is obtained. The direct and inverse problems of liquid shell evolution are formulated. The criterion of admissibility of gas feeding regime is stated. On the basis of the analytical solution of a hydrodynamic problem and this criterion the important for practice recommendations concerning the choice of acceptable conditions of process realization and materials with required rheological properties are formulated. Key words: mathematical model, expanding liquid spherical shell, solving stiff time independent nonlinear systems of ordinary differential equations.

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Igolkin V. N. About a calculation of an unruin probability of an insurance company.

A capital of an insurance company is changing as $u(t) = u + \sum_{k=1}^{N(t)} (c\tau_k - X_k)$ in the main Lundberg–Cramer's model; u is an initial capital, c is an intensity of a premium income, X_k are random claims, $F(x)$ is a distribution function of claims, $N(t)$ is a point process with a parameter λ , $\tau_k = t_k - t_{k-1}$ are intervals between claims. A model in which the intensity process is markovian is considered in [1]. A more general model is considered in [2]. The intervals between claims are several types in the model, they are connected in markovian chain, a type of an interval corresponds to the type of the claim, which came in the end of the interval. A system of integral equations for some auxiliary quantities $P_j(u_j)$ is given in [2]. These quantities are necessary in order to find an unruin probability. If the Laplace's transform is used in order to find P_j , then an unknown constants present in the obtained system of algebraic equations. Some equations for the unknown constants are constructed in the case, when there are claims of the two types only and intervals between claims are exponential ones. A numerical example addused.

Key words: markovian chain of claims, the Lundberg–Cramer's model, an unruin probability.

Kossovskaya T. M. Recognition of objects from classes closed under a group of transformations.

A problem of recognition of an object from classes closed under a group of transformations G^* with a finite number of generatrixes $G = \{g_1, \dots, g_r\}$ by a logical-objective recognition system is considered. For a logical-objective recognition system we understand such a pattern recognition system in which, first, a recognizable object is presented as a set of its elements and, second, both descriptions of objects and descriptions of classes are made with the use of predicates characterizing properties of elements of the recognizable object or relations between them. For every generatrix (elementary transformation) of the transformation group a notion of transformation description

is defined as an equivalence which poses changings of the object elements while acting such a transformation. Such transformation descriptions have the form $B_j^l(\bar{x}) \Leftrightarrow C_j^l(\overline{g_j(x)})$, where $B_j^l(\bar{x})$ and $C_j^l(\overline{g_j(x)})$ are elementary conjunctions. Problems of invariant recognition are formulated.

Invariant identification problem. *To check wheather the object ω or its part belongs to the class Ω_k , if the class Ω_k is closed under a group of transformations G^* with a finite number of generatrixes $G = \{g_1, \dots, g_T\}$.*

Invariant classification problem. *To find all numbers of classes k such that $\omega \in \Omega_k$, if classes Ω_k are closed under a group of transformations G^* with a finite number of generatrixes $G = \{g_1, \dots, g_T\}$.*

Invariant analysis of complex object problem. *To find and classify all parts τ of the object ω such that $\tau \in \Omega$, if classes Ω_k are closed under a group of transformations G^* with a finite number of generatrixes $G = \{g_1, \dots, g_T\}$.*

