

*Taras Shevchenko National University of Kyiv, Ukraine
University of Defence, Brno, Czech Republic
International Institute for Applied Systems Analysis,
Austria
Glushkov Institute of Cybernetics of NAS of Ukraine
System Analysis Committee of Presidium National Academy
of Sciences of Ukraine
Academy of Sciences "Vyshcha Shkola" of Ukraine
Noosphere Ventures Corporation
Brno Local Chapter of Union
of Czech Mathematicians and Physicists,
European Education Center, Georgia*

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JAROSLAV MICHÁLEK

70th ANNIVERSARY

On July 8, 2016 Jaroslav Michálek, Associate Professor of the University of Defence, Brno, celebrated his 70th birthday anniversary.

In 1968 he graduated from the Faculty of Mathematics and Physics, Charles University in Prague, and later on, he received the degrees RNDr. and PhD there. After the graduation, he joined the Faculty of Science, Masaryk University in Brno where he worked as the Vice-Dean for Science and Research in 1990-91. Then based on his initiative the Department of Applied Mathematics was established there and he has been the Head of the Department for 5 years. That time, he participated in preparation of the inter-faculty Master's degree program in Mathematics and Economics, and together with colleagues from the Faculty of Mechanical Engineering, Brno University of Technology, they prepared the interdisciplinary Master's degree program in Mathematical Engineering.

In 1994 he took the opportunity to work abroad (Zimbabwe, Botswana, Malta) and shortly after his return from abroad he joined the Faculty of Mechanical Engineering, where he served as the Head of the Department of Statistics and Optimization. Simultaneously, since 1990 he has worked at the University of Defence.

J. Michálek supervised 10 PhD students, four of them have already been habilitated. He has published more than 120 scientific papers and he also worked as an external examiner at foreign universities.

J. Michálek worked for a long time for the PDMU's Programme Committee and he collaborated with prof. A.G. Nakonechnyi whom he met during his first internship in Brno in 1976.

All participants of an International conference PDMU are sincerely congratulating Jaroslav Michálek on his 70th birthday and wishing him good health, happiness, prosperity, inspiration and many more scientific results.



IVAN SERGIENKO

80th ANNIVERSARY

Ivan Vasyliovych Sergienko is an Academician of the National Academy of Sciences of Ukraine and a well-known scientist in the fields of computer science, computational mathematics, optimization theory, system analysis and mathematical modelling, mathematical software for computers. He is an author of over 700 scientific publications including 44 monographs; 5 monographs are translated abroad (USA, Germany, Australia, Russia). Sergienko I.V. is a scientific advisor of 28 Science Doctors and over 60 PhDs.

Sergienko I.V. was born on August 13, 1936 in Poltava region of Ukraine. After graduating from the Faculty of Mechanics and Mathematics at Taras Shevchenko National University of Kyiv in 1959, he started working at Glushkov Institute of Cybernetics of NAS of Ukraine. Ivan Vasyliovych successfully defended his PhD thesis in 1964 and his doctoral dissertation in 1972. Scientific interests of I.Sergienko were shaped under the influence of the famous scientists - Academicians V.M. Glushkov, A.A. Dorodnitsyn, V.S. Mikhalevich.

I.V. Sergienko created a scientific school of computer mathematics and intelligent information technologies. His scientific research concerns formulating and investigating the mathematical optimization models and methods, particularly of discrete optimization, with solving current problems of computational and applied mathematics, and developing theory of programming and related intelligent computing technologies that constitute a basis for solving practical problems including the problems of transcomputational complexity.

I.V. Sergienko – an Honoured Worker of Science and Technology of Ukraine (1991), Laureate of the State Prizes in Science and Technology of Ukraine (1972, 1993, 1999, 2005), of USSR (1981), of the Council of Ministers of the USSR (1982), Laureate of V.M. Glushkov (1986), S.O. Lebedev (1997), V.S. Mykhalevych (2002) and A.A. Dorodnitsyn (2007) Prizes of NAS of Ukraine. Sergienko I.V. is a full cavalier of the Order of Merit of the 3rd (1996), 2nd (1998) and 1st (2007) grades.

All participants of an International conference PDMU are sincerely congratulating Ivan Vasyliovych Sergienko on his 80th birthday and wishing him good health, happiness, prosperity, inspiration and many more academic advances to the benefit of Ukraine.

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MULTIDIMENSIONAL ASSESSMENT OF COMPLEX SYSTEMS

¹Bakhrushin V., ²Ignakhina M.

¹Zaporizhia National Technical University, Ukraine

²Classic Private University, Zaporizhia, Ukraine

Vladimir.Bakhrushin@gmail.com

Making decisions always requires the objective information on the current state of the object of control. The state of complex systems almost always is characterized by a set of attributes. In the simplest cases, these assessments can be vectors, but more complicated situations also are possible. Examples of multidimensional vector assessments are well-known socio-economic indices (Consumer Confidence Index, Human Development Index, ...), GDP deflator, university rankings, etc. The main objectives of a multidimensional assessment are to compare and to optimize systems. States of one system at different moments of time or under different conditions, the current state with the target, states of different systems under comparable conditions, etc can be compared.

To construct a vector assessments the method of linear convolution of individual indicators most commonly is used. The popularity of this method is largely determined by its apparent simplicity and naturalness. Its great advantage is that for optimization problems under certain conditions it allows to obtain any of effective solutions. However, the obtained estimates may significantly depend on the selection of weighting factors of individual indicators and accuracy of the initial data. This may severely distort the results, for example, when ranking objects. Therefore other types of models become increasingly popular. In particular, minimax, hierarchical and fuzzy assessments are used.

In this regard, it is important the observance of certain principles of assessments design. In particular it is need to take into account the objectives of assessment and independently verify the validity and adequacy of the obtained models. The individual indicators should be independent of each other or be weakly correlated. Their selection should be based on the correspondence with objectives of assessments, but not only on the data availability. Each new objective requires a revision and new verification of the assessment model. The methods of collecting input data and all calculations should be clearly described.

GENERALIZED GROUPS OF SPECTRAL HOMOLOGY AND COHOMOLOGY ON A COUPLE OF COEFFICIENT GROUPS FACTORS

Bakhtadze Sh.

Batumi Shota Rustaveli State University, Georgia

Let LP_2 be a category of pairs of locally compacted paracompact spaces and their own mappings, $(X, A) \in LP_2$, $Cov^r(X, A) = \{(\alpha_r, \alpha_r) \mid \alpha_r \in Cov^r(X)\}$ a set (which is directed towards refinement between elements) of all pairs of regular coverings of the pair of spaces (X, A) , $(N_{\alpha_r}, N_{\alpha_r})$ a pair of simplicial complexes – the nerves of regular coverings pairs $(\alpha_r, \alpha_r) \in Cov^r(X, A)$, $\pi_{\alpha_r}^{\alpha_r} : (N_{\alpha_r}, N_{\alpha_r}) \rightarrow (N_{\alpha_r'}, N_{\alpha_r'})$ – simplicial mappings defined for $\alpha_r \succ \alpha_r'$ (see.[1]), while (G, G') and (H, H') are generalized pairs of groups (compact or discrete) (see.[2]).

For any $\alpha_r \in Cov^r(X)$, let an integer n and a generalized pair of groups (G, G') be denoted by $H_n(N_{\alpha_r}, N_{\alpha_r}; G, G')$ (see.[2]) n - dimensional homology group of pairs of complexes $(N_{\alpha_r}, N_{\alpha_r})$ on the pair of coefficients (G, G') , and by $H^n(N_{\alpha_r}, N_{\alpha_r}; H, H')$ (see.[2]) we will denote n - dimensional homology group of complexes pairs $(N_{\alpha_r}, N_{\alpha_r})$ on the pair of coefficient groups (H, H') . Let's denote induced by maps Homomorphisms $\pi_{\alpha_r}^{\alpha_r}$ by

$$\pi_{\alpha_r}^{\alpha_r*} : H_n(N_{\alpha_r}, N_{\alpha_r}; G, G') \rightarrow H_{n-1}(N_{\alpha_r'}, N_{\alpha_r'}; G, G'), n \in \mathbb{Z}$$

$$\text{and } \pi_{\alpha_r}^{\alpha_r*} : H^n(N_{\alpha_r}, N_{\alpha_r}; H, H') \rightarrow H^n(N_{\alpha_r'}, N_{\alpha_r'}; H, H'), n \in \mathbb{Z}.$$

We will get a reverse spectrum $\{H_n(N_{\alpha_r}, N_{\alpha_r}; G, G'), \pi_{\alpha_r}^{\alpha_r*} \mid \alpha_r \succ \alpha_r'; \alpha_r, \alpha_r' \in Cov^r(X)\}$ and a direct spectrum $\{H^n(N_{\alpha_r}, N_{\alpha_r}; H, H'), \pi_{\alpha_r}^{\alpha_r*} \mid \alpha_r \succ \alpha_r'; \alpha_r, \alpha_r' \in Cov^r(X)\}$. Let's

denote the limit groups of these spectrums by appropriately $H_n(X, A; G, G')$ and $H^n(X, A; H, H')$.

Definition1. The group $H_n(X, A; G, G')$, $n \in \mathbb{Z}$, is called generalized of n - a dimensional spectral Chogoshvili Homology group of a second-type pair $(X, A) \in LP_2$ on a pair of coefficient groups (G, G') .

Definition2. The group $H^n(X, A; H, H')$, $n \in \mathbb{Z}$, is called generalized of n - a dimensional spectral Chogoshvili Cohomology group of a pair $(X, A) \in LP_2$ on a pair of coefficient groups (H, H') .

For the constructed theory it is naturally to determine:

a) the induced Homomorphisms:

$$f_* : H_*(X, A; G, G') \rightarrow H_*(Y, B; G, G');$$

$$f^* : H^*(Y, B; H, H') \rightarrow H^*(X, A; H, H') \text{ for a Morphism}$$

$$f : (X, A) \rightarrow (Y, B) \text{ from } LP_2;$$

b) the connecting Homomorphisms:

$$\partial_* : H_q(X, A; G, G') \rightarrow H_{q-1}(A; G, G'), q \in \mathbb{Z};$$

$\partial^* : H^q(A; H, H') \rightarrow H^{q+1}(X, A; H, H'), q \in \mathbb{Z}$. At the same time H_* is a semiexact Homology theory, and H^* is an exact Cohomology theory.

Then the following **Theorem** is true.

Let $(X, A) \in LP_2$. **If** the generalized pairs of groups (G, G') and (H, H') are conjugated then for each $n \in \mathbb{Z}$ the groups $H_n(X, A; G, G')$ and $H^n(X, A; H, H')$ are dual, i.e.

$$H_n(X, A; G, G') \mid H^n(X, A; H, H').$$

Let's consider three particular cases in which the constructed groups coincide with previously known groups:

1. If supposing $A = \emptyset$, we will get the absolute groups of Homology and Cohomology $H_n(X; G, G')$ and $H^n(X; H, H')$ of space X on a pair of coefficient groups (G, G') and (H, H') , respectively;
2. If $G = G'$ and, therefore, $H' = 0$, then $H_n(X, A; G, G)$ is a group of Homologies of the infinite cycles of a spaces pair (X, A)

on a group G , and $H^n(X, A; H, 0)$ is a group of Cohomologies of the finite cocycles of a pair (X, A) on a group H ;

3. If $G' = 0$ and, therefore, $H' = H$, then $H_n(X, A; G, 0)$ is a group of Homologies of the finite cycles of a spaces pair (X, A) on a group G , and $H^n(X, A; H, H)$ is a group of Comololgies of the infinite cocycles of a pair (X, A) on a group H .

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SOME PROPERTIES OF FOURIER TRIGONOMETRIC SERIES OF EVEN AND ODD FUNCTIONS

Bakuridze M.S.

Batumi Shota Rustaveli State University, Georgia

We study the properties of the sum of some trigonometric series related to Fourier series of even and odd functions.

Let us assume that the function $f \in L[-\pi, \pi]$, is even and $\sigma[f] = \sum_{i=1}^{\infty} a_i \cos ix$. Based on the investigation of Hardy [4], Bellman [2], Loo [3], the following trigonometric series can be considered:

$$\sum_{k=1}^{\infty} U_k \cos kx, \quad (1)$$

$$\sum_{k=1}^{\infty} U_k \sin kx, \quad (2)$$

$$\sum_{k=1}^{\infty} U_k^* \cos kx, \quad (3)$$

$$\sum_{k=1}^{\infty} U_k^* \sin kx, \quad (4)$$

where $U_k = k^{-1} \sum_{i=1}^k a_i$, $U_k^* = k^{-1} \sum_{i=1}^k \frac{a_i}{i}$.

Analogously, if $g \in L[-\pi, \pi]$ is odd and $\sigma[g] = \sum_{i=1}^{\infty} b_i \sin ix$, then we can consider the following trigonometric series:

$$\sum_{k=1}^{\infty} M_k \cos kx, \quad (5)$$

$$\sum_{k=1}^{\infty} M_k \sin kx, \quad (6)$$

$$\sum_{k=1}^{\infty} M_k^* \cos kx, \quad (7)$$

$$\sum_{k=1}^{\infty} M_k^* \sin kx, \quad (8)$$

Where $M_k = k^{-1} \sum_{i=1}^k b_i$, $M_k^* = k^{-1} \sum_{i=1}^k \frac{b_i}{i}$.

The sum of series (1)–(4) is established for classes of functions with bounded variation. The question of the continuity of the sum of series (3) and (4) is considered.

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FOR SOME ONTOLOGICAL ISSUES OF DECISION MAKING IN DISTANCE EDUCATION

Bagrationi I.

Batumi Shota Rustaveli State University, Georgia

irmabag@yahoo.com

The present paper outlines that until recently, the term "Distance Education" brought correspondence courses to mind. Profit and

nonprofit organizations offered a wide variety of courses for students who were unable to attend, classes for one reason or another. Students could stay in their own homes, complete the assignments, and mail them to an address at a distant location. Students could take individual courses for no credit or a series of courses for a certificate, a diploma, or a degree. Students were sometimes, but not always, required to complete a portion of the work at the organization's center. It was possible to receive a university degree without ever having set foot on a college campus.

The report emphasises, that the growth of distance learning offers teachers and students many new opportunities but also presents many challenges. The increasing role of commercial companies in distance education poses a threat to traditional academic institutions and may create pressure for mass, low-quality education [6]. There is a concern that a small number of "superstars" will develop on-line course materials and that courses themselves may be taught by untrained assistants. Related to this issue is the question of who controls the electronic materials that teachers develop. If the ownership of the materials passes over to their employers, teachers fear that they might lose control over who uses the materials and how they are used [1].

The paper underlines, that the potential dangers of commercialized distance education are catching the attention of educators. In his work "Distance Learning: Promise or Threat?" Andrew Feenberg writes: "Once the stepchild of the academy, distance learning is finally taken seriously. But not in precisely the way early innovators like myself had hoped. It is not faculty who are in the forefront of the movement to network education. Instead politicians, university administrations and computer and telecommunications companies have decided there is money in it" [2]. In his work "Distance Learning: Promise or Threat?" Andrew Feenberg points out: "First, administrators and businessmen should forget the idea that distance learning systems based on videoconferencing and star professors will replace face-to-face classroom education. The dream of automating the educational process has failed so often in the past that there is little reason to take it seriously on this, the nth round. Second, politicians need to be realistic about the future costs of higher education. Distance learning is not going to be a cheap replacement for campuses. Some other solution to the parking problem will have to be found. The campus experience will remain in demand for the foreseeable future. Third, the overselling of foolish ideas about technology should not be allowed to discredit the

whole field of online education. We as faculty need to get beyond defensive contempt for this significant educational innovation and look at specific designs with legitimate pedagogical objectives in mind. Fourth, the educational technologists themselves need to continue to work creatively with faculty and students to devise truly viable applications that fulfill real needs. There are good reasons for sticking with interactive text based systems and supplementing them with visual and other online resources, rather than attempting to duplicate face-to-face education online. The design challenge of improving the original text based systems is well worth pursuing" [3]. Here we note, that Andrew Feenberg is Canada Research Chair in Philosophy of Technology in the School of Communication, Simon Fraser University, where he directs the Applied Communication and Technology Lab. He is the author of "Distance Learning: Promise or Threat?", "My Adventures in Distance Learning", and "The Question of Distance Learning Technology". He is also recognized as an early innovator in the field of online education, a field he helped to create in the early 20th century.

The paper tells, that some faculty are beginning to protest threatening trends in distance education. Faculty members at York University in Canada went on strike to defend their ownership of electronic materials they create. David Franklin Noble, writing in "Digital Diploma Mills", describes a letter signed by several hundred faculty members in the state of Washington, in the United States, in protest to speeches given by Washington's governor praising digital education. The letter reads: "We feel called upon to respond before quixotic ideas harden into disastrous policies. While costly fantasies of this kind present a mouth-watering bonanza to software manufacturers and other corporate sponsors, what they bode for education is nothing short of disastrous... Education is not reducible to the downloading of information, much less to the passive and solitary activity of staring at a screen. Education is an inter-subjective and social process, involving hands-on activity, spontaneity, and the communal experience of sharing in the learning enterprise" [5]. Here we note, that David Franklin Noble is a Canadian critical historian of technology, science and education. He is best known for his seminal work on the social history of automation. He currently teaches in the Division of Social Science, and the department of Social and Political Thought at York University in Toronto. In his work "Digital Diploma Mills" David Franklin Noble writes: "The book began life as a series of articles on the automation of higher education, written from the

trenches. Having studied the automation of other industries and its consequences for the workers of those industries, especially in my book "Forces of Production" and having tried in my own way to contribute to their struggles, I suddenly and unexpectedly became witness to the very same assault on the industry in which I worked. What I had learned, what I presumed to know, would now be put to the test of practice, on my colleagues' and my own behalf. Did historical understanding and experience of the trials of others give us any advantage in our own? What were the lessons of those earlier episodes that might be applied here, to forestall and potentially reverse this latest offensive on people's lives and livelihoods? First and foremost, my knowledge endowed me with a small degree of foresight, and the conviction that all too often in the past people had only belatedly realized the dimensions of the calamity that had befallen them, too late to act effectively in their own interest. Thus, above all these articles were written to sound an early alarm, a warning timely enough to provide some opportunity for defensive preparation and the envisioning of alternatives" [4].

We believe that, as shown by the many examples presented in this paper, on-line learning can be an "inter-subjective and social process, involving spontaneity and the communal experience of sharing in the learning enterprise", as the faculty in Washington demand. The technology available offers exciting possibilities for enhancing interaction at a distance. But such results are not ensured. Teachers need to actively participate in determining the direction of distance education so that on-line courses and programs are developed with teachers' and students' interests in mind. Teachers should join together to demand that distance education programs maintain standards of staffing, program quality and assessment. And educators should certainly work to keep ownership and creative control of their own products and materials.

The author of the paper concludes, that most important, as education extends from the classroom to the computer screen, we should never lose sight of the human factor in learning. Language learning, more than almost any other discipline, is a social endeavor.

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ON SOME THREE STEP RECURSIVE NEWTON METHOD

Bartish M.Ya., Bartish V.Ya., Ogorodnyk N.P.

Lviv National University named Ivan Franko, Ukraine

ogorodnyk.nataly@gmail.com

We will consider the optimization problem

$$f(x) \rightarrow \min_{R^n}, \text{ де } f: R^n \rightarrow R, f \in C^1(R^n). \quad (1)$$

Based on recursive modification of Newton method

$$v_k = x_k - \alpha_k f'(x_k), \quad (2)$$

$$x_k^{i+1} = x_k^i - \left(f'' \left(\frac{x_k + v_k}{2} \right) \right)^{-1} f'(x_k^i), \quad (3)$$

$$x_{k+1}^0 = x_{k+1}^p, x_0^0 = x_0. \quad (4)$$

we proposed the next three step recursive algorithm:

$$v_0^0 = x_0 - \alpha_0^0 f'(x_0),$$

$$u_k^i = x_k^i - \left(f'' \left(\frac{x_k + v_k^0}{2} \right) \right)^{-1} f'(x_k^i), \quad (5)$$

$$v_k^{i+1} = x_k^{i+1} - \alpha_k^{i+1} f'(x_k^{i+1}), \quad (6)$$

$$x_k^{i+1} = \arg \min_{\gamma} f(u_k^i + \gamma(v_k^i - u_k^i)), \quad (7)$$

where $i = 0, \dots, p-1$, $x_k^0 = x_k$, $x_k^p = x_{k+1}$, $v_k^p = v_{k+1}^0$, p - the depth of recursive; $\alpha_k > 0$, γ - step factors, $k = 0, 1, \dots$

It is proved that the algorithm (5) - (7) convergent. The order of convergence is $p+1$. Denominator of algorithm's (5) - (7) convergence is less than the denominator of algorithm's (2) - (4) convergence. Algorithm (5) - (7) are used when calculating of second derivatives matrix is hard.

As the practical research method (5) - (7) shows better results in terms of number of calculations than the simple recursive modification of Newton method, especially for problems of large dimensions.

STRUCTURAL EQUATION MODELING USING THE AMOS AND REGRESSION FOR IDENTIFICATION OF EFFECTIVE LEADERSHIP INDICATORS IN MILITARY ACADEMY OF LITHUANIA

¹Bekesiene S., ¹Diliunas P., ²Hoskova-Mayerova S.

¹The General Jonas Zemaitis Military Academy of Lithuania

²University of Defence, Czech Republic

svajone.bekesiene@lka.lt

The interest in Structured Equation Modeling (SEM) techniques are growing. The recognition of their importance to the scientific research suggests the need to evaluate and compare different types of techniques so that the scientific research designs can be elected fittingly. Moreover, second-generation data analysis techniques enabling researchers to answer a set of interrelated research questions in a single, systematic, and wide-ranging analysis by modeling the relationships among multiple independent and dependent constructs at the same time. After assessing the area to which these techniques are currently being used in the scientific research, the article presents a consecutively example which analyzes the same dataset via two very different statistical techniques. It then compares two modeling possibilities: modeling using Analysis of Moment Structures (AMOS) and statistical software package SPSS. Finally, the article discusses linear regression models and offers guidelines as to when SEM techniques and when regression techniques should be used.

ONE CASE OF ASYMPTOTIC BEHAVIOR OF THE PROBABILITY OF BANKRUPTCY OF INSURANCE COMPANY

Bilynskyi A., Kinash O.

Ivan Franko National University of Lviv, Ukraine

andrii.bilynskyi@gmail.com

Let the distribution function $F(x)$, $x \in R_+ = [0; \infty)$ satisfies the condition $F(x) < 1 \quad \forall x \in R_+$ and belongs to the so-called subexponential type [1, p. 189].

Denote by S class subexponential distribution functions.

Note that the class S is wide enough. In particular, this class includes such distributions as Log-normal distribution, Pareto distribution, Weibull distribution, Benktander type I and type II distributions. Asymptotics of the probability of bankruptcy for some of these distribution considered in [1], [2].

Statement. Consider payments distributed by Benktander type I distribution

$$1 - F(x) = \left(1 + \frac{2\beta \log x}{\alpha}\right) e^{-\beta \log^2 x - (\alpha+1) \log x} \quad \alpha, \beta > 0, x > 1,$$

the asymptotic of the probability of bankruptcy $\phi(u)$ ratio is

$$\phi(u) \sim -\frac{\lambda u}{((\alpha + 2\beta \log u)c - \lambda u)} \cdot \left(1 + \frac{\alpha + 2\beta \log u}{u} \cdot \frac{x^{-\alpha} e^{-\beta \log^2 u}}{\alpha}\right), u \rightarrow \infty.$$

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ABOUT TECHNOLOGICAL PERFECTION OF DSS (2)

Bondarchuk Y.V.

Taras Shevchenko National University of Kyiv, Ukraine

byv@univ.kiev.ua

In [1] an opinion of DSS developers on technological maturity of DSS is proposed. Presentation of DSS technological maturity using CMMI model is proposed in [2]. One of the ways to implement technological maturity and harmonization is proposed in [3].

Representation in terms of CMMI is not a model of processes, but rather goals that can be measured. The first level is not detailed and corresponds unsystematic implementation of any kind. 4 upper levels contain 22 component items of technological excellence.

In particular, we propose the following interpretation according to the levels:

5 Optimizing: CAR= Concurrent use of references DSS; OID=DSS as a platform (PaaS). The solution has unified representation of a certain standard.

4 Quantitatively Managed: OPP+QPM= DSS is a shell over any decision.

3 Defined: RD+TS=reference DSS architecture; PI= reference DSS model; VER+VAL=verification and validation; OPF+OPD= DSS in the Situation Centre (CI); OT= adaptive learning; IPM=CI; RSCM=base of complete solutions; DAR= analysis and implementation of solutions..

2 Managed: REQM = scenario of solutions adaptation; PP = SC; PMC = solutions base management; SAM = not required; MA + PPQA= monitoring solution; CM=configuration management.

1 Initial: DSS is the only solution making procedure(s). They don't have the full life cycle of the solution processing and are always open for other DSS.

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ON THE EXISTENCE OF IDEMPOTENT-MATRIX MODELS WITH TOUGH CONDITIONS HAVING PREDICTABLE DIMENSION

¹Bondarenko V., ²Degtiar S., ³Tertychna O.

¹Institute of Mathematics of NAS of Ukraine

vitalij.bond@gmail.com

^{2,3}Vadym Hetman National Economic University of Kyiv, Ukraine

svdegtyar@gmail.com, olena-tertychna@mail.ru

In applied mathematics, there often arise various models, in the study of which there are widely used various algebraic structures and objects. We study a class of matrix models for finite networks, so-called idempotent-matrix models, introduced in [1].

By a network we mean a finite digraph $G = (V, A)$ without loops and multiple arrows (V denotes the vertices set and A the arrow set). A subalgebra $M_m(P_1, P_2, \dots, P_n)$ of the algebra M_m of all $m \times m$ matrices over the field of real numbers R , generated by idempotent matrices $P_1, P_2, \dots, P_n$, is called (see [1]) an idempotent-matrix model for the network $G = (V, A)$ with $V = \{1, 2, \dots, n\}$ and $A = \{i \rightarrow j, i \neq j \mid P_i P_j \neq 0\}$. The number m is called the dimension of the model.

Let $G = (V, A)$ be a network without oriented cycles. Put $A_0 = V$, $A_1 = A$ and denote by A_i , where $i > 1$, the set of all oriented paths of the length i (i.e. with i arrows). Then the set $\bar{A} = \bigcup_{i=0}^{\infty} A_i$ is finite, and we put $N = |\bar{A}|$.

Theorem. The network $G = (V, A)$ has an idempotent-matrix model $M_m(P_1, P_2, \dots, P_n)$ of dimension $m = N$ such that the matrices corresponding to different elements of $\bar{A}$ are different.

Recall (see [1]) that the matrix, which corresponds to an oriented path $i_1 \rightarrow i_2 \rightarrow \dots \rightarrow i_s$ ($s \geq 1$), is equal, by definition, to $P_{i_1} P_{i_2} \dots P_{i_s}$.

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INVENTORY MODELS WITH BOUNDARIES

¹Bratiichuk M., ²Lukovych O.

¹Institute of Mathematics of Silesian University of Technology, Poland

²Taras Shevchenko National University of Kiev, Ukraine

Mykola.Bratiichuk@polsl.pl , lukovych@unicyb.kiev.ua

Let us consider a process of the form

$$R(t) = ct + \sum_{n=1}^{N_1(t)} \eta_n - \sum_{n=1}^{N_2(t)} \xi_n, \quad t \geq 0, \quad (1)$$

where $c > 0$, $N_i(t)$, $i=1,2$ are Poisson processes with intensity λ_i , and $\eta_n, \xi_n, n \geq 1$ are independent nonnegative random variables. All these random variables and processes are supposed to be independent.

The processes of the form (1) are widely used for modelling the functioning of the warehouse. We are considering the process $R(t)$ in the following scheme. Let the maximal capacity of the warehouse be bounded by some number T . From the mathematical point of view it means that on the level T we have reflection of the process $R(T)$, i.e. we are dealing with the process

$$R^+(t) = R(t) - \max\{0, \sup_{u \leq t} R(u) - T\}.$$

Let $\tau(T, x) = \inf\{t > 0 : R^+(t) < 0\}$ and $N(\tau(T, x))$ be the number of reflections of the process on the interval $[0, \tau(T, x))$. In the report we study the distribution of the random variables $\tau(T, x)$, $N(\tau(T, x))$. Under some additional conditions about distribution functions $F_1(x) = P\{\eta_n < x\}$, $F_2(x) = P\{\xi_n < x\}$, $x \geq 0$ the optimization problem for the functional $C_1 \mathbf{E} \tau(T, x) - C_2 \mathbf{E} N(\tau(T, x))$ is considered as well.

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COMPARISON OF DIFFERENT ALGORITHMS FOR IDENTIFICATION OF OUTLIERS

¹Čampulová M., ²Holešovský J., ¹Michálek J.

¹University of Defence, Czech Republic,

²Brno University of Technology, Czech Republic

martina.campulova@unob.cz, jaroslav.michalek@unob.cz

holesovsky.j@fce.vutbr.cz

Outlier observations are present in many different types of data sets. They may result from unusual measurement conditions or they may be caused by measurement and experimental errors.

Because outliers may significantly affect data analysis and modelling, they require special attention and treatment. In order to evaluate the quality of observations significantly deviated from the other measurements outlier values need to be identified and further inspected by a specialised researcher, who decides about their removal, revision or keeping in data set.

This article compares three different procedures for the automatic identification of outlier values. All three algorithms are based on kernel regression with local bandwidth, which is used to smooth the raw data. Subsequently outliers in residual process are detected by using different approaches.

The first approach uses change point analysis and detects outliers based on quantiles of normal distribution. The second method identifies outliers by using control charts and Sixsigma methodology and the third method uses approach based on extreme value estimation of high threshold exceedances.

All three methods for outlier detection are demonstrated on environmental data, concretely on PM10 concentrations. The results are compared and advantages as well as weaknesses of each procedure are discussed. Although that presented methods are applied on environmental data their methodologies are general and can be used for evaluation of data from different areas, e.g. econometric or hazardous events.

THE PROPERTIES OF THE MULTIDIMENSIONAL INVESTMENT CASH FLOW

Chechelnytska K.

Taras Shevchenko National University of Kyiv, Ukraine

kchechelnytska@gmail.com

Stochastic models whose properties describe investment income are of great interest for applications in many spheres of activity. We assume that the moments of investment payments are the moments of the jumps of the Poisson process $\nu(t)$ with rate λ . The amount of payments ξ_k , $k=1,2,\dots$ are positive, independent and identically random variables with Laplace transform $g(s)$. There are r strategies of the investment activity. The intervals of investments are independent exponential distributed with rate $\mu_k, k=1, r$ random variables. If the company can not invest an amount ξ_k , $k=1,2,\dots$ for a full term or not at all may make investment, we assume that amount ξ_k decreases with rate ν . So we construct our process of investment income as a stochastic process of the following type:

$$p(t) = \begin{pmatrix} p_1(t) \\ \dots \\ p_r(t) \end{pmatrix} = \sum_{k=1}^{\eta(t)} \xi_k I_k(t), \text{ where } I_k(t) = \begin{pmatrix} i_1 e^{\delta_1 t} + (1-i_1) e^{-\nu t} \\ \dots \\ i_r e^{\delta_r t} + (1-i_r) e^{-\nu t} \end{pmatrix} \text{ with}$$

$$\text{probability } p_{(i_1, \dots, i_r)}(t), i_k = 0 \vee 1, p_{(i_1, \dots, i_r)}(t) = e^{-\sum_{k=1}^r i_k \mu_k} \prod_{k=1}^r (1 - e^{-\mu_k})^{(1-i_k)},$$

where $\eta(t)$ is a Poisson process with rate λ , δ_k is a rate of investment income.

The next theorem is true.

Theorem. The Laplace transform of the process of investment income has the following form:

$$\varphi(s, t) = E e^{-\langle s, p(t) \rangle} = \exp \left\{ -\lambda \left(t - \sum_{(i_1, \dots, i_r) = (0, \dots, 0)}^{(1, \dots, 1)} \int_0^t g(\langle s, I_1(t-u) \rangle) p_{(i_1, \dots, i_r)}(t-u) du \right) \right\}.$$

Using last formula we can obtain explicit expression for important parameters of our flow. For example

$$Ep_i(t) = -\frac{\partial}{\partial s_i} \varphi(0, t) = \lambda E \xi_1 \left\{ \frac{1}{\mu_i - \delta_i} \left(1 - e^{(\delta_i - \mu_i)t} \right) + \frac{1}{\nu} \left(1 - e^{-\nu t} \right) + \frac{1}{\mu_i - \nu} \left(1 - e^{-(\nu - \mu_i)t} \right) \right\}$$

$$\text{Var}(p_i(t)) = \lambda^2 (E \xi_1)^2 \left\{ \frac{1}{\mu_i - \delta_i} \left(1 - e^{(\delta_i - \mu_i)t} \right) + \frac{1}{\nu} \left(1 - e^{-\nu t} \right) + \frac{1}{\mu_i - \nu} \left(1 - e^{-(\nu - \mu_i)t} \right) \right\}^2 +$$

$$+ \lambda E \xi_1^2 \left\{ \frac{1}{\mu_i - 2\delta_i} \left(1 - e^{(2\delta_i - \mu_i)t} \right) + \frac{1}{2\nu} \left(1 - e^{-2\nu t} \right) + \frac{1}{\mu_i - 2\nu} \left(1 - e^{-(2\nu - \mu_i)t} \right) \right\} - \{Ep_i(t)\}^2.$$

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STRUCTURAL MODEL FOR INDICATED MANAGEMENT'S DECISION-MAKING ON THE CITY'S SOCIAL-ECONOMIC PROCESSES

¹Chachanidze G., ²Nanobashvili K.

¹Georgian Technical University

²David Agmashenebeli University of Georgia
guramchachanidze@yahoo.com

The goal of the research is to work out the decision-making and implementation processes through the indicated management model of the city's social-economic processes in case of uncertainties, first of all we define the main indicators. Generally, it can be the following: main demographic indicators (number of population, number of new-born, mortality of new-born babies, number of death according to the ages, natural increase, marriage, divorce, etc.), average level of employment per year, real income of the population, household fund (in compliance with the population), educational data (general, professional and high education), portion of the underprivileged children, number of low income families, amount of the main capital invests, goods and services provided by the small and micro enterprises and entrepreneurs, consolidated taxes and nontaxable income in the budget, executive and local government's performance evaluating indicators by the citizens, etc.

According to the indicated management principles analyzed by us [1], we have built the general structural model for city's social-economic process' indicated management.

In order to build the general structural model, we have the following marks:

$X_i, i = \overline{1, n}$ - indicated indicator;

$[a_i; b_i], i = \overline{1, n}$ - number interval of the indicated indicator;

$K_i, i = \overline{1, n}$ - factorial magnitude of indicated indicator.

It is obvious, we will receive the following:

1. $a_i \leq K_i \leq b_i$;

2. $K_i > b_i$

In the first case, the factorial magnitude of indicated indicator is on the feasible interval, and in the second case, it exceeds the maximum level of the interval.

Let's analyze those cases:

The first case:

Besides the fact that for the first case, K_i factorial magnetite is on the feasible interval, we will have a better result, when $K_i - a_i \Rightarrow \min$, but in case of $K_i - a_i = 0$, we will receive the best result.

The second case.

When K_i factorial magnitude of the X_i indicated indicator exceeds the maximum level, we should analyze the following difference $K_i - b_i$. It is obvious that much difference or $K_i - b_i \Rightarrow \max$ results more troubled situation on the X_i indicated indicator's object. This object is a weak part and needs to be improved, and be paid attention by the municipal authorities.

In order to make the analysis easier, we have conducted it on the specific example, such as the demographic indicator X_i **the number of new-born babies' mortality**.

If we consider that the indicator per thousand new-born babies' mortality is 3-4 in the high-developed countries, and 8-9 in the average European countries, then for indicated indicator we can take $[a_i; b_i] = [3; 9]$, so for the factorial K_i , magnitude of the indicated indicator we have $3 \leq K \leq 9$.