These problems are reduced to the proof of dedusibility from the object description and the set of transformation descriptions formulas $\exists \overline{y} \neq A_k(\overline{y})$, $\bigvee_{k=1}^K A_k(\overline{w})$, $\bigvee_{k=1}^K \exists \overline{y} \neq A_k(\overline{y})$ respectively. An algorithm of finding a transformation (if such one exists) which is a superposition of not more than R elementary transformations and distinguishes the recognizable object from some one from a class closed under a group of transformations with a finite number of generatrixes is offered. Upper bounds of number of steps of this algorithm are proved. For the class closed under a group of transformations G^* with a finite number of generatrixes $G = \{g_1, \dots, g_T\}$ with the restriction that the embedding depth of a term defining a transformation from the group G^* is not greater than a given number R , the number of invariant identification algorithm steps depends of the algorithm chosen for the proof of the consequence of the formula $\exists \overline{y} \neq A_k(\overline{y})$ from a finit set of closed atomic formulas. Thus while using an exhaustion algorithm the number of invariant identification algorithm steps increases in $T^R R |S|$ times. If an algorithm of derivation in predicate calculus search is used then such an increasing is $T^R (1 + \frac{R\delta}{s})^a$. (Here $|S|$ and s – the number of different occurences of objective constants and maximal number of occurrences of a predicate in the description of the recognizable object; a – maximal number of occurrences of atomic formulas in elementary conjunctions containing in the description of the k -th class; δ – maximal change of number of atomic formulas with the same predicate in the transformation descriptions.)

Key words: pattern recognition, predicate logic, invariance to a transformation group, algorithm complexity.

Kreps V. L. Finite non-cooperative games with unique equilibrium points.

A necessary and sufficient condition for a given completely mixed strategy N -tuple to be the unique Nash equilibrium point of some finite N -person non-cooperative game is demonstrated. The condition means the following inequality: the maximal dimension of the simplex of player's mixed strategies is not more than the sum of analogous dimensions of other players.

Key words: finite non-cooperative games, Nash equilibrium point.

Krivulin N. K. On solution of a class of linear vector equations in idempotent algebra.

A class of vector equations that are linear in the sense of an idempotent semiring is considered. In particular, the equations appear in idempotent algebra when solving the problem of evaluation of the coefficients in decomposition of a vector into the vectors of a given system. Existing results are normally based on representation of existence conditions and solutions in terms of operations in the dual semiring. In many cases, only a particular (maximal) solution is given, whereas the problem of representing all solutions remains to be investigated. In this paper, an approach is proposed which reduces the solution of the equation to the analysis of distances between vectors in an appropriate metric space. A metric is taken which can be evaluated only through the basic binary operations in the semiring together with the inverse operation. This allows one to get existence conditions as well as the general solution in a compact vector form in terms

of the underlying semiring. The obtained results are clearly and conveniently illustrated by geometry in the plain with the conventional Cartesian coordinate system. In conclusion, solution of a combined system that consists of linear vector equations and inequalities is considered.

Key words: linear vector equations, existence and uniqueness conditions, linear dependence, metric space, idempotent semiring.

Kudryashova E. V. **Computation of bifurcation parameters for digital phase-locked loop.**

Bifurcation theory is very important in digital phase-locked loops (DPLLs) which are frequently encountered in radio engineering and communication and have been used during 60 years. DPLLs showed their high efficiency in eliminating a clock skew—an undesirable phenomenon arising in parallel computing. Analysis of equations of PLL and finding bifurcation values of the parameters can determine the conditions for existence of clock skew correction. Mathematical discrete model of digital phase-locked loop with sinusoidal characteristic of phase discriminator is considered. Bifurcations parameters of period doubling bifurcations are calculated. The Feigenbaum's effect for nonunimodal map which describes such DPLL is investigated by theoretical approach and numerical calculations.

Key words: PLL, period-doubling bifurcations, bifurcation parameters.

Levina A. B. **Encryption with first order splines.**

Cryptography nowadays is used almost in all information systems – from Internet to databases. Maintenance of a required level of protection without it is impossible. By means of cryptographic algorithms swindle attempts in systems of electronic commerce are prevented and legality of financial transactions is provided. Every year the value of information protection maintenance increases, however nobody can give an absolute guarantee of safety. In the given work the algorithm of enciphering the information based on wavelet decomposition of splines of the first degree on a non-uniform grid is presented. Using splines and their wavelet decompositions leads to a rather wide variety of the keys defined by mesh and the order of ejection of nodes. The suggested algorithms can also be applied to the key transfer. The presented algorithm has the Feistel Structure, but there is no XOR operation with the round key, as it was presented in all block ciphers. Algorithms have easy mathematical structure for analysis. The algorithm provided can work with the block length equal to 512 and 1024 bit, which is not possible for AES or 3DES. It was also made researches to use wavelet decomposition of splines of the second and third degree in symmetric block cryptography. Presented algorithm can provide good secrecy.