In case of $K = 3 - 9$, new-born babies' mortality will be satisfactory, but if the number reaches $K > 9$, the urgent actions should be implemented by the city municipality with the relevant management decisions. The reason of the problem can vary: lack of qualification of

the medical personal, badly-equipped maternity wards, low access of the healthcare or difficult social problem, and other reasons.

In the report, the problem content and conception for its solving will be broadly presented.

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THE NETWORK MODELS WITH MULTIDIMENSIONAL SEMI-MARKOV INPUT FLOW

Chechelnitzki A., Kucherenko O.

Taras Shevchenko National University of Kyiv, Ukraine

che@unicyb.kiev.ua

We will consider r systems of the type $[SM/M/\infty]$ with a multidimensional input flow customers $(v_1(t), \dots, v_r(t))$, where $v_i(t) = y_i(t) + c(t)$, and $y_i(t)$, $i=1, 2$ are independent Poisson processes with rate λ_i , $i=1, 2$ and $c(t)$ is a semi-Markov process with a finite state space S .

We suppose, that next conditions are true:

a) $\left[\sum_{k \in S} m_k \pi_k \right]^{-1} = \beta \neq 0$, m_k is the mean value of the sojourn time in the state k , π_k is the stationary distribution of the embedded Markov chain..

b) $\mu_i^{(n)} = \mu_i / n + o(1/n)$, $i=1, 2$, μ_i is a rate of service.

$$n^{-1/2} (c(nt) - \beta nt) \rightarrow \sigma w(t), \quad n \rightarrow \infty.$$

For sequence of processes

$$\xi_n(t) = (\xi_n^1(t), \dots, \xi_n^r(t)), \quad n \geq 1, \quad t \in [0, T],$$

$$\xi_n^1 = n^{-1/2} (X_i^{(n)}(nt) - \alpha_i nt), \quad i=1, \dots, r$$

($X_i^{(n)}$ is a number of customers in i -th system), where

$\alpha_i = (\lambda_i + \beta) / \mu_i$, $i=1, r$ the following theorem is true.

Theorem. The sequence of stochastic processes $\xi_n(t)$ converges in uniform metric to diffusion process with infinitesimal mean $a(x) = (a_1(x), a_2(x))$ and diffusion matrix B , where

$$(a_1(x), \dots, a_r(x)) = (-\mu_1 x, \dots, -\mu_r x)$$

$$B = \|b_{ij}\|_{i,j=1}^r, \quad b_{ii} = 2\lambda_i + \sigma^2 + \beta, \quad b_{ij} = \sigma^2, \quad i \neq j.$$

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INTERNATIONAL LABOR FORCE EMIGRATION AND THE “BRAIN DRAIN”: THE ECONOMICAL DISCOURSE OF EMIGRATION FROM UKRAINE

Chernyak O., Chernyak Y.

Taras Shevchenko National University of Kyiv, Ukraine

chernyak@univ.kiev.ua

The article generalizes theoretical aspects and gives practical approaches for regulation of high qualified workers and for the estimation of international migration processes' economical effectiveness. The main aspects of the attractiveness of emigration revealed. The fact, that inequality of wages in different countries is causing migration, is emphasized.

The notion of the net profit from migration is provided. The average rates of emigration from Ukraine, according to the worker's specialty, are calculated. The methods of evaluation of probability of the “brain drain” are proposed. That allows to evaluate the emigration rate, according to the concrete level of professional skills. The dependence between probable emigration and average salary rate in the destination country and the country of origin, average rates of individual-specific costs and fixed costs for migration is shown. The comparison of the emigrational attractiveness of Poland and Germany is done.

Positive and negative consequences of the international migration processes for the country of origin and for the receiving country are shown [1,2].

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TEACHING COMPUTER TRAININGS

Didmanidze I., Akhvlediani N., Didmanidze D., Khujadze N.

Batumi Shota Rustaveli state University, Georgia

ibraimd@mail.ru

The use of Computer training systems gives opportunity to get primary sources of information through interactive training programs, which significantly helps students with proper competencies to acquire particular subject or any of the fields of the subject.

The use of Modern computer systems in the teaching process should not be limited only to the acceleration of the process (which is a characteristic feature of information technology), but rather, should be focused on the deep understanding of the target topics and events.

The problem solving methodology of each single exercise at the computer trainings should be based on strict logic and should include the following steps:

1. To discuss one and the same type of several tasks;
2. To compile specific algorithms for solving each task;
3. To analyze the results and the solutions to the tasks.

The main focus of the target methodology is compiling the algorithm, which is a specific type of task sequence precisely formulated rules. Obviously, this algorithm is nothing more than a plan for solving the problem. As a result of solving tasks of different types, students should be able to compile generalized algorithm and the particular program in an interactive mode by using computer trainings.

Working on computer trainings through such a method solves a number of problems. For example, it enhances students' interest towards solving the tasks and teachers can economize the time at the lecture. But, if you use the computer training as a calculating device only and do not pay much attention to working on algorithms for solving the problem, it will turn out to be more harmful in terms of mastering the study of the subject or topic.

These above mentioned issues are highlighted in this paper.

THE METHODS AND OBJECTIVES OF THE SUPPORTING AUTOMATION SYSTEM OF WIRELESS NETWORK SECURITY

Didmanidze I.Sh, Beridze Z.R.

Batumi Shota Rustaveli state University, Georgia

ibraimd@mail.ru

Without an adequate security organizations avoid the use of wireless networks. Appropriately, the security of corresponding wireless networks is a significant area, which requires a reaction in the case of such networks' extensive use. It is necessary for the resesarchers of the given scope to identify and provide the appropriate solutions to these problems. The goal of the given work is to develop a series of activities, which would increase the safety of wireless networks; it would allow, in its turn, to provide a remote workplace management.

On the basis of the issues of Security Automation System (SAS) it is necessary to define and establish system algorithms, to develop the procedures of dialogue and information support and to consruct a program complexity of Automation System.

Each algorithm would have the input and output data bases, supporting the security processes and considering the algorithms.

The System would be supplied with dialogue procedures, which help to organize the relations between a customer and the System, and have selected a sequence for an effective fulfillment of some certain functions.

The next stage is a development of SAS program complexity and its structure; particularly, there should be worked out the types, procedures, functions and methods of the program complexity.

ON THE QUESTION OF BIASES OF DECISION-MAKING IN COMPUTER SYSTEMS

¹Didmanidze I., ²Glybovets M., ³Piranishvili R.

¹Batumi Shota Rustaveli State University, Georgia

²National University "Kiev-Mohyla Academy", Ukraine

³Iakob Gogebashvili Telavi State University, Georgia

ibraimd@mail.ru

It is known, that from an analysis of actual cases, three categories of bias of decision-making in computer systems have been developed:

preexisting, technical and emergent. Preexisting bias of decision-making has its roots in social institutions, practices, and attitudes. Technical bias of decision-making arises from technical constraints or considerations. Emergent bias of decision-making arises in a context of use. Although others have pointed to bias in particular computer systems and have noted the general problem, we know of no comparable work that examines this phenomenon comprehensively and which offers a framework for understanding and remedying it.

In its most general sense, the term bias means simply “slant.” Given this undifferentiated usage, at times the term is applied with relatively neutral content. A grocery shopper, for example, can be biased by not buying damaged fruit. At other times, the term bias is applied with significant moral meaning. An employer, for example, can be “biased” by refusing to hire minorities. In this article we focus on instances of the latter, for if one wants to develop criteria for judging the quality of systems in use - which we do - then criteria must be delineated in ways that speak robustly yet precisely to relevant social matters. Focusing on bias of moral import does just that [3].

Accordingly, we use the term bias to refer to computer systems that systematically and unfairly discriminate against certain individuals or groups of individuals in favor of others. A system discriminates unfairly if it denies an opportunity or a good or if it assigns an undesirable outcome to an individual or group of individuals on grounds that are unreasonable or inappropriate. Consider, for example, an automated credit advisor that assists in the decision of whether or not to extend credit to a particular applicant. If the advisor denies credit to individuals with consistently poor payment records we do not judge the system to be biased because it is reasonable and appropriate for a credit company to want to avoid extending credit privileges to people who consistently do not pay their bills. In contrast, a credit advisor that systematically assigns poor credit ratings to individuals with ethnic surnames discriminates on grounds that are not relevant to credit assessments and, hence, discriminates unfairly [5].

We derived our framework by examining actual computer systems for bias. Instances of bias were identified and characterized according to their source, and then the characterizations were generalized to more abstract categories. These categories were further refined by their application to other instances of bias in the same or additional computer systems. In most cases, our knowledge of particular systems came from the published literature. In total, we examined some computer systems

from diverse fields including banking, commerce, computer science, education, medicine and law [1]. The framework that emerged from this methodology is comprised of three overarching categories - preexisting bias, technical bias, and emergent bias. Preexisting bias has its roots in social institutions, practices, and attitudes. When computer systems embody biases that exist independently, and usually prior to the creation of the system, then we say that the system embodies preexisting bias [2]. Preexisting biases may originate in society at large, in subcultures, and in formal or informal, private or public organizations and institutions. They can also reflect the personal biases of individuals who have significant input into the design of the system, such as the client or system designer. This type of bias can enter a system either through the explicit and conscious efforts of individuals or institutions, or implicitly and unconsciously, even in spite of the best of intentions. For example, imagine an expert system that advises on loan applications. In determining an applicant's credit risk, the automated loan advisor negatively weights applicants who live in "undesirable" locations, such as low-income or high-crime neighborhoods, as indicated by their home addresses. To the extent the program these categories describe ways in which bias can arise in the design of computer systems [4].

The report discusses the point of view of American Professor of the University of Pennsylvania, forecasting and marketing expert Jon Scott Armstrong, who writes: "Although we've only touched on the very surface of biases, we believe this was a good intro on how we employ heuristics in our natural thought processes and on the other hand, how our innate experiences and tendencies can negatively affect our judgment. However, the intersection between heuristics and biases is very complex and there are still numerous studies that need to be made in order to fully understand them. Whether it's a confirmation bias influencing how we process information or a funding bias compelling us to skew results in favor of an employer, having an understanding and a constant awareness of all of our biases will keep our thought processes in check as we make data-driven decisions" [1]. We often think of "data" as an objective form of information, as something we just observe and record into computers and write on spreadsheets. In reality, data can be just as subjective as the humans that record it. In scientific fields especially, where empirical methods are used to observe and understand nature, data must always be collected and interpreted from an impartial point of view. Cognitive biases, however, are an ever-

present obstacle when trying to interpret data and can easily skew results. They are innate tendencies to understand and process information based on our previous experiences, preferences, and in fact, many of them are genetically wired into us! For data scientists biases influence how we think about and interpret data and when left unchecked and misunderstood, cognitive biases can lead us errors in judgment and less objective decision-making.

The authors conclude, that Because biased computer systems are instruments of injustice - though admittedly, their degree of seriousness can vary considerably - we believe that freedom from bias should be counted among the select set of criteria according to which the quality of systems in use in society should be judged. The methods delineated here can be used to assess and minimize bias in the design of systems. Concern with bias in system design and experience with these methods can be integrated with other software engineering methods as part of the standard for a computer science curriculum. As with other criteria for good computer systems, such as reliability, accuracy, and efficiency, freedom from bias should be held out as an ideal [5]. As with these other criteria, this ideal might be difficult if not impossible to achieve. Nonetheless, in practice we must approach actively the task of minimizing bias in our designs. Furthermore, as a community we must hold our designs accountable to a reasonable degree of freedom from bias against which negligence can be judged.

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NEURON NETWORK MODELING FOR FINANCE DATA SERIES FORECASTING

Didmanidze I.Sh., Kakhiani G.A., Didmanidze D.Z.

Batumi Shota Rustaveli state University, Georgia

ibraimd@mail.ru

Neuron network modeling problem is viewed as an optimal management discrete problem. Let us analyze a discrete neuron network model, in which transition from 1 to $l+1$ occurs with the following rule:

$$x_i^{(l+1)} = f_l \left(\sum_{j=1}^{q-1} w_{ij}^l x_j^l \right), \quad i = \overline{1, n}, l = \overline{0, q-1},$$

$|x_i^l| \leq B_i, i = \overline{1, n}, l = \overline{0, q}$ with phase limits w_{ij}^l weight coefficients are selected from the

$$I(w) = \sum_{l=0}^{q-1} \sum_{i=1}^n \sum_{j=1}^n r_{ij} (w_{ij}^l)^{2p} + \sum_{i=1}^n M_i (x_i^q - A_i)^{2m}$$

functional's minimum condition.

Construction of the neuron network in order to solve a specific problem means to determine topology of the neuron network connections, w_{ij}^l weight coefficients of the connections, f_l activation functions, and $I(w)$ target functional. Neuron network acquires its properties throughout the training process, which includes either determination of the weight coefficient of the synaptic connections or introduction of specific rules which will enable change of the weight coefficients of the synaptic connections according to the specific neuron network's output.

Upon the neuron network's properties training, the obtained outcomes should be generalized and obtained properties should be prolonged. This can provide for creation of positive preconditions for creation various prediction systems.

The criterion for the assessment of the deviation from the actual value of the prediction was an Error which can be calculated with the following formula:

$$E = \frac{1}{r} \sum_{i=1}^r \frac{|x(i) - \hat{x}(i)|}{x(i)} \cdot 100\%.$$

Where $\hat{x}(i)$ - is a time series i element's predicted value, $x(i)$ is time series i element's actual value, r - is a test collection dimension (volume).

Modelling of time series – based on the financial instruments of the currency market quota, by means of usage one-layer neuron network approach. One day and several days' predictions have been obtained for the time series under research. Effects of various parameters of the model produced on the task collectivity has been analyzed. The tests verify that training's adaptive rapidity enables 10% decrease of the neuron network training time, however it does not provide for the better prediction quality for the given tasks. The best prediction quality has been obtained by the neuron networks, where activation function applied sigmoid function (a one -day prediction error didn't exceed 2.6%).

Software package for investment management in the international currency market financial instruments has been tested and optimized with the approaches given in the current study. Software package for investment management in the currency market financial instruments has been worked out based on prediction of time series with Microsoft Visual Studio and MQL5 programming environment, by means of neuron networks' apparatus, investment portfolio models and on the elaborated approaches.

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FORECASTING TASK PRECONDITIONS OF DEMAND FOR SPECIALISTS

Didmanidze I., Motskobili I.

Batumi Shota Rustaveli state University, Georgia

Batumi state maritime Academy, Georgia

ibraimd@mail.ru

The training of specialists with technical education is an issue, which mostly depends on the current educational reforms. These reforms should be provided by the methods of modern innovative system formation for the training of professionals.

The formation of the training conception for specialists with technical education is affected by the situation in regional enterprises

and other economic facilities, the addition of new object according to a strategic plan and the reconstruction of the existing ones; the requirements of technical staff, their professional level and skills of modern technologies management. All the above issues represent the forecasting task preconditions of a demand for specialists with higher technical education. This requires a scientific research, application of modern technologies, which must be performed by high-quality specialists.

Obviously, the existing technologies need a complex scientific research. The investigation should be accompanied by modern computer technologies, test a variety of simulated models; there should be worked out the necessary methods; there should also be constructed mathematical models and computer programs for their realization; finally, it should be summed up in a detailed project, which indicates to an existence of the preconditions for the region's demand for high-quality education specialists.

All the above mentioned issues are dealt in our research work.

ALGORITHMS AND DATASTRUCTURES

Didmanidze I., Nakashidze G., Imnaishvili G., Zakaradze Z.

Batumi Shota Rustaveli state University, Georgia

Batumi state maritime Academy, Batumi public school, Georgia

ibraimd@mail.ru

Programming process, first of all, involves the construction of an appropriate algorithm for a solution of any task (complex of tasks), but the structure of the algorithm is mostly determined by its data processing structure, especially when the task specificity requires a large volume and complex interrelated data work.

The research deals with a number of practical issues, which arise during the development of program complexes from the view of their algorithms and appropriate data structures development.

Algorithm presents a computing procedure which is described by a formalized (or semi-formalized) language, inputs an initial data and outputs the results of processing.

The aim of **Procedure** is to serve a specific task. The task formulation describes the requirements that satisfy the time of the problem solution.

An algorithm is considered to be correct if it successfully completes work at a required time by a result output for a permissible input data of the task. In this case, they say, the algorithm solves a given computing task. A wrong algorithm may stop work for any of the initial data, "hang" or bring a wrong result.

An algorithm can be written in any algorithmic or conventional language, pseudocode or machine code. Its main demand is that the computation procedure would not allow different interpretations.

THE TECHNOLOGIES OF CARGO HANDLING OPERATIONS BY MARINE TRANSPORT MEANS

¹Didmanidze I.Sh., ²Tsitskishvili G.D., ¹Kuchava M.Sh.

¹Batumi Shota Rustaveli state University, Georgia

²Batumi state maritime Academy, Georgia

ibraimd@mail.ru

The Technologies of cargo handling operations by marine transport means is a field of science, which considers all issues, procedures and its consequence related to production of maritime transport.

The Technologies of cargo handling operations by marine transport means covers all main issues:

- ◆ Classification, transport normative base of cargo handling technologies;
- ◆ Obligations of cargo owner and forwarder taking into account cargo security and safety;
- ◆ Regulation of cargo heat exchange with environment;
- ◆ Tap, bulk, timber, general, food, dangerous goods handling;
- ◆ Heavy and bulk cargo handling equipment;
- ◆ Transport plan issues and some characteristics of exploitation of vessel and transport process service.

All above mentioned issues are related to cargo loading, safe and secure cargo handling and unloading.

One of the main issues of cargo handling technology is to define optimal variant of loading, where one should determine volume-mass characteristics of detention (storage) of cargo, physical and chemical properties, as well as some commodity feature.

These issues are highlighted in the scientific work.

MODERN TENDENCIES OF THE FOREIGN LANGUAGE STUDY

¹Didmanidze I., ²Zoidze N., ³Zoidze K.

¹Batumi Shota Rustaveli state University, Georgia

²The scientific-research center of Black Sea and Fauna study, Georgia

³Batumi state maritime Academy, Georgia

ibraimd@mail.ru

For such a small country like Georgia foreign language teaching is the subject of discussion. In spite of the fact that, Georgian language is one of the oldest language with its unique writing, cannot be the language of communication. For the researchers Georgian language is the one of interesting language and consider it as the subject of intensive study, they think that the language is in progress.

Nowadays, every person has a wish to receive or send any information to any part of the world, It is obvious that the delivered information should have clear and acceptable for the consumer with its form and contest. Day by day the intercultural communications are getting more and more actual, which directs us to the necessity of learning a foreign language.

Today for any citizen of any country, who is involved in the process of social and economic development of the country, foreign language is the tool of the activity for the sake of communication with a foreigner.

The knowledge of foreign language encourages the social and cultural behaviours of the person. Influences on the development of the person's intellectual and mental potential. The illiteracy of the language vice versa, makes many problems, which can be called the problem of communication. This is discussed as language communications and technical communicative means. It is certain that these both are the problem spheres.

Language communication is the main request-communicative approach, the main problem of which is formation and development of the communicative competences in foreign language.

MATHEMATICS AND APPLICATIONS: "VS" OR "WITH" HEURISTICS AND NON CLASSICAL MATH

Donchenko V.S.

Taras Shevchenko National University of Kyiv, Ukraine

voldon@bigmir.net

Mathematics after Georg Cantor has as its objects sets with “ties”, “links”, “relations”, - between its elements, namely - structure in general understanding. "General understanding" means that "structure" is an object as collection of its constituents, relating to each other. There are four fundamental types of such relationships: four fundamental math structures and also their combinations. These are: relations, functions, operations, and collections of subset from some "universal" set. The latter in particular is the mean for determination of topology on abstract sets. Actually the transfer of topology to abstract set finished the process of designing fundamental mathematical structures by the middle of the last century, namely - the process of mathematics formatting in its modern sense .Applications of mathematics for describing by mathematics means real object – math modeling – needs the real object to be represented as structure: collection of a constituents, connected among themselves. This certainly extends to complex systems. Thus, a complex system is an object with the constituents interconnected in a complex way. And one more notion. Principal difference between fundamental mathematics - math by itself - and math in applications - applied math - is that applications need the correspondences between "elements" and "relations" in objects and "components" and "relations" in mathematics. The mathematical counterpart we denote a representative This conformity is called the interpretation.

The standard interpretations used in math modelling: value – number, time evolution of the value – function, speed of the evolution – derivation, frequency – probability and so on. But math modeling - what for? - For using the way in which math establish the truth. The fundament of the Math truth is the conception of deducibility. It means that the status of truth (proved statement) has the statement which is terminal in the specially constructed sequence of statements, which called its proof. The peculiarity in sequence constructing means, that a next one in it produced by previous by special admissible rules (deduction rules) from initial admissible statements (axioms and premises of a theorem). The specification of the restrictions on admissible statements and the deduction rules are the object of math

logic. So, is, for example Fuzzy theory Applied Math? Surely not, because there is no generally adopted and used interpretation in it. Though in [1-3] the theorems about universal statistical interpretation were successfully proved. Does it possess special "fuzzy logic"? Surely not. There are no verified deduction rules in it. And the question about "fuzzy truth" is still open. There are powerful for practice means heuristics[5-7]. "Heuristic or heuristics (from the Greek "Εὕρισκω" for "find" or "discover") refers to experience-based techniques for problem solving, learning, and discovery. Heuristic methods are used to speed up the process of finding a good enough solution, where an exhaustive search is impractical. Heuristics including artificial neural nets are useful and powerful tool for solving practical problems when the desired result by itself. Nowadays heuristics often designated by the term "non-classical mathematics".

Classical Math in its applications - Applied Math - both with heuristics or non-classical variants are important in joint combinations in getting the final practical result.

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THE GROUPING INFORMATION PROBLEM IN MATRIX MULTIPLE REGRESSION

Donchenko V.S., Tarasova O.V., Nazaraga I.M.

Taras Shevchenko National University of Kyiv, Ukraine

voldon@bigmir.net

The grouping information problem in general and function fitting in particular are of great importance in applications. The class of matrix functions with set of matrix arguments – matrix multiple regression - is offered for formulation and solution of prediction problem on the base of Least Square Method. Mathematical technique of Singular Value Decomposition and of Moore-Penrose pseudo inverse [1, 2] technique is developed in this paper to provide successive solution of prediction problem in the case. Conception of cortege operators [3, 4] make it possible to extent in constructive way correspondent methods on matrixes Euclidean spaces. The LSM-estimation algorithm is proposed and realized in unknown parameters estimation. The application usage of the proposed methods was demonstrated for predictions in TV Ukrainian market. The example shoes the matrix multiple regression to be effective prediction instrument in media business with acceptable business planning processes accuracy. Moreover, for commercial time slots prediction indicators accuracy higher than for noncommercial. The last is especially important for commercial media planning and planning the TV-media business processes.

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GROUPING INFORMATION AND CORTEGE OPERATORS IN PROBLEM FOR MATRICES

Donchenko V., Zinko T.

Taras Shevchenko National University of Kyiv, Ukraine

voldon@bigmir.net

Cortege operators concept is implemented for version when cortege is a set of matrices with fixed dimensions is proposed in the paper. Suggested concept allows to transfer constructive tools of describing the basic linear and nonlinear structures of numerical vectors Euclidean space to matrix Euclidean spaces with preservation of the basic relations and ties. This completely concerns the use of these structures in applied problems of classification and clustering. The critical moment is that the difficulty of describing such structures in the matrix Euclidean space not exceeding the difficulty of describing numerical vectors for Euclidean spaces and reduces to the eigenvalue problem for matrices [1,2].

Considering the problems of Grouping Information Function/ Problem, which include the problem of function fitting, represented by their values [3] and the problems of classification, clustering and pattern recognition.

In many applied problems there appear matrices as a mathematical "representatives" of objects of the analyzed subject area. Examples of such "matrix representation" is a matrices of the spectrograms in the analysis of voice signals and matrices of images in image processing problem. Therefore, it is necessary to develop the description tools of the main structures for Euclidean spaces wider, than R^n class, in particular – for Euclidean $(R^{m \times n}, (\cdot, \cdot))$ matrix spaces of fixed dimension $m \times n$ with "scoordinate-wise" linear operations and "coordinate-wise" (trace) scalar product. These adequate to the problem operators turned out to be "cortege operators" [1], operations of which define an extended version of the "matrix algebra".

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EXPERIENCE-WEIGHTED ATTRACTION MODEL IN SPONSORED SEARCH AUCTIONS

Drebot A.

Ivan Franko National University of Lviv, Ukraine

adrebot13@gmail.com

In this proposal, I consider a particular case of position auction, called a sponsored search auction. This type of auction is extremely popular in online advertising and widely applied by such large companies as Yahoo! and Google. More precisely, bidders are competing for a certain proposed number of slots intended for advertising and are interested in the amount of clicks received on their web-link. Every advertiser prefers a higher slot because it is deemed that higher position in a search list brings more clicks. Assuming that all advertisers use the simplified analogue of bidding simulator, the paper considers experience-weighted attraction model to explain the bidding behaviour of regular advertisers. Experience-weighted attraction learning model includes the features of belief and reinforcement learning models. This paper considers the advertisers with different learning parameters. Therefore, the aim of this research is to find the impact of the different set of learning parameters on the auctioneers' revenue and on the bidders' payoff. Additionally, it might be considered as an attempt to shed light on equilibria in repeated position auctions. The results of this theoretical research might be considered by search engines as a potential subject for future experimental policies. Moreover, it could be the basis of further research regarding the application of experience-weighted attraction learning model to sponsored search auctions.

SOLVING THE PROBLEM OF MATHEMATICAL MODELING OF A FIELD OF DYNAMIC DISPLACEMENT OF THICK ELASTIC PLATES

¹Dvirnychuk K., ²Stoyan V.

¹ Yurii Fedkovich Chernivtsi National University Ukraine

² Taras Shevchenko National University of Kyiv, Ukraine

k_v_dvirnychuk@ukr.net, v_a_stoyan@ukr.net

Theoretical fundamentals of the study of the dynamics of elastic structures such as "plate" and "shell" were traditionally based on the assumption of the small thickness of the latter compared with their basic geometric dimensions. Differential equations resolving the dynamics of such structures, even in this case are solved only for private classically determined initial and boundary conditions. The study of the dynamics of plates and shells of finite thickness has always been associated with certain numerical and analytical problems that have arisen both constructing the object's mathematical model and forming its initial-boundary observations and solving the problem – it turned out to be complex both mathematically and computationally. There are many approaches to construction of specified equations of the dynamics of the plates of finite thickness, which, however, had some mechanical hypotheses.

The present report offers no hypotheses to solve the problem of mathematical modeling of the dynamics of elastic plates of finite thickness and arbitrary geometry in cylindrical and Cartesian coordinate systems. The authors suggested two-dimensional differential equations, which are the accurate mathematical model of the three-dimensional field of elastic dynamic displacements of surface-loaded elastic plates. Application of the method [1] of mathematical modeling of the dynamics of distributed space-time processes to the study of the obtained models allowed to solve successfully the initial-boundary value problems of the dynamics of thick elastic plates with no restrictions on the shape of the object, as well as the amount and quality of information about its initial and boundary condition. The control problems of the mechanical objects under study are also solved.

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ON THE LEFT-CENSORED SAMPLES FROM EXPONENTIAL AND WEIBULL DISTRIBUTION: THEORY AND APPLICATION.

Fusek M.¹, Michálek J.²

¹ Brno University of Technology, Brno, Czech Republic

² University of Defence, Brno, Czech Republic

fusekmi@feec.vutbr.cz , jaroslav.michalek@unob.cz

Left-censored samples with one or more detection limits are very frequent in many application areas. The normal or log-normal distributions are usually used. However, the interest in statistical analyses of censored data with asymmetric distributions which cannot be easily transformed into symmetric ones (e.g. normal distribution) has increased in many application areas recently. This contribution is focused on type I left-censored samples from exponential and Weibull distribution (see, for example, [3,4]). The statistical inference is based on the maximum likelihood method and the analytic form of the expected Fisher information matrix is presented. Properties of the unknown parameter estimates are examined using simulations and a special attention is paid to small sample sizes. Various asymptotic tests for comparison of two independent left-censored samples will be presented (see [2]). Finally, use of the described methods will be demonstrated on real environmental data (see [1,4]).

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RESEARCH OF OPTIMAL FUNCTIONING OF MEDICAL WORKERS BASED ON PRIOR KNOWLEDGE ABOUT FUNCTIONING SECTORS

Galkin O.

Taras Shevchenko National University of Kyiv, Ukraine

galkin.o.a@ gmail.com

This work is devoted to the determining the optimal functioning of medical workers during working hours using a prior knowledge about the relevant functioning sectors. We assume that the probabilities between any sectors s_l^c and $s_{l'}^c$ ($l \neq l'$) are independent [1]. In the case when s_l^c is fixed, a_t^c can be obtained for $b(l) \leq t \leq e(l)$, so we can remove $P(a_t^c | s_l^c)$. Therefore,

$$P(z_{b(l):e(l)}, a_{b(l):e(l)}^c, s_l^c) = P(s_l^c) \prod_{t \in b(l):e(l)} P(z_t | a_t^c). \quad (1)$$

We reduce s_l^c to obtain conditional probabilities between $a_{b(l):e(l)}^c$ and $z_{b(l):e(l)}$, resulting in the following equality:

$$P(a_{b(l):e(l)}^c, z_{b(l):e(l)}) = \sum_{s_l^c} P(s_l^c) \prod_{t \in b(l):e(l)} P(z_t | a_t^c). \quad (2)$$

Then, we consider the marginal probability for each time $1:T$ as

$$P(a_{1:T}^c, z_{1:T}) = P(a_{b(1):e(1)}^c, z_{b(1):e(1)}, a_{b(2):e(2)}^c, z_{b(2):e(2)}, \dots, a_{b(L^c):e(L^c)}^c, z_{b(L^c):e(L^c)}). \quad (3)$$

Assuming that couples of sectors are independent of each other, we obtain the following equality:

$$P(a_{1:T}^c, z_{1:T}) = \prod_{l \in 1:L^c} \left\{ \sum_{s_l^c} P(s_l^c) \prod_{t \in b(l):e(l)} P(z_t | a_t^c) \right\}. \quad (4)$$

Since the probability $P(s_l^c)$ can be quite informative, the proposed method can lead to increased precision in the process of functions definition throughout the working day.

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LOCAL DYNAMICS IN MODELS “PREDATOR-PREY” WITH AFTEREFFECT

Garkusha N.I.

Taras Shevchenko National University of Kyiv, Ukraine

ngarkusha@gmail.com

A classic example of systems dynamics in ecology is a model of the "predator-prey", proposed in Volterra V., which was modified by Verhulst P., Kolmogorov A.N., Bazykin A.D. Prerequisites for the development of the model are: victim population with a small number multiplies exponentially; the volume of produced and consumed by predator food per time depends of the size of the victim; in the absence of the victim of the predator population is dying at a rate determined by the natural mortality and competition.

The most common mathematical model of population dynamics for the system leads to a system of two ordinary differential equations

$$\begin{aligned}\dot{x}(t) &= a(x(t))x(t) + b(x(t))y(t), \\ \dot{y}(t) &= -c(y(t))y(t) + d(x(t))y(t).\end{aligned}$$

Here $x(t)$ - prey population, $y(t)$ - predator population,

$a(x(t)) = r \left(1 - \frac{x(t)}{K} \right)$ - growth rate of an isolated population of the

victim, $b(x(t)) = \frac{bx(t)}{1 + Ax(t)}$ trophic predator function,

$c(y(t)) = c + gy(t)$ - the specific rate of extinction of predator population; r, K, b, A, c, g are constant parameters of this system.

More adequate is a system with delay:

$$\begin{aligned}\dot{x}(t) &= a(x(t-\tau))x(t) + b(x(t-\tau))y(t) \\ \dot{y}(t) &= -c(y(t-\tau))y(t) + d(x(t-\tau))y(t).\end{aligned}$$

which takes into account the time between food consumption and maturation of offspring.

The report studies the dynamics of the stationary equilibria of the system with arbitrary lag $\tau > 0$ and with lag $\tau < \tau_0$, which depends from many different system parameters. The evaluation of convergence (divergence) in local vicinity of equilibria was made.

COMPARATIVE MANAGEMENT AND PECULIARITIES OF ITS USAGE IN GEORGIA

Gechbaia B., Didmanidze M.

Batumi Shota Rustaveli State University, Georgia

The interest towards management is especially increasing simultaneously with growth of integration of Georgia into the world business community and domestic Georgian civilized competitiveness and market development. It is important to assess foreign experience in order to determine what is useful to adopt and what may be negative, what is necessary to implement combination of own experience and world scientific and practical achievements and what is the way of the best arrangement of collaboration with the foreign companies.

Actuality of comparative management for Georgia is stipulated with its entering into the world market, including capital markets, activation of business of foreign companies at the domestic market, necessity of recognition of Georgian companies' business capability by foreign contractors, rising of the international rating of Georgian companies, which requires the highest level of management. It is impossible to provide the appropriate reaction to the new economic challenges without further improvement of Georgian management, including application of experience of the other countries.

Nowadays Georgian economy is only on the initial stage of establishment of market mechanisms and development. That is why, study of the leading international experience and finding own original way are real means of above noted.

The experience shows that the management system is prerequisite for successful activity of the separate industries and for the whole countries also, but in any case it is necessary to adopt them to the conditions existed and developed in the country's management system.

The comparative research of national models of management gives possibility to avoid other's mistakes, such researches are necessary as for Georgian companies, which obtain Western experience and also for foreign firms, which open their branches and representations in Georgia. It is necessary to develop the models, which use is possible in Georgia, taking into consideration "donor country's" cultural peculiarities and their application sphere. The world experience proves that a big success in management is noted in use of foreign leading experience taking into account national traditions.

INFORMATION - LEARNING ACTIVITIES

Geladze D.

Batumi Shota Rustaveli state University, Georgia

Active involvement in the world's information space is considered to be our country's priority. To solve this problem is crucial for many strategic goals, such as: democratic, free, legal state, civil society development, security, human rights, information technology not only the technical skills will give the pupil, but also the creation of favorable conditions for national and universal values, personality-free establishment. Without information technology, today it is impossible to see the progress in the state and public activities in any field. Computer is used to serve certain information-processing content, therefore computer placed in educational environment should be oriented to be used for educational content of the programs and resources of the learning process. Educational resource can be anything that will help the teacher to conduct an effective lesson.

The teacher must be guided by the standards of the subject, the content of the program and on the basis of the need to find and prepare training resources. Digital learning object is a combination of re-usable materials, where the materials are related and logically laid out, the object may include documents, images, simulations, videos, audio recordings, etc. Information technology can solve the problem of professional relationships, learning problems, education to individual needs, situation modeling, active time increasing at the expense of the knowledge and visual enhancement of information technology. We can single out the following teaching objectives with the use of information technology: the student's personality development, individual preparation of the information society in terms of a comfortable life. Thinking, aesthetic education, communication and research skills, developing the ability to make optimal decision in a difficult situation, developing the skills of implementing experimental- research work, information culture - knowledge-based information processing system establishment. The students receive knowledge in an interesting and authentic way. Modern information technology as a mean of teaching resource increases quality and efficiency of teaching-learning process. It should be noted that the teacher should give recommendations to students on network and information security, whether it is acceptable to use this or that program, and about the reliability of a given resource.

USING MULTIMEDIA RESOURCES FOR STUDENTS WITH SPECIAL NEEDS

¹Geladze D., ¹Didmanidze D., ²Geladze M.

¹Batumi Shota Rustaveli state University, Georgia

²Batumi public primary school, Georgia

During the teaching process, the usage of multimedia resources can be achieved by means of information and communication technologies, which helps students to develop their technical skills and creates conditions for forming a freeman with national and universal values. ICT is connected to the humanistic model of teaching, because its principles are taking into consideration the specific characteristics of individual students, which contributes to the child's perception of the material in an easier way. This way a child can easily move from Current Development Zone to the Nearest Zone of Development and thus the results are also achieved easily. It is recommended to use multimedia educational programs for pupils with special educational needs as additional lessons and for independent work as well. With the help of multimedia technologies:

- individualization of teaching is possible;
- increases student participation and technical skills;
- teaching and learning process becomes more intensive;
- Motivation is increasing;
- The conditions are provided for independent work;
- The teaching process takes place in a comfortable environment.