Key words: block ciphers, first order splines, non-uniform grid, formulas of decomposition and reconstruction from wavelet theory.

Nikushchenko D. V., Chistov A. L. **An algorithm of numerical simulation of wings systems with high thickness ratio.**

Main approaches to determination of hydrodynamic characteristics of underwater vehicles' wings systems (like elements of the fin, fairwater, etc.) are discussed. Such systems contain wings with high aspect ratio (12...25%), therefore it is necessary to take it into account during simulation. The «WingSim»software presented allows to simulate the flow around of such systems on a base of panel method. Results of numerical simulation of single wings and their systems are given.

Key words: liquid, wings systems, rheology, model, flow.

Novoselov V. S. **Asymptotically optimum multiparameter transfer. 2. Second and third approximations.**

The variation method of the optimal traffic control in problem of transfer in gravitational field

with second active sections is proposed. An analytical solution of third order taking into account of reduced reactive velocity, of the duration flight is given.

Key words: analytic methods of spaceflight mechanics, maneuvers in the central gravitational field, optimal transfers between orbits, optimal direction of the thrust.

Petrenko E. I. On optimization of algorithms of invariant set localization of dynamical systems using code generation.

Set oriented methods belong to the well-known class of the methods for numerical investigation of dynamical systems behaviour. They are based on the approximation of the phase space of a dynamical system by a finite set of cells. The construction of the images of cells enables us to gain an idea of system behaviour. By applying successive subdivision process to the initial covering and tending cell diameters to zero we obtain the approximations of the phase portrait of the system. The symbolic image method belongs to this class as well. Symbolic image of a dynamical system is an oriented graph, which is constructed using both the system and the given covering. Vertices of the graph correspond to the cells of the covering and there is an edge between two vertices if the image of the cell corresponding to the initial vertex intersects the cell corresponding to the terminal one. On this graphic interpretation, paths on the graph can be related to the system trajectories, a path may be connected with several trajectories. A symbolic image is a finite approximation of the system, and the construction of a sequence of symbolic images according to the successive subdivision process results in the approximation of system dynamics with a given accuracy. In the present paper, we consider the application of on-the-fly code generation to speed-up the algorithms of invariant set localization of dynamical systems. The algorithms contain many loops both on the dimension of a system and the loops for vertices enumeration. Our approach is to generate a code for given dynamical system to omit unnecessary loops and simplify the calculation process. The generated code is compiled and loaded into the program.

Key words: dynamical systems, numerical methods, symbolic image, code generation.

Pronina Yu. G. Periodic problem of concentrated forces in an elastic half-plane with holes.

The plane problem of the theory of elasticity for the linearly elastic half-plane with an infinite periodical series of free-form holes bounded by identical smooth contours is investigated. The half-plane is considered to be subjected to the tension at infinity, periodic external load at the rectilinear boundary and at the surface of cavities. Periodic concentrated forces or different types of singularities are also supposed to be applied within the solid concerned. The periods of all the systems are taken to be equal. The problem has been formulated using the Kolosov–Muskhelishvili complex stress potential technique. The results have been obtained by the superposition of two auxiliary problems. The first of them is the problem of the intact semiplane (without holes) under given periodic outside load at the straight boundary, tension at infinity and under known periodic concentrated forces. The second one is the problem of the intact semiplane under unknown periodic inside load (applied within the body) to be defined. Applying formulas of summation of series to complex potentials for single and distributed forces at points within a half-plane, the solution for the periodic problem has been written. The solution found thoroughly satisfies boundary conditions at the straight-line border of the semiplane and at infinity. For the surface of the cavities resolving Fredholm integral equations of the first kind in unknown load have been derived. Further, using the concentrated fictitious forces, the problem has been directly reduced to the system of linear algebraic equations. The system of the equations solved, stress-components at any points within the body can be defined by Kolosov's formulas. A worked out example for the semiinfinite plane with elliptic cuts is presented. Calculations have shown that increasing the period of series of holes may lead to both rise and fall of stresses in the half-plane depending on external load.