Using multimedia resources in teaching school disciplines contributes to effective teaching of the disciplines. It can enhance learning visuals (video, audio, computer graphics, modeling), extend the individual activities and feedback possibilities (virtual reality technologies), as well as possibility to access a variety of information (Telecommunications). In addition, teachers should first examine and then tailor multimedia resources to the students with disabilities. Students with special educational needs become actively involved not only in the learning process, but also in school events. Therefore, teachers will take part in the implementation of inclusive education, which aims to support the education of the students with special needs, social integration and the development of their interests and opportunities. Appropriate conditions should be created in order to give opportunities to these youngsters to develop their inner world, to express their opinions freely, protect their rights and dignity.

SPECIAL TRANSPOSITIONS OF ELEMENTS OF PERMUTATIONS, THEIR PROPERTIES AND APPLICATION IN VEHICLE ROUTING PROBLEMS

Grebennik I.V., Chernaya O.S., Urniaieva I.A., Sereda Y.V.

Kharkiv National University of Radio Electronics, Ukraine

igorgrebennik@gmail.com, titovaolga90@gmail.com

In some research and applied problems in different areas the mathematical models are based on combinatorial sets. The most utilized sets are permutations and its various subsets including cyclic permutations. Properties of the sets may be used when modeling and solving generation and combinatorial optimization problems. A class of the applied problems, mathematical models of which may be constructed on the base of permutations and its various subsets, is the widespread Vehicle Routing Problems.

Inclusion mapping of permutations into Euclidean space is one of the ways to investigate its properties. The convex hull of permutations set after the mapping is a permutation polyhedron. One of the basic properties of permutation polyhedron is a criterion for the adjacency of its vertices.

Permutations could be constructed by transpositions of generative elements. Special class of transpositions, which correspond to the criterion of adjacency in the permutation polyhedron, is considered in the report. We investigate the properties of the composition of several transpositions from special class, and analyze their impact on some types of permutations. It is necessary to take into account that different order of the transpositions in the following composition defines the various changes in a permutation for which the composition is used.

The report is devoted to the investigation properties of the composition of several transpositions of the considered special class, analysis of their impact on the permutations and application of some of these properties for mathematical modeling and solving the combinatorial optimization problems including Vehicle Routing Problems.

Propositions about the number of different permutations that can be obtained by applying a predetermined composition of transpositions that follow in a different order are proved.

Approvals examined in this report allow creating an algorithm for solving the problem of optimization of a linear function on the set of cyclic permutations.

ALGORITHM OF NUMERICAL MODELING OF TRANSPORT PROCESSES ON MULTIPROCESSOR COMPLEXES

**¹Gryshchenko O., ¹Zagorodnia G., ¹Martsafei A., ¹Onotskyi V.,
²Lyashko N.**

¹Taras Shevchenko National University of Kyiv, Ukraine

²Glushkov Institute of Cybernetics of NAS of Ukraine

**Ogryshchenko@ukr.net, Anna.zagorodnia@gmail.com,
vingar@ukr.net**

In spite of great progress in research models based on systems of transport equations and Navier - Stokes equations, a problem associated with the development of high-speed numerical methods exists nowadays. This problem can be solved by using modern multiprocessor technology and development of new numerical methods that focus on parallel computing.

The report is devoted to the construction and study method of numerical modeling of these processes, which focuses on the efficient use of multiprocessor systems. The method is based on two-step explicit-implicit differences schemes (DS-algorithms) [1,2]. Researched questions the existence of solution of the system of difference equations and their approximation, stability, dispersity and dissipativity. Received formulas of the solution, given the level depth of parallelization of numerical methods and proposed effective algorithm of parallelization.

The developed approach is applied to the construction solution of important problems of high radiation field modeling, which is generated by a laserbeam. Tests calculations and computational experiment practically confirm the effectiveness of the algorithm.

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GENERATIONAL PROBLEMS AND WAYS OF SOLVING THEM

Gurgenidze M., Mamuladze N.

Batumi Shota Rustaveli State University, Georgia

All relevant values create an era. There are eternal values like love, kindness, and other God-fearing values which are important and are not vitally affected by time. But there are values that bring a certain era and are constantly re-evaluating. The generations are changing, changing their ways of thinking, ways of life, thoughts and ideas.

The old generation of faith has become a dangerous and destructive process to change the values you consider important. Resistance and gap are formed between the new and the old generation; all of these promotes human values related to the value of the origin of the conflict and the problem of a bridge between the generations break.

In order to be able to live in such an environment, we need to know, what are the roots of the problem of the broken bridge between generations and can we recover it?

There is a solution to all the problematic issues; generational disagreement is no exception.

The main foundation of human development is a matter of education. The family, the school and the community are to look for the cause of this triangle of views and communication difficulties in distinguishing arising problems.

This triangle is more of a responsibility for the school, especially because it is not only a new generation of education and preparation for life; but also one of the most important functions of pedagogical education and parent's pedagogical deficit.

It is important for parents of adolescent children to be friends, discuss the issues which are of interest to children and briefly, the child looks at the world and compares it to ourselves. The child would remember that, "in my childhood, just as they had the same requirements, it is only a form of expression that has changed. So, I have to try to neutralize the conflict".

It is necessary to carefully consider the children. The parents are the people closest to them, who is more interested in their success, prosperity, happy future and general achievements; as well as the soon to become parents. Life is often like a boomerang summarizes the answer.

It is inadmissible to forget about the past. The future must be built on it, as it was in the national traditions of the past. It can help one to have the personal qualities that make it worthwhile and original. Each time a person is fulfilling the requirements of the era of great value creation.

It's a huge responsibility to faithfully execute this kind of education as the children need more education; the education of the past and its traditions, education in today's circumstances and its requirements in order to be able to fit in the past on the basis of a better future in the creation so that the time is not far behind.

NON-PARAMETRIC DENSITY ESTIMATES OF THE FIRST HITTING TIME

Hasilová K.

University of Defence, Czech Republic

kamila.hasilova@unob.cz

We examine soft failure occurrence of Li-ion energy power sources. Namely, we focus on the so called first hitting time (FHT), i.e. the time when a battery is no longer able to produce a sufficient amount of voltage. When modelling the discharge course and the time of reaching the threshold, we use a model $X(t) = \mu(t) + \sigma W(t)$, where $\mu(t)$ is a function representing drift, σ^2 is a variance and $W(t)$ is a standard Wiener process. Parameters of the model are obtained from measured experimental data.

We focus on estimating the first hitting time. From the literature it is known that FHT follows a parametric distribution. However, when using a non-linear function $\mu(t)$, we need to employ non-parametric estimates of the FHT distribution. Especially, temperature below zero influences the distribution of FHT. We compare the non-parametric estimates with the commonly used parametric estimates.

APPLICATION OF MARKOV QUEUING SYSTEM IN THE MANAGEMENT OF CLOUD TECHNOLOGIES

Ignatova Iu.

Vadym Hetman Kyiv National Economic University, Ukraine

u1@ukr.net

A significant problem in the management of the cloud technologies is force-majeure factors such as the unintended pairing of independent

components that control the load, energy consumption, and infrastructure elements. Such situation may cause undesired feedback and the loss of the dynamic stability of a system. The solution of this problem, from our point of view, is the estimation of the time which system requires to enter the stationary mode after the force majeure crash. For this purpose, we propose to use Markov multi-channel queuing system with Poisson input flow and denial of service. Consider the operation of one server as the work of the multi-channel queuing system. Suppose that k -channel queuing system serves requirements which create an input Poisson flow with the parameter λ ; the time of the service of requirements is an exponentially distributed random variable with the parameter μ . Let one of the service channels may fail. At the same time, the breaking of the channel occurs at random times, creating a Poisson flow with parameter λ_0 . Time which is spent on the restoration of the service channel is a random variable that has an exponential distribution with parameter μ_0 . We denote the following variables: (*) the probability $P_{m(k)}(t)$ – which means that k requirements are serviced in the system at time t and m requirements remain in the queue; the channel is in working condition; (**) the probability $R_{m(k)}(t)$ – which means that k requirements are serviced in the system at time t and the channel is out of order; at the same time, requirements continue to come in the system and m requirements are in the queue.

A stochastic model of such a system has the following form:

$$\begin{aligned}
 P'_{0(0)}(t) &= -(\lambda + \lambda_0)P_{0(0)}(t) + \mu P_{0(1)}(t) + \mu_0 R_{0(0)}(t) \\
 P'_{0(1)}(t) &= -(\lambda + \lambda_0 + \mu)P_{0(1)}(t) + 2\mu P_{0(2)}(t) + \mu_0 R_{0(1)}(t) + \lambda P_{0(0)}(t) \\
 P'_{0(2)}(t) &= -(\lambda + \lambda_0 + 2\mu)P_{0(2)}(t) + 3\mu P_{0(3)}(t) + 2\mu_0 R_{0(2)}(t) + \lambda P_{0(1)}(t) \\
 &\vdots \\
 P'_{m(k)}(t) &= -(\lambda_0 + k\mu)P_{m(k)}(t) + k\mu_0 R_{m(k)}(t) + \lambda P_{m-1(k)}(t) \\
 R'_{0(0)}(t) &= -(\lambda + \mu_0)R_{0(0)}(t) + \lambda_0 P_{0(0)}(t) \\
 R'_{0(1)}(t) &= -(\lambda + \mu_0)R_{0(1)}(t) + \lambda_0 P_{0(1)}(t) + \lambda R_{0(0)}(t) \\
 R'_{0(2)}(t) &= -(\lambda + 2\mu_0)R_{0(2)}(t) + \lambda_0 P_{0(2)}(t) + \lambda R_{0(1)}(t) \\
 &\vdots \\
 R'_{m(k)}(t) &= -k\mu_0 R_{m(k)}(t) + \lambda_0 P_{m(k)}(t) + \lambda R_{m-1(k)}(t)
 \end{aligned} \tag{1}$$

The solution of system (1) in dynamics will allow us to find the time which system need to enter the stationary mode and will define more precisely the force majeure risks in cloud technologies management.

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THE OPTIMAL CONTROL PROBLEM WITH MINIMUM ENERGY FOR PARABOLIC EQUATION WITH NON-LOCAL BOUNDARY CONDITIONS IN THE CLASS OF NON-STATIONARY CONTROLS

Kapustian O.A.

Taras Shevchenko National University of Kyiv, Ukraine

olena.kap@gmail.com

In this paper we investigate the classical resolvability of the energy minimization problem for parabolic equation in sectorial domain with non-local boundary conditions in the class of non-stationary controls. Resolvability of such a problem in the case of stationary control function has been proved in [1].

In domain $Q = (0, T) \times \Omega$, $\Omega = \{(r, \theta) | r \in (0, 1), \theta \in (0, \pi)\}$ we consider the problem: to find a state function $y(t, r, \theta)$ and control time-dependent function $u(t, r, \theta)$ such that

$$\begin{cases} \frac{\partial y(t, r, \theta)}{\partial t} = \Delta y(t, r, \theta) + u(t, r, \theta), & (t, r, \theta) \in Q, \\ y(t, 1, \theta) = 0, & t \in (0, T), \theta \in (0, \pi), \\ \frac{\partial y(t, r, 0)}{\partial \theta} = \frac{\partial y(t, r, \pi)}{\partial \theta}, & t \in (0, T), r \in (0, 1), \end{cases} \quad (1)$$

$$y(0, r, \theta) = h(r, \theta), \quad y(T, r, \theta) = z(r, \theta), \quad (2)$$

$$J(u) = \int_0^T \int_0^1 r \|u(t, r)\|_{L_2(0, \pi)}^2 dr dt \rightarrow \inf, \quad (3)$$

where $\Delta y = \frac{1}{r} \frac{\partial}{\partial r} \left(r \frac{\partial y}{\partial r} \right) + \frac{1}{r^2} \frac{\partial^2 y}{\partial \theta^2}$ be a Laplace operator in polar

coordinates, $h, z \in C(\overline{\Omega})$ are given functions. By using the biorthonormal basis systems of functions and the Fourier-Bessel series, we reduce the problem (1)-(3) to the infinite-dimensional moment problem and prove its resolvability in the class of non-stationary controls.

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ABOUT STRUCTURAL FORMULAS METHODS IN PROBLEMS OF SYNTESYS

Kasianiuk V.

Taras Shevchenko National University of Kyiv, Ukraine

veda.kasianiuk@gmail.com

Many problems of modern science and technology require establishment of effective means for control fields of physical values of various kind and synthesis of systems with distributed parameters for their solution. Methods for solving problems of systems' synthesis described by structural formulas [1] – by classes of linear (or nonlinear) integral operators defined on the set of elements of a Hilbert (or Banach) space are considered in the work. The same methods can be applied to solve fields' management tasks given by structural formulas.

From mathematical point of view the tasks can be divided into three classes:

- the problem of finding elements that can be represented by structural formulas that optimally approximate specified field or specified functions in accordance to norm given;
- the problem of finding elements that can be represented by structural formulas that optimally interpolate specified field or specified functions in accordance with given values of finite or infinite set of linear functionals.
- the problem of finding elements that can be represented by structural formulas optimizing the specified functionals or functionals' systems that characterize "quality" of field or function with limitations on other functionals.

To solve the problems, optimization and functions' theory methods were applied. The particular tasks of antenna patterns synthesis, function-signals restoration (in antennas' technique and theory of communication), tense and displacement fields' restoration (in plane problem of the theory of resiliency). The results discrete analogues (in

particular for antenna arrays, for fields of deformations caused by concentrated loads) are obtained as well.

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STATIONARY POINTS OF ONE ASYMPTOTIC DISSIPATIVE LORENZ SYSTEM

¹Kinash A.V., ²Chabanyuk Ya.M., ¹Khimka U.T.

¹National University "Lviv Polytechnic", Ukraine

²Lublin University of Technology, Poland

anastasiikinash@gmail.com

Considering the specific generalized Lorenz model, which describes the economics of the city

$$\begin{cases} \frac{dX}{dt} = Y - 6X, \\ \frac{dY}{dt} = 3X - 3Y - 7XZ, \\ \frac{dZ}{dt} = 6XY - 4(1 + x(t))Z + dw(t), \end{cases} \quad (1)$$

where $x(t)$ – Markov process and $w(t)$ – Wiener process [1].

Let us find the stationary points of the averaged system for the system (1), which has the form

$$\begin{cases} \frac{dX}{dt} = Y - 6X, \\ \frac{dY}{dt} = 3X - 3Y - 7XZ, \\ \frac{dZ}{dt} = 6XY - 4Z. \end{cases}$$

By the equating the right sides of equations to zero and using the conditions of asymptotic dissipativity of the initial system[2], we get that the only one stationary point of the system is $D(0,0,0)$.

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DYNAMIC SYSTEM PARAMETER'S OPTIMIZATION BY MATHEMATICAL MODELING METHODS

Kharchenko I.I., Matvienko V.T.

Taras Shevchenko National University of Kyiv, Ukraine

ihar@unicyb.kiev.ua, matvienko.vt@gmail.com

Solving problems of real objects' or processes' studying and their features' discovering considering attitude and optimal control prediction becomes simpler if one studies their mathematical models. In general case under process we consider complex of consequent actions aimed at defined result. Namely mathematical models are used today not only to study physical processes, but also to determine features of social and economic processes.

Studies using mathematical models are arranged in the following sequence.

Problem definition of modeling, aim, results statement and model output are performed first. Problem definition is performed in any case according to the client's requirements or research plan. It's necessary to consider calculation parameters, their quantity, operation mode analysis, system indices and characteristics estimation. Set of studied or measured parameters may be considered as model output. Model output usually corresponds to the parameters of system output. These parameters are basis for following processing of modeling results. Modeling problem statement is impossible without processing and analysis of information.

Mathematical model obtained may make mistakes so that its conformity should be analyzed. That's while the mathematical model created should correspond to certain requirements and criteria. Main quality estimation parameters of mathematical model are accuracy, efficiency, generality and informatively. All of the mathematical model's characteristics are interdependent. Necessary accuracy being one of the main criteria of model estimation is determined by adequacy condition and depends on modeling errors.

Differential equation systems were studied by the author to model acceleration systems and focus charged particles in linear accelerators and following optimization of beam initial parameters by selected criteria.

ASYMPTOTIC SMALL DIFFUSION SCHEME WITH GLOBAL BALANCE CONDITIONS

¹**Khimka U.T.**, ²**Chabanyuk Ya.M.**, ³**Semenyuk S.A.**

¹Lviv Polytechnic National University, Lviv, Ukraine

²Lublin Technology university, Poland

³Institute of information technologies “Intellias”, Lviv, Ukraine

ulyana.himka@gmail.com, semenyuk@gmail.com

Consider random evolution in asymptotic small diffusion scheme with global balance conditions defined by stochastic differential equation[1,2]

$$du^{\varepsilon, \delta}(t) = C(u^{\varepsilon, \delta}(t), x(t / \varepsilon^3))dt + (\varepsilon^{-1} + \delta^{-1})C_0(u^{\varepsilon, \delta}(t), x(t / \varepsilon^3))dt, \quad (1)$$

where $x(t), t \geq 0$, - Markov process in phase space of states $(X, \mathbf{X})$ with stationary distribution $\pi(B), B \in \mathbf{X}$ [2]. The balance condition holds

$$\int_{\mathbf{X}} C_0(u, x)\pi(dx) = 0.$$

The generator $L^{\varepsilon, \delta}(x)$ of random evolution (1) on perturbed test-function $\varphi^{\varepsilon, \delta}(u, x) = \varphi(u) + (\varepsilon + \delta)\varphi_1(u, x) + \varepsilon^3\varphi_2(u, x)$, where

$$\varepsilon / \delta \rightarrow 1, \varepsilon \rightarrow 0, \text{ has form } L^{\varepsilon, \delta}(x)\varphi^{\varepsilon, \delta}(u, x) = L^\delta \varphi(u) + \theta_L^\varepsilon(x)\varphi(u),$$

where

$$L^\delta = \Pi C(x)\Pi + \delta \Pi C_0(x)R_0^C(x)\Pi,$$

$C_0(x)\varphi(u, x) = C(u, x)\varphi'(u, x)$ [3]. The result got in the article allows to consider asymptotic presentation of exponential generator

$$H^\delta \varphi^\delta(u) \rightarrow H \varphi(u), \varphi^\delta(u) \rightarrow \varphi(u),$$

in the chart of cerouss with a small parameter $\delta \rightarrow 0$

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CONTROL OF THE MICROHARDNESS OF MODIFIED METAL LAYER

¹Kolyada Yu.E., ²Bulanchuk O.N.