Key words: elastic half-plane with holes, periodic cavities, concentrated forces, stress concentration.

Sokolov S. V. Stability conditions and estimates of solutions for a class of complex systems.

One of the main problems of the control theory is studying of stability of the complex dynamic systems, which are characterized by multi-dimensionality, great amount of different links between subsystems and are described by non-linear equations. All this results in serious difficulties and requires easier ways of dealing with the matter. That's why is widely used the idea of decomposition, i.e., separation of the complex system into several simpler subsystems of lower dimensionality. For each subsystem a definite function of Lyapunov is found in order to then study the stability of the complex system in general. In the present work the complex system consisting of n interacting oscillators is reviewed. Each of isolated subsystems is supposed to be essentially non-linear and is described by the equation of Lienard. By means of Lyapunov functions' method are achieved sufficient conditions of asymptotical stability of the studied system's zero solution. Estimates of solutions for the considered system were found. As far as Lyapunov's functions constructed depend on the set of parameters, the task of finding the most precise estimates in the space of these parameters was solved.

Key words: stability, Lyapunov's functions, estimates of solutions.

Surovtsova T. G., Chistiakov S. P. On statistical test construction for a literary work authorship attribution.

The problem of anonymous or pseudonymous literary work attribution has a long history and a broad range of applications. Statistical tests are extensively used for this problem solving. However these tests enable us to give an opportunity for testing an authorship hypothesis only for a single linguo-statistical parameter. This paper proposes a new approach to the statistical test construction for testing an authorship hypothesis. The approach allows us to take into account all available linguo-statistical parameters simultaneously. It is based on an inductive construction of a sentence classifier which serves as a basis for the statistical test for testing hypothesis whether a text comes from a particular author's pen. A statistical test based on an inductive construction of a sentence classifier has been used for testing F. M. Dostoevsky's authorship. The results obtained show the approach capacity for work even in the short literary text case.

Key words: text classification, authorship attribution, statistical tests, inductive construction of classifiers.

Tulupyyev A. L. Probabilistic estimates consistency in conjuncts and disjuncts ideals.

Algebraic Bayesian networks (ABN) are one of the probabilistic graphical models of knowledge pattern bases with uncertainty. The paper goal is to present a formal definition for ABN and to investigate the problems of consistency maintenance of those which are connected and acyclic. In the theory of algebraic Bayesian networks, the model for a knowledge pattern (KP) is a conjuncts ideal with either scalar or interval estimates of their probabilities. An ABN itself is a set of KP models where this set has a special structure that is referred to as an join graph. There can be considered two particular kinds of ABN structure: join tree and an join chain. If an ABN has a join tree structure, this network is an acyclic ABN. If an ABN has a join chain structure, this network is not only acyclic but it can also be represented as a path (without self-intersections) between two knowledge patterns. The paper contains definitions of the above mentioned structures, explicates the essential links between notions of a join tree and a join chain and provides a reader with the formal definition of ABNs and acyclic ABNs in this context. As opposed to the local case in which just a separate knowledge pattern can be checked for consistency or supported, in the case of an algebraic Bayesian network four different ABN consistency degrees: local consistency, external,