¹Mariupol State University, Ukraine

²Priazovskiy State Technical University, Ukraine

yukol @ukr.net, o_bulan@gmail.com

According to the model proposed in [1] were produced by numerical calculations in the package Comsol Multiphysics the phenomena of rapid pulsed heating of the metal surface. In this task we took into account the melting and solidification of the substance. In this case there is a jump of density and thermal conductivity material at the transition from liquid to solid phase. The account of this phenomenon leads to the fact that the thermal conductivity equation is transformed to quasilinear nature. This jumps lead to a number of anomalies associated with the numerical simulation and determine complex nature of the rate change of temperature in the space and in time.

To test the stability and convergence of numerical simulation was carried out a series of calculations with decreasing step in time and space. In addition, various methods for solving systems of nonlinear equations obtained in the framework of the finite element method were used.

Calculations have shown that due to the nonlinearity of the thermal conductivity in the solid is formed such rate profile of temperature change that in the given time has a maximum at a cooling rate is not at the boundary (as is usually the case in the solid state heating) and at a certain depth from the surface. Thus, this maximum occurs at a time when the the substance is in state of mixing the two phases. In the earlier and later times the rate of temperature change near the surface is a monotonic function of the coordinate. It should be noted that by varying the law of energy input can be controlled cooling rate parameters in the subsurface.

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OPTIMIZING DYNAMIC OF SYNCHRONIZATION SYSTEM WITH PHASE-LOCKED LOOP FOR INFOCOMMUNICATION NETWORKS

¹Koval V., ¹Dorogobed V., ¹Kalian D.,

²Khudyntsev M., ³Koval V.

¹ National University of Life and Environmental Sciences of Ukraine

²State Service of Special Communication and Information Protection of
Ukraine, State Center of Cyberdefense and Cyberthreats Counteraction

³State University of Telecommunications

v.koval@nubip.edu.ua , nh@te.net.ua , koval.victor@gmail.com

The processes in complex and geographically distributed dynamic systems, such as infocommunication networks, take place in space and time, which raises the obvious need of coordination through the use of synchronization systems (SS). SS are a different dynamic automatic control systems, that in the real world of technical operation and disturbances generate signals for performing synchronous operations on different processes of the information and communication networks by adjusting their time and frequency scales.

One of the requirements for operation characteristics of SS with phase-locked loop is minimizing time of achieving synchronism, which is provided by speed-optimal control. Particular effects of limits, that were created by digital shapers of periodic control actions, on speed-optimal transition process were investigated. The synthesis of speed-optimal structure of synchronization system based on two-level hierarchical controller was done.

To increase the accuracy and temperature stability of synchronization signals that are formed in real conditions of technical operation of the SS, it was proposed to use the method of statistical optimization.

Original algorithms and “CALCULATION” application were developed to automate optimization process. The optimal conditions of temperature stability of the synchronization system were determined.

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GLOBAL INFORMATION INFRASTRUCTURE AND ITS IMPACT ON TEACHING METHODS OF "COMPUTERS AND COMPUTER TECHNOLOGIES" DISCIPLINE

¹Koval V.V., ²Khudyntsev M.M., ¹Kalian D.O., ¹Kozyrska T.O.

National University of Life and Environmental Sciences of Ukraine

²State Service of Special Communication and Information Protection of
Ukraine, State Center of Cyberdefense and Cyberthreats Counteraction

v.koval@nubip.edu.ua, nh@te.net.ua

The rapid development of technical progress in the world causes an increase in amount of information and its share in the world's gross product volume becomes even more significant and that leads to development of information society in near future [1].

It is known fact that global information infrastructure (GII) is a technological base for information society [1]. Regarding that, studying its main principles and fundamentals is important within "Computers and computer technologies" discipline. That creates opportunity to form students' skills and knowledge to design and integrate new (update existing) equipment and computer technologies, organizational support, technical operation, including planning enterprise production activities, performing technological tasks, administration (monitoring) of computer networks, telecommunication appliances in a context of development of National information infrastructure of Ukraine and integrating it into European and Global information space.

According to developed methodology, it is proposed to study the following. Main principles of building GII and its role in development of global community. Integration of National information infrastructure of Ukraine into European information infrastructure (EII) and Global one (GII). Fundamentals and main goals of National Program of Informatization of Ukraine. Architecture of GII, including industrial, structural, functional model and implementation model. Principles of global telecommunications, cloud computation technologies, statistical decision making.

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RECURSIVE THREE STEP METHOD FOR SOLVING SYSTEM OF NONLINEAR EQUATIONS

Kovalchuk O.

Ivan Franko National University of Lviv

olyak2005@gmail.com

Consider the system of nonlinear equations

$$P(x) = 0, \quad P: R^n \rightarrow R^n \quad (1)$$

We propose recursive three step method based on Newton's method and modification descend method

$$\begin{aligned} u_k^{i+1} &= x_k^i - P'(x_k^i)^{-1} P(x_k^i), \\ v_k^{j+1} &= x_k^i - \alpha_k^i h_k^j, \\ x_k^{i+1} &= \arg \min_{\lambda} \|P(u_k^{i+1} + \lambda(v_k^{j+1} - u_k^{i+1}))\|, \end{aligned} \quad (2)$$

$$x_k^0 = x_k, \quad x_{k+1} = x_k^p, \quad h^j = \left(0, \dots, \frac{\partial f}{\partial x^j}, \dots, 0 \right)^T, \quad \frac{\partial f}{\partial x^j} = \sum_{q=1}^n \frac{\partial P_q}{\partial x^j} P_q,$$

$$i = 0, \dots, p-1, \quad k = 0, 1, \dots \quad j = \text{random}(1, n),$$

where α_k^i such as $\|P(v_k)\| < \|P(x_k)\|$.

Under certain conditions, the sequence $\{x_k\}$ which is build according to (2), have $p+1$ a rate of convergence, however, convergence denominator is less than in regular recursive method. Using proposed method helps us reduce the calculating time for finding the solution of the system comparing with classical method. From numerical experiments, we show that three step method is very efficient when Jacobian is a singular and large dimension.

JUSTIFICATION OF THE REGULARITIES OF FLOW RESISTANCE COEFFICIENT OF DARCY-WEISBACH FORMULA

Krivenko S., Nazarenko N.

Mariupol State University, Ukraine

ksv_pgtu@rambler.ru

The most of works devoted to the definition of hydraulic resistance ΔP of granular layers. Researchers most often use the Darcy-Weisbach formula [1].

For pelletized sintering mix containing more than 30% of fine fractions, significant impact along with porosity layer have a tortuosity of the channels and the local resistance, which take into account the flow resistance coefficient Ψ . The position of the first maximum of the coefficient $\Psi_{\max}$ when adding small fractions to the layer corresponds to their part of 20 % and increased 2.2 times. Likely that the fine particles, located between the large and accumulating at the bottom between them in narrow places, reduce the diameter of the channels and increase the tortuosity faster than the specific volume of the cavities is reduced.

According to the Slighter formula the laying angle of the particles in a rhombus $\theta = 73,74^\circ$ corresponds to the porosity of the layer $\varepsilon = 0,418$. It is estimated that the placement of two or more particles in the narrow voids between the larger ones, which are held for the account of friction forces for the occurrence of locking effect, is necessary. For the most typical ratio of diameters $d_s/d_b = 1/10$, the maximum number of small particles located in the voids of the rhombohedral stacking taking into account the porosity monofractional layer is 418 PCs. The proportion of fines $m = 0,2$ corresponds to 250 particles in the hollow of the packing. This is $\approx 60\%$ of the volume of hollow. Complete filling of the rhombohedral packing and reducing the porosity of the layer to $\varepsilon = 0,27$, with the reduction coefficient Ψ , with the further addition of small fractions to $m = 0,3$ is happens. The maximum amount of fines, that can be boarded in the hollow, is coincide, which confirms the correctness of reasoning.

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TOMATOES QUALITY AS FEEDBACK OF AUTOMATION SYSTEM

Lysenko V., Dudnyk A., Lendel T.

National University of Life and Environmental Sciences of Ukraine
dudnikalla@mail.ua

Modern control systems which ensure plants growing process in the greenhouses usually do not track their response to the action of natural disturbances and control actions. That is, the biological complex object's states are not taken into account and it does not allow getting the highest-possible economic effect. As such, there is a need to develop

energy-efficient control method of electrotechnical complex in the greenhouse, and to maximize profits by considering biological features of the object.

Modern productions of tomato plants in greenhouses are standardized, and therefore the quality of plant products at a certain stage of technology should be in certain limits. Availability of quality limits are explained by the random disturbances (solar radiation intensity, external air temperature, etc.) and by biological component features [1, 2]. That is, there is uncertainty which existing control systems overlooked.

Neural network with input parameters (air temperature, plant humidity, the quantity and quality of plant production), and output (profit) was used to assess the impact of process parameters, quality and quantity of plant products for plants profit [2]. The different types of neural networks were studied, and the multilayer perceptron demonstrated the best result – training error is 2.4 %, and control – 1.9 % [2].

Analysis of research results allows us to conclude possibility of using neural network (multilayer perceptron) for forecasting and profit maximization of tomatoes in the conditions of uncertainty, which is typical for greenhouse technology.

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MATHEMATICAL SIMULATION OF EXTERNAL BALLISTICS PROBLEMS

¹Makeev V., ²Stelia O., ²Potapenko L., ²Sirenko I.

¹Sumy State University, Ukraine

²Taras Shevchenko National University of Kyiv, Ukraine

oleg.stelya@gmail.com, lpotapenko@ukr.net

Model analysis of the artillery projectiles trajectories involves the use of mathematical models that take into account various influencing

factors. In this regard, there are different models that use these or other assumptions for the projectile motion. These assumptions may be 1) projectile motion is analyzed as a material point motion or 2) aerodynamic model is used with the choice of the number of degrees of freedom. Due to the complexity of the problem and for a more detailed study of the projectile trajectory parameters we used two models: a model based on the STANAG standard, adapted to the existing baseline data [1] and the model presented in the paper [2].

The first model uses a system of equations, which is written in vector form:

$$m \frac{d\vec{u}}{dt} = \vec{GF} + \vec{DF} + \vec{LF} + \vec{MF}, \quad (1)$$

$$\frac{d\vec{X}}{dt} = \vec{u}, \quad (2)$$

where m – mass of projectile– $\vec{u}$ – velocity vector, $\vec{X}$ – vector coordinates, $\vec{GF}$ – gravity, $\vec{DF}$ – drag force, $\vec{LF}$ – lift force, $\vec{MF}$ – Magnus force.

To solve a system of ordinary differential equations using numerical Kutt-Merson method. As a result of the fact that some additional conditions for (1)-(2) is defined at one end of the integration interval, and other conditions are at the second end, we used the firing method for solving this problem.

The paper provides examples of the calculation of the effects of wind, the impact of the Magnus force, initial velocity to the projectile trajectory at different distances to the target, and at various heights above the target shooting plane. The simulation results are compared with the firing tables.

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SYSTEM APPROACH FOR ALTERNATIVE ENERGY SOURCES

CAPACITY EXPANSION PROBLEM

Manovytska D.O., Dolenko G.O.

Taras Shevchenko National University of Kyiv, Ukraine

galinadolenko2006@yandex.ru, manovytska_dariia@ukr.net

The majority of countries consider developing alternative energy based on renewable sources (solar, wind, hydraulic, geothermal, etc.) a priority direction in the evolution of the energy sector.

Nowadays renewable energy sources are providing about 19% of final energy consumption in the world. The largest producers of "green" electricity are 7 countries, the total capacity of which constitutes to 71.5% of the world's (470 GW, excluding hydropower): China (23.3%), the USA (16%), Germany (13%), Italy (4.9%), Spain (4.9%), Japan (4.7%), India (4.7%) [1].

According to the long-term plans of the energy sector development of the leading EU countries, the share of electricity derived from renewable sources is supposed to be risen by 2020 to 18% - in Germany (comparing to 11.3% in 2015), 20% - in Spain (13.8% in 2015), 23% - in France (16% in 2015), 49% - in Sweden (43.9% in 2015), etc. [2].

Ukraine has also committed to reach the level of 11% energy produced from renewable sources in the total energy consumption till 2020, which will stimulate the further development of renewable energy in Ukraine.

Preceding information significantly updates the solving of optimization problems related to the development of renewable energy.

The paper presents results multi-criteria models analysis [4], algorithms and tools for structure choice of wind, solar and biomass capacity in the year t . The goal of this investigation was to choose and to build up techniques using system optimization methodology [3].

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COOPERATIVE GAMES WITH FUZZY SET OF FEASIBLE COALITIONS

Maschenko S.O., Morenets V.I.

Taras Shevchenko National University of Kyiv, Ukraine

s.o.mashchenko@gmail.com, v.i.morenets@gmail.com

In classic cooperative games, it is assumed that for a given set of players N , any coalition $S \subset N$ is allowed. In real world situations that can be modeled by cooperative games, not all coalitions of players can form for a variety of reasons economic, political or technical nature. Moreover, in some cases it is also difficult to clearly specify the set of feasible coalitions.

The report discusses a cooperative game with fuzzy set of feasible coalitions. The proposed approach allows to generalize to this case the basic principles of optimality for cooperative games: the C-core, the N -core and Shapley value.

The basis of the developed approach is the notion of fuzzy set intersection distinct sets. This operation is a generalization of the corresponding classical operations. It is shown that the result is a fuzzy set of type 2 (fuzzy set, membership function which can take the fuzzy membership values). Proposed definition of a fuzzy set of type 2 by using fuzzy mapping. Developed constructive representation of membership function to this set. Considered examples of the implementation of the operation of intersection.

The report discusses the optimization problem [1,2] that allow to implement the basic principles of optimality for cooperative games: the C-core, the N -core and Shapley value in a fuzzy set of feasible coalitions of players and approaches to their solution.

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LAPLACE CRITERION FOR MAKING DECISION UNDER UNCERTAINTY

Mashkina M.

International Research and Training Center for IT and Systems
of the NAS of Ukraine and MES of Ukraine

masha.mashkina@gmail.com

In current trends of economic globalization, fierce competition and rapid development of information technologies virtual enterprises have become increasingly popular.

Virtual Enterprise is created by combining the resources of several different companies (agents), with the result that often need to make decisions under conditions of uncertainty.

Making decisions - an integral part of any activity aimed to choose a method for achievement the goal. The decision – is a choice of alternatives

The decision is made in conditions of uncertainty, when impossible to estimate the probability of potential outcomes. It happens, when requiring accounting factors are so new and complicated that it is impossible to get enough of the relevant information that can help to objectively determine the probability or the current situation situation is not subject to known laws. Therefore, the probability of certain consequences can not be predicted with reasonable certainty. The uncertainty is characteristic of some of the decisions which are taken in a rapidly changing environment.

Selection of the best solutions in the face of uncertainty depends on what is the degree of uncertainty, that is what kind of information the decision maker has.

If the uncertainty is too high, then the decision-maker prefers not to make assumptions about the probability of various external conditions, this person can not to make assumptions about the probability of various external conditions, this person may or may not to take into account the probability, or to treat them as equals, that one is almost the same. If you use this approach for the assessment, you have four criteria for estimation of prospective strategies:

- Wald's maximin criterion;
- Routh–Hurwitz stability criterion;
- Savage criterion (regret theory);
- Bayes – Laplace criterion

Bayes – Laplace criterion states, that within the information approach in the situation of uncertainty state probabilities are unknown, there is no evidence to suggest that they are different. Therefore, it can be assumed that they are the same.

In this case, the chosen strategy, characterized by the estimated cost provided equal probability. Laplace criterion allows to transform the condition of uncertainty into condition of risk. According to Laplace criterion average gain is used as an alternative assessment:

$$L_i = \frac{\sum_{j=1}^M x_{ij}}{M}.$$

Optimal is an alternative with the maximum average gain:

$$X^* = X_k, \quad L_k = \max(L_i), \quad i = 1, \dots, N.$$

The appropriateness of use of this criterion stems from the fact that it is completely insensitive to the ratio of the decision maker, it is the so-called criterion of rationality, while it assumes greater awareness and a sufficiently long implementation.

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CLASSIFICATION OF THE IMAGE FOR SOLVING THE PROBLEM OF METALLOGRAPHIC ANALYSIS

Merkulova K.V., Kolyada Yu.E.

Mariupol State University, Ukraine

k.merkulova@mdu.in.ua, yukol@ukr.net

To determine the quality of thermal and mechanical processing of metals and alloys is used a wide range of metallographic examination. For that expensive equipment is used. Conducting of these studies needed for the analysis of the crystal and grainy structures of modified materials. Recently, for the study of microstructures are used methods of automatic image analysis and their comparison with the corresponding atlases of structures.

One of the promising methods of computer processing metallographic image analysis is a log-polar wavelet analysis, resulting in a vector which contains classified information component of the image.

To solve the problem of determining the affiliation of the classification vector to the etalon class is proposed the method of image classification. This method uses the distances Mahalanobis (Mh) and Euclidean (E), according to which the distances between the classification and the reference vectors was determined. The etalon vectors were obtained as result of processing etalon images (provided by experts). Mahalanobis distances:

$$Mh = \{(xt - V)^{\tau} C_{im}^{-1} (xt - V)\}, \quad (1)$$

where xt - vector subject of classification or test vector; C_{im}^{-1} - an inverse covariance matrix; τ - the transpose; V - the vector of mean values of the reference grade.

Euclidean distance was calculated between the vector of subject classification and mean vector for the reference class:

$$E = \sum_{i=1}^n (xt_i - V_i)^2, \quad (2)$$

where n - the number of elements in the vectors.