internal and global ones can be considered. The consistency degrees are presented in the increasing order of their computational complexity. If an algebraic Bayesian network is globally consistent, it means that there exists a probabilistic distribution over all possible ABN atom assignments that satisfy probabilistic logic axioms as well as initial estimates belonging to the ABN. Such probabilistic distributions can even make a non-empty family. In a general case, none of the rest of consistency degrees can guarantee existence of such probabilistic distribution; the paper presents a set of proper counter-examples. However, in the case of an acyclic algebraic Bayesian network its internal consistency implies its global consistency. The verification of ABN internal consistency is reduced to solving a set of the linear programming problems whose number of variables and constraints is linear regarding to the number of atoms in the ABN (taking into account the limitations imposed on the upper limit for the size of knowledge patterns). The direct verification of the ABN global consistency will require solving a set of the linear programming problems whose number of variables and constraints is exponential regarding to the number of atoms in the ABN. The fact that to verify an ABN global consistency it is enough to verify the network internal consistency provides sufficient reduction in computational complexity of the verification procedure. The paper contains brief examples that demonstrate the data keeping advantages of an ABN in comparison with the corresponding ABN-embracing knowledge pattern as well as the computational complexity advantages of various degrees of consistency.

Key words: probabilistic graphical model, knowledge uncertainty, knowledge pattern, algebraic Bayesian network, interval estimate of probability, consistency degree.

Usevich K. D. Decomposition of functions in 2D-extension of Singular Spectrum Analysis and related partial differential systems of equations.

The 2D-SSA method (the 2D-extension of Singular Spectrum Analysis) is intended to perform a decomposition of two-dimensional functions (or 2D-arrays of data, e. g. digital images) into sums of components with different structure: smooth (slowly varying) components, regular (oscillating) components and noise. The 2D-SSA method comes in two versions: discrete arguments case and continuous arguments one. Discrete 2D-SSA is based on the SVD expansion of a matrix that is composed of elements of the input 2D-array, while continuous case is based on the Schmidt decomposition of a function constructed from the input 2D-function. A key role in the 2D-SSA theory is played by the functions that have finite number of elements in their expansions (the 2D-functions of finite rank). This paper applies to the 2D-functions of finite rank in the continuous arguments case. Main results are: a general form of 2D-functions of finite rank is obtained and independence of rank (the number of components in the expansion) on the parameters of the method is shown. The results are obtained with the help of the theory of partial differential systems of equations. The same technique can be developed for the discrete case.

Key words: Singular Spectrum Analysis, SSA, 2D-SSA, 2D data, digital images, linear partial differential systems, finite rank, 2D-array.

Hieu L. T., Granichin O. N. Using application of statistics for word extraction from vietnamese documents.

For last 20 years, the field of Natural Language Processing (NLP) has seen numerous achievement in domains as diverse as part-of-speech (POS) tagging, topic detection, or information retrieval. However, most of those works were carried out for occidental languages. Thus, there clearly exists today a need to develop tools and resources for those other languages. Just recently, Vietnamese researchers have been starting being involved in NLP. Since it seems that no common methods for vietnamese word definition and word categories have been found by experts, fundamental tasks for automatic vietnamese language processing such as POS tagging, parsing, etc. become rather complicated. In the framework of this paper, we would like to implement the application of statistics to make

a Vietnamese list of words and phrases. Our project, thus, aims at building a common linguistic database exploited freely and easily during the automatic vietnamese language processing. This article proposes a new system to build a collection of vietnamese words, based on statistical methods and information entropy, as well as two new algorithms. The first – an algorithm for separation of phrases, using statistical significance, segment the phrase to smooth and simplify their further processing. The second – an algorithm adaptation, performs a cyclical process of statistical processing and separating phrases in order to obtain statistical values from the original data. This system can be used to resolve some problems of recognition and classification. In the process of training, the system classifies the elements into classes characteristic vectors while the information of these classes haven't known yet. The system itself "collects" random vectors in some compact group.

Key words: identification words in vietnamese documents, method statistics.

Shalymov D. S. Continuous speech recognition using simultaneous perturbation stochastic approximation algorithm.