The calculated distances M_h and E should be compared with the established threshold, computed by reference images, and to determine belonging to a particular class.

The accuracy of such a classification is of the order 92% [1].

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THE DEFINE SURVIVABILITY OF INFORMATION SYSTEMS AND TECHNICAL MEANS OF PROTECTION USING METHODS OF SYSTEM ANALYSIS

Mjakuhin Yu.V., Nakonechny V.S., Rozorinov G.N.

State university of telecommunications, Ukraine

szl.dut@gmail.com

As a rule, the application of information technology has a positive impact on all spheres of life activity in modern society. However, there are also negative aspects, which are manifested in the form of deception, violation of the integrity of electronic information, its theft, destruction or stolen hardware for data storage, which in general can result in damage, as the objects of the economy and the state as a whole.

The degree of protection of the objects of the economy from these threats depends on the efficiency, reliability, performance and survivability of technical means of protection (TMP). These technical parameters are proposed to estimate quantitatively applying the system analysis methods for solve semistructured tasks.

We investigated the possibility of using and improving these methods for purpose to improve efficiency their performance.

As the basis was chosen the method which is implemented by Bayes-Laplace function, id est, additive weighed function as a polynomial of n -th degree with m unknowns. This function is being modified for a particular group of technical characteristics of the TMP. This change allows us to interpret the level of technical efficiency of TMP. The survivability level of TMP is offered to define with using function that displays a numerical the coefficient of saving efficiency technics. The proposed method is also considered binding to the place where will be operated this TMP. The method allows for:

1. A functional compliance of technical characteristics and the basic elements of TMP.
2. Independent processing of specific data that relate to the relevant groups of TMP (information from the analyzed sources said that the number of groups shall not exceed seven).
3. The mathematical transformations of quantitative to qualitative values. For this purpose we developed a special method of conversion which is completely absent such a thing as "loss of information".
4. This method is proposed to be used for the TMP which have topology of the class - "common bus" + "tree." Also, this method is proposed to be used for determining the level of survivability

information systems against cyber attacks.

THE CONSTRUCTION OF RISKLESS PORTFOLIO FOR STUDENT-LIKE FAT MODELS

Musienko J., Shchestyuk N.

National University "Kyiv-Mohyla Academy", Ukraine
mursienko@ukr.net, Natalyshch@gmail.com

Black, Scholes and Merton [1] showed using lemma Ito that it is possible to set up a riskless portfolio consisting of a position in an option on a stock and a position in the stock. Expressed in terms of Δ - "delta", the Black-Scholes portfolio is

-1: derivative (option),
+ Δ : shares of the stock.

The holder of this portfolio is short one derivative and long an amount Δ of shares. Using delta terminology [3], we can say that Black and Scholes valued options by setting up delta-neutral position and arguing that the return in the position should be the risk-free interest rate.

In this paper we set up a riskless portfolio for alternative to Black-Scholes GBM model that incorporates the Student-like distribution of the returns. This FAT model [2] gives asset prices as GBM but is driven by some nondecreasing stochastic "activity time" (or "fractal time") process. We consider the model for the stock price P_t , where parameters $\mu \in \mathbb{R}$ and $\sigma > 0$ reflect drift and diffusion, and P_t is the

strong solution of the SDE
$$dP_t = \mu P_t dt + \left(\theta + \frac{\sigma^2}{2} \right) P_t dT_t + \sigma P_t dW_t.$$

We construct the activity time $T_t^m = \sum_{i=1}^t \tau_i^m$, where τ_i has reciprocal (inverse) Gamma distribution $R\Gamma(\alpha, \beta)$.

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MEAN SQUARE ESTIMATION OF SOLUTIONS AND RIGHT-HAND SIDES OF POISSON'S EQUATION UNDER UNCERTAINTY

Nakonechniy O., Demydenko S., Losieva M.

Taras Shevchenko National University of Kyiv, Ukraine

a.nakonechniy@gmail.com, s.demidenko@gmail.com

mv.loseva@gmail.com

Let D be a bounded domain in R^n such that D has piecewise smooth boundary Γ . Vector-function $y(x)$ is observed on D , where

$$y(x) = \text{grad } \varphi(x) + \eta(x), \quad (1)$$

$\varphi(x)$ - generalized solution of the following boundary value problem

$$\Delta \varphi(x) = (Bf)(x) + g(x), \quad x \in D,$$

$$\varphi|_{\Gamma} = 0,$$

functions $g_1(x) = (Bf)(x)$ and $g(x)$ belong to $L_2(D)$ space, f - some vector from Hilbert space F , B - continuous linear operator, $\eta(x)$ - realization of random vector field with conditions $E\eta(x) = 0$, $\int_D E|\eta(x)|^2 dx < \infty$.

It is assumed, that function $g(x)$ is known, while vector f and function $E|\eta(x)|^2$ are unknown and belong to $G_1 = \{f : \|f\| \leq \gamma_1\}$ and $G_2 = \{\eta : \int_D E|\eta(x)|^2 dx \leq \gamma_2^2\}$ respectively.

We discuss the problem of finding optimal in some sense linear estimates of function $\varphi(x)$ and vector f using observation (1). To solve this problem, it is proposed to find guaranteed linear mean square estimates of some linear continuous mappings $l_1(\varphi)$, $l_2(f)$ and relaying on such estimates get optimal estimates of function $\varphi(x)$ and vector f .

Theorem. Let f and $\eta(x)$ belong to G_1 and G_2 respectively. If

$$\hat{l}_2(f) = \int_D (u(x), y(x)) dx + c,$$

than

$$\min_{u, c} \max_{G_1, G_2} E |l_2(f) - \hat{l}_2(f)|^2 = \max_{G_1, G_2} E |l_2(f) - \hat{l}_2(f)|^2,$$

where $\hat{l}_2(f) = \int_D (\hat{u}(x), y(x)) dx + \hat{c}$, $\hat{u} = \gamma_2^{-2} \text{grad } p(x)$ and function

$p(x) \in W_2^1(D)$ is solution of equation

$$\int_D (\text{grad } p, \text{grad } \psi) dx + \gamma_1^2 \gamma_2^{-2} \int_D BB^* p \psi(x) dx = \int_D B l \psi(x) dx \gamma_1^2$$

$$\forall \psi(x) \in W_2(D),$$

where $W_2^1(D)$ is Sobolev space of functions with generalized first-order derivatives and zero trace on Γ ,

$$\hat{c} = \int_D (\hat{u}(x), \text{grad } p_1(x)) dx,$$

where $p_1(x)$ is a solution of Poisson's equation

$$\Delta p_1 = g(x), \quad p_1|_{\Gamma} = 0.$$

Theorem for estimation of $l_1(\varphi)$ is also considered.

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OPTIMAL CONTROL IN LINEAR PARABOLIC EQUATIONS UNDER UNCERTAINTY

¹Nakonechnyi O., ²Kotsur M.

¹Taras Shevchenko National University of Kyiv, Ukraine

²Yuriy Fedkovych Chernivtsi National University, Ukraine

a.nakonechniy@gmail.com, mpcc@chnu.cv.ua

Let G is restricted region of space R^n with a piecewise smooth boundary Γ . $G_T = G \times (0, T)$ and $\Gamma_T = \Gamma \times (0, T)$ is a cylinder and a lateral surface of the cylinder respectively.

We consider a parabolic equation in the cylinder G_T :

$$\begin{aligned}\frac{\partial u}{\partial t} &= L(\theta, u)\varphi + f_2(x, t, u), \\ \varphi|_{t=0} &= f_0(x, \theta), \quad \varphi|_{\Gamma} = f_1(x, t, u, \theta),\end{aligned}\tag{1}$$

where

$$L(\theta, u)\varphi = \sum_{i,j=1}^n \frac{\partial}{\partial x_i} a_j(x, u, \theta) \frac{\partial \varphi}{\partial x_i} + \sum_i a_j(x, u, \theta) \frac{\partial \varphi}{\partial x_i} + a_0(x, u, \theta)\varphi.$$

θ is a vector of parameters from a set Θ of space R^m , the vector u belongs to the control set U of a Hilbert space.

Let impose the conditions on the coefficients, right parts, boundary and initial data, according to which there is a unique generalized solution in the Sobolev space.

It is assumed further that the functional $J(\varphi, u, \theta)$ is specified based on solutions of initial-boundary problem (1), which is differentiable in φ and u according to Gato.

Under the condition of uncertain parameter θ we put the problem of finding a control vector $u \in U$, which is independent on θ and in a sense minimizes the functional $J(\varphi, u, \theta)$.

To remove the uncertainty we introduce the average functional

$$\bar{J}(\varphi, u) = \int_{\Theta} J(\varphi, u, \theta) \mu(d\theta), \tag{2}$$

where $\mu(\cdot)$ is a probability mass.

The necessary conditions of extremum for the average functional are given and it is shown the connection with the Pontryagin maximum principle.

The result of control by temperature distribution under uncertainty were used in the problem of transient thermoelectric cooling of optimal control.

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ESTIMATES OF UNSTEADY PARAMETERS IN MODEL OF INFORMATION CONFRONTATION

Nakonechnyi O., Zinko P.

Taras Shevchenko National University of Kyiv, Ukraine

petro.zinko@gmail.com

Let on the interval $[t_0, T]$ observe values $Y_{1k}, Y_{2k}, k = \overline{1, N}$, where

$$Y_{ik} = L_i(t_k) + \xi_{ik}, \quad (1)$$

where functions $L_i(t)$ is a solution of equations system:

$$\begin{aligned} \frac{dL_1(t)}{dt} &= (\alpha_1(t) + \beta_1(t)L_1(t))(N - L_1(t) - L_2(t)), \\ \frac{dL_2(t)}{dt} &= (\alpha_2(t) + \beta_2(t)L_2(t))(N - L_1(t) - L_2(t)). \end{aligned} \quad (2)$$

Note that the system of equations (2) is known in the literature as a model of information confrontation.

For the analysis of solutions of the system (2) it is need to find coefficients $\alpha_i(t), \beta_i(t), i=1, 2$. To find the estimates of these coefficients on the observation (1) it is assumed, that ξ_{ik} – sequence of random variables with Gaussian distribution, and functions $\alpha_i(t), \beta_i(t)$ have derivatives, which are limited by known constants. It is shown that the problem of parameter estimation $\alpha_i(t), \beta_i(t), i=1, 2$ is reduced to the optimal control problem. To solve this problem the proposed approximate algorithms. In approximate algorithms initially are approximated functions $\frac{dL_1(t)}{dt}, L_1(t)$ та $\frac{dL_2(t)}{dt}, L_2(t)$ on the observations (1), and then these approximations are used to obtain the desired estimates.

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INDICATED MANAGEMENT PRINCIPLES OF CITY'S SOCIAL-ECONOMIC PROCESSES

¹Nanobashvili K., ²Chachanidze G., ²Jikia D.

¹David Agmashenebeli University of Georgia

²Georgian Technical University, Georgia

The life level of XXI century's people is directly depended on the effective management of a city. The modern city management is one of the problematic issues that needs to be explored. The problem is very complicated because of the continuous increase of the city, its infrastructure development and new demands of the city's population.

The characteristic of increase of the city is the accretion of the house problems or so-called "city problems". First of all, the most problematic is processing of the biological remains, which is troubling for all the cities. The remains pollute the environment and generate the explosion of the epidemic diseases. Besides the biological remains, the other chemical remains enter the environment that make a big danger for the living organisms, especially for humans' life.

With many other challenges, the increase of the city sets the necessity of the following tasks' development into agenda: transport, communication, sewerage system, building the social objects, etc.

The mentioned problems are very urgent for the city inhabitants from as developing as developed countries, therefore, this actual problem of the modern world needs to be researched and solved.

We should say that with the natural development of the city, in the effective management of the current processes, in most cases uncertainties are being arisen. In the social-economic process management, during the uncertainties, the effective decision-making model has not been implemented as in Georgia as in the foreign countries. Thus, the city remains as a difficultly manageable or almost unmanageable object.

In Georgia, the situation is more difficult because of the fact that the relevant theoretic researches and legislative analysis of the modern management of cities, as a complicated and hardly formalized object,

have not been conducted. All these have the formalized feature and the city mostly remains as a centralized managed object.

Our research topic is that the city's social-economic development process management is not a fundamentally new direction. The cities have existed for a long time, and working on these issues always was an actual issue. It is obvious we can hardly find a city, which citizens and management authorities do not want to increase the city's life level and city development, but how it should be implemented, and which methods should be used is the main problem and needs to be paid attention.

The main factors of the city's development and management are the great development of the management's technological processes, society's modern challenges and demands, synergetic and demographic process inconvertibility. All these hinders the city's municipal perfect performance.

The city's municipal management, which is being implemented for the improvement of the citizens' life level, is mainly divided into two parts: **social and economic directions.**

The social tasks are: creating the social infrastructure, developing the house communication, developing the healthcare and education system, creating the conditions for the household social-cultural development, providing the public service and trading, contributing to the employment, processing the building, energetic systems' and domestic remains, providing the sanitary, transport service, creating the stable condition for living, etc.

The economic issues are: the development of the city's infrastructure, invest increasing policy in the city, interregions' and inside the regions' communication development, creation of the united economic space, decrease of the irrational expenses, etc.

Our goal is to work out the indicated management conception of the city in case of uncertainties.

First of all, we highlight that indicated management is considered as an economic research based management, but we add that only this is not enough and needs to widely use the modern information technologies in the process.

If we analyze the city's social-economic processes' indicated management principles and methods, we find out that it is the collection of the state and non-state subjects' interests and coordinated action. The coordinated action contributes to the market and non-market economy self-regulation processes, which are directed to the city's social-

economic development. Thus, the indicated management can be considered as a multiplicity of the harmonization processes of the reproductive processes, which implementation is realized at the different level of city management, such as social-economic development strategy, specific management decision-making coordination, implementation of the decisions.

Among the above mentioned, the first and important is a city's social-economic development. This is a main issue of the local (municipal) management.

SELECTED METHODS OF MILITARY EXPENDITURE MODELING*

Neubauer J.

University of Defence, Brno, Czech Republic

jiri.neubauer@unob.cz

The aim of the article is to offer appropriate statistical models for description of time series of military expenditure. The issue of military expenditure modeling belongs among main contemporary topics of defense economics. The article focuses on selected quantitative models, such as vector autoregressive models (VAR), vector error-correction models (VECM) or autoregressive-distributed lag models (ARDL), see Johansen (1995), Lüthepohl (2007) or Johnston (1984). These models are applied to the time series of economic indicators of selected NATO member states.

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STABILITY FOR ITO-SKOROKHOD STOCHASTIC DIFFERENTIAL equations IN HILBERT SPACE

Nikitin A.V.

Taras Shevchenko National University of Kyiv, Ukraine

nikitin2505@gmail.com

We are interested in stability of certain system of Ito-Skorohod stochastic differential equation in a Hilbert space. We investigate the stochastic differential equation

$$dX(t) = A(t, \xi(t))X(t)dt + \sum_{j=1}^r B_j(t, \xi(t))X(t)dW_j(t), \quad X(0) = \zeta, \quad (1)$$

defined on a fixed filtered probability space. Here A and B_k are some linear operators defined on R^m .

We are interested in the case when equation (1) has a solution with finite second moment. By a solution to (1) is meant a strong operator process $X(t)$.

Stability of solutions to stochastic differential equation (1) in Hilbert spaces is equivalent to solvability of the Lyapunov-Sylvester operator equation

$$A_k^* H_k + H_k A_k + \sum_{j=1}^r B_{jk} H_k B_{jk}^* + \sum_{s=1}^q \alpha_{sk} C_{sk}^* H_s C_{sk} = -E, \quad k = \overline{1, q}, \quad (2)$$

where $\alpha_{sk} > 0$ when $s \neq k$ and $\alpha_{kk} > 0$.

In the following we shall use an approach based on the methods of convex programming. Instead of dealing with the Lyapunov-Sylvester operator equation we shall solve an equivalent optimization problem.

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TRANSFORMERMETICAL TECHNOLOGY OF TIME CODING OF INFORMATION

¹Osadchyy Ye., ¹Gorbunov O., ²Osadchyy O.

¹Taras Shevchenko National University of Kyiv, Ukraine.

²Concord, CA

public@sana.net.ua, gorol21@bigmir.net, lockerua@hotmail.com

Information essence of this technology is to improve the efficiency of information processing (due to compression and increasing the transmission rate). The main goal is to provide a reasonable interpretation of the meaning of information to all users. It is known that any information can be represented as a number. Its analog-to-digital conversion is reduced in the process of finding matching different number systems (NS). At the semantic level of communication information interpreted by problem orientated languages, such as graphics. It is also known that it is easier (more efficient) to process the information in the digital form. Obviously, the most expensive of information and / or a capacious "unit" (singly-binary) NS. It is characterized by the fact that even though it contains the most characters but the last position of a finite number of "1" potentially contains the main high-quality property - a quantitative value. Therefore, to continue to operate this property, it is enough just to remember this position. We call it "timer" label, because it meets a stable time interval processor. It also simultaneously provides the effect of the maximum possible number of compression.

Hence, it is advisable to all the computer processing of the information to carry out it in the midrange NS. Classical von Neumann computer architecture was ineffective for this purpose. We need the appropriate software and hardware, providing emulation operations on its numbers. The main advantage of the TT is a significant acceleration of time on computer processing (transformation) of information. It is achieved through the use of basic computer shift operations on compressed "by the clock marks" rather than over many dimensional computer binary numbers equivalent to quantitative values of information.

FUZZY MODEL FOR EVALUATING CORPORATE GOVERNANCE PRACTICES IN INDIA

¹Pankaj Kumar Gupta, ²DevendraTayal, ³Shallu Singh

¹JMI University, ²Indira Gandhi Delhi Technical University for Women,

³JMI University, New Delhi, Republic of India

**pkgfms@gmail.com, dev_tayal2001@yahoo.com,
shallu9891@gmail.com**

Corporate Governance (CG) has become a major concern for global economies particularly the transition world. Sound corporate governance is extremely important for transition economies for creation of the key institutions, the private corporations, which drive the successful economic transformation to a market based economy, effective allocation of capital and development of financial markets, attracting foreign investment and making a contribution to the process of national development. Corporate Governance issue has emerged primarily because of the growing importance of corporations in the national economies and their interaction with the international agencies and institutions.