Problems of speech recognition are still important today. Many of modern methods which are used to solve this problem are computationally resource-intensive. The capacity of such resources is often limited. For many algorithms it is impossible to use it in portable devices. This makes researchers find more effective methods. This paper represents the usage of the new simultaneous perturbation stochastic approximation algorithm (SPSA) for solving the speech recognition problem. Due to SPSA's simplicity and small number of operations per each iteration, this algorithm can be used as an alternative method for real time speech recognition. The noise robust speech recognition method which is based on mel-frequency cepstral coefficients (MFCC) is briefly described. Each sound-wave that entered the recognition system includes some noise. In case of noisy measurements of loss function SPSA algorithm keeps reliable estimations under almost arbitrary noise. It is very important to the speech recognition problem where the noise often represents the phase or spectrum shifts of a signal, or external environment, or recording device settings, etc. SPSA algorithm is based on trial simultaneous perturbations which provide appropriate estimations under almost arbitrary noise. The main characteristic of SPSA algorithm is that only two measurements of function to approximate loss function gradient are needed for any dimension of an unknown feature vector. Based on this characteristic it is convenient to use SPSA algorithm in a speech recognition problem where feature vectors of large dimensions are used. It is simple to use this kind of algorithm in optimization problems with the large number of variables. In that way we have an opportunity to operate with many words at once. Moreover its realization is simple for understanding and embedding in electronic devices. Effectiveness of proposed method is demonstrated in the end of the paper.

Key words: continuous speech recognition, stochastic optimization, simultaneous perturbation.

Grishkin V. M. Computer system for monitoring monuments representing cultural heritage.

The revelation of object destruction regions, definition of their parameters and identification of the types of biological affection is one of the main tasks in monitoring the state of the monuments representing cultural heritage. The methods used at present are rather labour-consuming and do not allow to automatize a monitoring process. It is suggested to provide monitoring with the help of regular electronic survey of the objects with the subsequent processing of obtained images. Regions of destruction are revealed by means of segmentation of coloured and brightness regions on the images, specific for biological affection and mechanical destruction. Image segmentation is provided with the help of cluster analysis methods. The methods of image recognition are used for classification of destruction regions. The methods are based on information attributes revealing and comparing them with some master values. The structure of the program algorithms

realizing a monitoring system is presented. Processing results are saved in the database. Database contains all information of a monitoring object, including a description part, initial data, images of the segmentation districts, types of the districts with pointing out the types of the biodestructors and degree of their aggressiveness, and parameters of the regions as well. Experimental work with the system proves the validity of the approach to monitoring.

Key words: monitoring, image processing, cluster analysis, pattern recognition.

Ivanov A. N., Koznov D. V., Tyzhgeyev M. G. User interface modeling for Rich Data Intensive Internet Applications.

Rich Internet Applications (RIA) are next generation information systems following after desktop applications. They are used anywhere and has become near to desktop applications in user interface, business logic and other facilities. Actually, RIA combine functionality of usual desktop systems, multimedia systems and traditional html-applications. It is very important to provide new development approaches and tools for them. In this paper we suggest to integrate modeling techniques of data-intensive Web applications (WebML/WebRatio) with REAL-IT technology that provides advanced generated-based modeling facilities of user interface. WebML is a standard de-factum in Web modeling area but it has a lack support of rich interface modeling. We add to WebML some constructions from REAL-IT to provide easy way of specifying wide-used window forms. We also support comboboxes modeling. At least we expand data model incorporating many-to-many relationships with properties.

Key words: Web-applications, visual modeling, WebML, REAL-IT.

Kan D. A. A problem of synthesis of sentences in a natural language.

A method of synthesis of sentences in a natural language is proposed. The synthesis of the sentences has many applications, amongst which there are the automatical abstracting, plagiarism detection systems and machine translation. A subtask of the natural language synthesis is the problem of linearization as the task of searching the place for a given word in a sentence. The existing approaches to linearization can be grouped into two main categories: the statistical synthesis (natural language statistical models) and the classical synthesis (natural language rules). The suggested algorithm belongs to classical methods and performs a hierarchical linearization of a semantic tree by appropriately permutating the tree nodes following the rules of the natural language. The method is believed to be scalable and extendable for all the natural languages.

Key words: semantic analysis, machine translation, synthesis, natural language, word ordering.

Merkuryev D. V. Universal dictionary with morphologic, syntactic and semantic information about wordforms of Russian Language.

A syntactic-semantic analyzer of the Russian language developed by V. A. Tuzov, uses morphological, syntactic, and semantic dictionaries during the process of text analysis. The dictionaries contain information about basic forms of words. However, in the case of another form handling, a modification of the given information by program modules of the analyzer is required. Thus, the system performs some dictionary search operations and the large amount of calculations before the syntactic-semantic analysis stage. The new approach which means the construction of universal dictionary containing all necessary information for the syntactic-semantic analysis is considered. The given information is calculated and transformed to a standard form in advance for more than 2250 000 wordforms of the Russian language. Preliminary analysis stages are reduced to search of dictionary entries by wordforms in the given approach. The received dictionary originally has a big size. Methods of its essential compression are described. Besides, questions of processing, modification, and indexing of the given dictionary are considered. The system of the preliminary text analysis, developed on the basis of the new approach, has shown productivity substantial growth and also reliability and stability of its operation that allows to use

it in the processing of big text document collections. The method stated in the paper can be useful in the construction of universal dictionaries of the other natural languages.

Key words: automatic text processing, morphological analysis, syntactic-semantic analysis, universal dictionary.

Pimenov V. Yu. **Local interest point detection method evaluation in the problem of near-duplicate image detection.**

The paper proposes a methodology for evaluating local interest point detection methods, based on the solution of the problem of near-duplicate image detection. Local interest point detectors recently gained attention in mobile robotics due to visual simultaneous localization and mapping problem. General means for method evaluation include its implementation in robotic environment and further experiments with real-time estimation of robot-dependent values. At the same time it is possible to evaluate the quality of detectors with respect to geometric and photometric image transformations, which are the most common sources of data association errors, apart from the robot on the base of solution of near-duplicate image detection problem. To illustrate suggested methodology, one of the widely spread local interest point detection methods based on PCA-SIFT descriptor usage is implemented and evaluated. For the purpose of fast descriptor filtering an inverted index structure is proposed. Experimental results show that proposed approach can be effectively applied for near-duplicate image detection tasks.

Key words: local interest point, near-duplicate image detection, mobile robot vision.

Aleksandrov A. Yu., Zhabko A. P. **On the existence of limiting operating modes of nonlinear difference systems.**

Many problems in control theory come to the studying of stationary operating modes that arise in controlled systems under the action of external perturbations. Of great practical interest is the situation when these stationary modes are globally asymptotically stable. Such a phenomenon is called the convergence. Conditions for the existence and stability of forced stationary oscillations are well investigated for the systems whose right-hand sides are periodic or almost periodic functions of time. In the present paper, certain classes of nonlinear difference systems with the bounded perturbations of weakly varied type are considered. It is known, that functions possessing weak variation can describe oscillatory processes with periods that grow with time. By the use of the Lyapunov direct method, the conditions for the existence of limiting modes to which all the solutions of systems considered tend with increasing of time are obtained. It is proved, that these limiting modes, like perturbations, are bounded and possess weak variation. However, they, in general, are not proper motions of systems investigated.

Key words: difference systems, stability, Lyapunov's functions, limiting operation modes.

Smirnov N. V., Solovyeva I. V. **Application of the positional optimization method for the multiprogrammed stabilization of the bilinear systems.**

In the present work the bilinear control systems are considered. The modification of the synthesis method of the multiprogram control by applying the constructive methods of the optimal control theory is developed.

Key words: bilinear systems, multiprogram control, positional optimization.