Measuring corporate governance is a difficult issue primarily because of the quantitative measurement of the determinants and complex interrelationship between them. Researchers have attempted a regression based approach for measurement by constructing a Corporate Governance Index (CGI). CGI suffers from serious limitations like inability to define good governance, unpredictability of corporate performance and confusing relationship between the sub variables that determine the CGI value. Moreover, cultural and contextual differences between companies are not taken into consideration for CGI construction.

In this paper, an effort has been made to develop a fuzzy based model to evaluate the level of corporate governance in Indian companies. We develop an Expert System that rate a given company on the governance parameters. Appropriate fuzzification and defuzzification strategies have been used and the implementation of the system has been carried out in MATLAB 7.0.1.

Typical Traditional Approach Challenged

CGI = f (Board Structure, Ownership Structure, Auditor Committee Quality,)

CGI = $X_1 + X_2 + \dots + X_n$ {Non-weighted}

CGI = $\alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$ {Weighted}

Limitations – Multicollinearity, Relative Scores, Qualitative Data Capturing, Contextual Data, Overlapping Interrelationships, Imprecise Inputs

Our Approach – Fuzzy Sets – Rule Method

We have represented each of the variable like Board Structure, Ownership Structure, Auditor Committee Quality as a fuzzy set i.e Fuzzification. We choose them as Triangular Fuzzy Set and Trapezoidal Fuzzy Sets. A Triangular Fuzzy Set is represented as

$$\mu_{(A)}(x) = \begin{cases} 0, & x < a_1, \\ \frac{x - a_1}{a_2 - a_1}, & a_1 \leq x \leq a_2, \\ \frac{a_3 - x}{a_3 - a_2}, & a_2 \leq x \leq a_3, \\ 0, & x > a_3. \end{cases}$$

We will develop a Fuzzy Rule Base, using all these fuzzy sets as inputs variables. The inference Engine is uses the Fuzzy Rule Base and Database of the Facts available. The Output value i.e. CG is then Defuzzified.

We are able to overcome the limitations of context dependence in evaluating the CG. Our results are different from the previous researches that establish a strong correlation between the CGI and the market performance of the company represented by excess returns. We also find that CG practices are varying and context dependent in Indian companies.

SIMULATION OF ATMOSPHERIC TURBULENCE

Pashko A.A.

Taras Shevchenko National University of Kyiv, Ukraine

aap2011@ukr.net

In this topic, we study the methods of statistical simulation of atmospheric turbulence. In many applied problems, such as stabilization flight altitude [1], atmospheric turbulence is a Gaussian stationary random process $W(t), t \in [0, T]$ with correlation function

$$R(\tau) = \sigma^2 \left(1 - \frac{|\tau|}{2V} \right) \exp \left\{ -\frac{|\tau|}{V} \right\}, \text{ or } S(\lambda) = \frac{\sigma^2}{2\pi V} \frac{1 + 3(\lambda)^2 V}{(1 + (\lambda)^2 V)^2} - \text{spectral}$$

density, where σ^2 - wind speed dispersion, V - scale of turbulence.

Let $\Lambda > 0$, $D_\Lambda : 0 = \lambda_0 \leq \lambda_1 \leq \dots \leq \lambda_M = \Lambda$ - some partitioning of interval $[0, \Lambda]$. The model based on the following formula:

$$W_M(t, \Lambda) = \sum_{i=0}^{M-1} (\cos(T\lambda_i)\xi_{1i} + \sin(t\lambda_i)\xi_{2i}),$$

where $\{\xi_{1i}, \xi_{2i}\}$ - strictly sub-Gaussian independent random variables, $E\xi_{1i} = E\xi_{2i} = 0$, $E\xi_{1i}^2 = E\xi_{2i}^2 = F(\lambda_{i+1}) - F(\lambda_i)$, $F(\lambda)$ - spectral function.

Lemma. The model $W_M(t, \Lambda)$ which approximates $W(t)$ with reliability $1 - \alpha$ and accuracy $\delta > 0$ in $L_2([0, T])$, if for any $\Lambda > 0$ and M the following are true

$$B(M, \Lambda) \leq \delta^2, \quad \exp \left\{ \frac{1}{2} \right\} \frac{\delta}{\sqrt{B(M, \Lambda)}} \exp \left\{ -\frac{\delta^2}{2B(M, \Lambda)} \right\} \leq \alpha,$$

$$\text{where } B(M, \Lambda) = \frac{T^3}{3} \sum_{i=0}^{M-1} \int_{\lambda_i}^{\lambda_{i+1}} (\lambda - \lambda_i)^2 dF(\lambda) + T(F(\infty) - F(\Lambda)),$$

$$F(\lambda) = \frac{\sigma^2}{4\pi V^2} \left(\arctg \left(\frac{\lambda}{V} \right) + \frac{3(\lambda)^2 + \lambda V}{\lambda^2 + V^2} \right).$$

Estimates for different functional spaces, including spaces for Orlicz received in [2].

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GUARANTEED ESTIMATION OF SOLUTIONS TO INTERFACE PROBLEMS IN DOMAINS WITH SMOOTH BOUNDARIES AND INTERFACES FROM POINTWISE NOISY OBSERVATIONS

Podlipenko Yu.

Taras Shevchenko National University of Kyiv, Ukraine

yourip@mail.ru

Let $\Omega, \Omega_1 \subset R^n, n=2,3$, be bounded domains whose boundaries Γ, Γ_1 are smooth with $\bar{\Omega}_1 \subset R^n$. We set $\Omega_2 = \Omega \setminus \Omega_1$ and consider the following interface problem on Ω :

$$A_1 \varphi_1 = f_1 \text{ in } \Omega_1, \quad A_2 \varphi_2 = f_2 \text{ in } \Omega_2, \quad (1)$$

$$\varphi_2 - \varphi_1 = g_1 \text{ on } \Gamma_1, \quad \frac{\partial \varphi_2}{\partial \nu_{A_2}} - \frac{\partial \varphi_1}{\partial \nu_{A_1}} = g_2 \text{ on } \Gamma_1, \quad \varphi_2 = g \text{ on } \Gamma, \quad (2)$$

where $\frac{\partial w}{\partial \nu_{A_k}} = \sum_{i,j=1}^n a_{ij}^k(x) \frac{\partial w}{\partial x_i}(x) \nu_j^0, \quad x \in \Gamma_1, k=1,2$, and ν^0 denotes the

unit outward (with respect to Ω_1 normal to Γ_1 . Here A_1, A_2 are the

second order uniformly elliptic operators $A_k = - \sum_{i,j=1}^n \frac{\partial}{\partial x_i} (a_{ij}^k(x) \frac{\partial}{\partial x_j}),$

$x \in \Omega_k, k=1,2$, with smooth coefficients $a_{ij}^k \in C^2(\Omega'_k)$, where $\bar{\Omega}_k \subset \Omega'_k$.

We study the optimal reconstruction (estimation) of unknown solutions to problem (1), (2) from pointwise noisy observations of the form

$$Y_i = C_i d_i(\varphi_i) + \xi_i, \quad (3)$$

where $d_i(\varphi_i) = (\varphi_i(x_1^i), \dots, \varphi_i(x_{l_i}^i), \dots, \varphi_i(x_{n_i}^i))^T$, $x_{l_i}^i$ are fixed points of Ω_i , $i=1,2$, $l_i=1, \dots, n_i$, C_i are prescribed nonzero $m_i \times n_i$ -matrices, $\xi_i = (\xi_1^i, \dots, \xi_{m_i}^i)^T, i=1,2$, are observation errors in (3) that are realizations of random variables $\xi_i = \xi_i(\omega)$ with zero expectations, $E \xi_i = 0$, and finite second moments $E |\xi_i|^2$.

We assume that right-hand sides f_1, f_2 of equations (1) and the interface and boundary data g_1, g_2 and g are not known, as well as the

second moments of random noises in observations (3); the only available information is that they belong to given bounded sets in the appropriate function spaces.

This leads to the necessity of introducing minimax statements of estimation problems, when optimal estimates both for the unknown solutions and for linear functionals from them are looking for in the class of linear, with respect to observations, estimates and are defined as the estimates for which the variance of the estimation error calculated for the "worst" implementation of perturbations takes its minimal value. Such estimates are called guaranteed or minimax estimates.

We develop constructive methods for finding these estimates and estimation errors which are expressed in terms of solutions to certain systems of elliptic equations.

ON RETRIAL QUEUES WITH CONSTANT RETRIAL RATE AND HYSTERESIS CONTROL POLICY

Ponomarov V.

Taras Shevchenko National University of Kyiv, Ukraine

vponomarov@gmail.com

In this presentation we will discuss a research of three-dimensional Markov process $\{X(t), t \geq 0\}$ with a state space $S(X) = \{0, 1, \dots, c\} \times \mathbb{Z}_+ \times \{1, 2, \dots, r\}$. $\{X(t), t \geq 0\}$ describes the service process in a multi-server retrial queue in which the rate of repeated flow does not depend on the number of calls in the orbit and the incoming calls flow is controlled by a hysteresis policy. This class of control policies can be considered as an extension of the well-known threshold policy: an operation mode of the system is switched if the number of repeated calls exceeds or becomes smaller than one of the thresholds, but does not change if it lies between two adjacent thresholds. The existence of such hysteresis of operation mode change allows system to operate more smoothly and lower the switching expenses. Currently explicit representations of the stationary probabilities for such class of processes were obtained only for the simplest cases of systems with one and two servers.

For the described above class of retrial queues, a vector-matrix representation of steady state distribution was obtained. This representation allows to write down the stationary probabilities through the model parameters in closed form. The investigative techniques use

an approximation of the initial model by means of the truncated one and the direct passage to the limit.

Authors also present a multicriteria problem of maximization of total income from the system. The obtained representation of steady state probabilities allows to build an algorithm for solving this problem and find out an optimal hysteresis policy, that will grant the maximum income.

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AN APPROACH TO ANALYSIS OF THE QUEUEING SYSTEM WITH REPEATED CALLS

Protopop Ju., Lebedev E., Usar I., Makushenko I.

Taras Shevchenko National University of Kyiv, Ukraine

usar@unicyb.kiev.ua

The theory of systems with repeated calls is an essential part of queueing theory. Such systems are used in many areas of application ([1], [2], [3],[4]), and their detailed analysis one can find in [1].

This work is dealing with systems in which the line, the number of service devices and orbit are finite. This means that arriving customer which finds all the service devices occupied joins the line providing it has a free place. Otherwise it becomes the source of repeated calls and after some random time repeats its attempt to join the line.

To study such systems we introduced a class of immigration processes which describe the service process. The arriving and service process can be described by the choice of the parameters of the processes of immigration.

It enables us to obtain formulae for steady state probabilities in a vector-matrix form which are convenient in calculating and solving optimization problems.

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ON RETRIAL QUEUES OF THE $M/M/c$ - TYPE WITH LIMITED NUMBER OF RETRIALS

¹Pryshchepa O.V., ²Lebedev E.A.

¹National University of Water and Environmental Engineering, Ukraine

²Taras Shevchenko National University of Kyiv, Ukraine

o.v.pryshchepa@nuwm.edu.ua, leb@unicyb.kiev.ua

The main characteristic of retrial queues is that a primary customer who finds busy the service facility upon arrival moment immediately leaves the servers area, but some time later he repeats his demand (see, for example, [1],[2]). Between retrials he is said to be in 'orbit'. Such queueing systems with repeated attempts are used in designing local area networks, communication networks.

In this work, we consider retrial queues of the $M/M/c$ - type in which the number of retrials of each customer is limited by a finite number, say N . That is, if a customer fails to enter the server facility at N -th retrial, then the customer leaves the system without service.

A retrial queue with c servers is given by three parameters: λ_j , $j=0,1,\dots$ is the rate of input flow depends on the total number of sources of retrial calls, μ is the service rate and ν_k is the rate of k -th repeated attempt, $k=\overline{1,N}$.

The system state at time t can be described by means of a process $Q(t)=(Q_0(t), Q_1(t), \dots, Q_N(t))$, where $Q_0(t)$ is the number of busy servers at time t , $Q_k(t)$ is the number of sources for k -th repeated attempt at time t , $k=\overline{1,N}$. The process $Q(t)$ is a continuous time Markov chain with the state set $S=\{0,1,\dots,c\} \times Z_+^N$.

An algorithm which finds the stationary probabilities for the system has been proposed.

In this work, we also consider optimization problem for finding optimal strategy of control of the rate of input flow for systems with limited number of retrials.

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COMPENSATION OPERATOR DIFFUSION PROCESS IN SEMI-MARKOV ENVIRONMENT

¹Rosa W., ¹Chabanyuk Ya.M., ²Khimka U.T.

¹Lublin Technology university, Poland

²Lviv Polytechnic National University, Ukraine
y.chabanyuk@pollub.pl, w.rosa@pollub.pl

Consider the diffusion process in semi-Markov environment defined by stochastic differential equation[1,2]

$$du^\varepsilon(t) = C(u^\varepsilon(t), x(t/\varepsilon))dt + \sigma(u^\varepsilon(t))dw(t), \quad (1)$$

where $u^\varepsilon(t)$ - random evolution in the form of a diffusion process [2], $x(t), t \geq 0$, is a semi-Markov process in the standart phase space of states (X, X) with the stationary distribution $\pi(B)$, $B \in X$, ε -small parameter[2].

Lemma. Compensating operator [2] by the process (1) on test-functions $\varphi(u, x)$ is defined by formula

$$\begin{aligned} L^\varepsilon(x)\varphi(u, x) &= \varepsilon^{-1}Q\varphi(u, x) + \theta_1^\varepsilon(x)Q_0\varphi(u, x) = \\ &= \varepsilon^{-1}Q\varphi(u, x) + C(x)\varphi(u, x) + \varepsilon\theta_2^\varepsilon(x)\varphi(u, x), \end{aligned}$$

where Q - generator of embedded Markov process [2], Q_0 - defined by

$$\text{form } Q_0 = q(x) \int_x P(x, dy), \quad q(x) = 1/g(x), \quad g(x) = \int_0^\infty (1 - G_x(t))dt,$$

stochastic kernel $P(x, B) := P\{x_{n+1} \in B | x_n = x\}$, limited operator $\theta_1^\varepsilon(x)$, $C(x)\varphi(u, x)$ is defined by the ratio

$$C(x)\varphi(u, x) = C(u, x)\varphi'(u, x) + (1/2)\sigma^2(u)\varphi''(u, x),$$

and residual term $\theta_2^\varepsilon(x)$ is defined by the ratio [1]

$$\theta_2^\varepsilon(x) = g(x)C(x) + \varepsilon(C(x))^2 G_2^\varepsilon(x).$$

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RATE OF CONVERGENCE OF ESTIMATOR FOR THE IMPULSE RESPONSE FUNCTION

Rozora I.V., Lukovych O.V.

Taras Shevchenko National University of Kyiv, Ukraine

irozora@bigmir.net, lukolga@ukr.net

A time-invariant casual continuous linear system with impulse response function $H(\tau)$, $\tau \in R$, is considered. It means that the response of the system to an input $X(t)$, $t \in R$ is

$$Y(t) = \int_0^{\infty} H(\tau) X(t-\tau) d\tau. \quad (1)$$

One of the problems arising in the theory of such systems is to estimate or identify the function H by observations of the responses of the system. Here we use a method of correlograms for the estimation of the response function H .

Assume that $X_{N,i}(t)$, $t \in R, i = \overline{1, n}$, is a family of measurable real-valued stationary zero-mean Gaussian processes that have such representation

$$X_{N,i}(u) = \sum_{j=1}^N \xi_{j,i} g_j(t-u), \text{ for } t, u \in R,$$

where $\xi_{j,i}$ are jointly independent random variables with $E\xi_{j,i} = 0$, $E\xi_{j,i}^2 = 1$ and $g_j(z)$, $j \geq 1$ is an orthonormal basis in $L_2(R)$.

Definition. As an estimator for H we will use the function

$$\hat{H}_{N,n}(\tau) = \sum_{i=1}^n Y_{N,i}(\tau) X_{N,i}(t-\tau), \quad \tau > 0.$$

The estimation of large deviation probability $P\left\{\sup_{\tau \in [0, A]} |\hat{H}_{N,n}(\tau) - H(\tau)| > \varepsilon\right\}$ is founded. To obtain this result the theory of Square-Gaussian Processes is used.

CONTROLLING STOCHASTIC EXCHANGE RATE EXPOSURE OPTIMALLY

Sant J., Attard N.

Department of Statistics & OR, University of Malta
jaromir.sant@seznam.cz, natalie.attard@um.edu.mt

Investors operating in markets adopting different currencies take decisions in the presence of uncertainties stemming from stochastic exchange rates. This paper aimed to derive the optimal hedging strategy for such investors through the use of futures and forwards. Firstly, the stochastic processes underlying the economic framework, in particular the dynamics of the exchange and interest rates, were described. Subsequently, the Markov chain approximation method was employed to solve the Hamilton-Jacobi-Bellman equation, since the latter involved a highly non-linear second order partial differential equation. By means of the Markov chain approximation method, a sequence of optimal stochastic control problems for Markov chains were formulated and solved via the dynamic programming approach. The latter lead to a functional equation, which was solved for the approximating value function. An approximate solution to this functional equation was then obtained numerically via the Implicit method, which guaranteed the convergence of the solution to the functional equation. Moreover, provided the local consistency of the approximating Markov chain holds, convergence to the original (continuous time) controlled stochastic integral equation is also ensured.

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A REALIZED p -VARIATION RANDOM FUNCTION AS A STATISTICAL DIAGNOSTIC FOR SEMIMARTINGALES

Sant L.

Department of Statistics and Operations Research, Faculty of Science,
University of Malta, Msida, Malta
lino.sant@um.edu.mt

The stochastic properties of the p -variation of semimartingales, and more recently the statistical properties of realized p -variation, have played important and crucial roles in the study and applications of semimartingales respectively. Realized p -variation can help solve problems involving hypothesis testing, diagnostic checking and parameter estimation for stochastic processes. In fact within the context of Levy processes the independent, identically distributed increments property largely determines the statistical behaviour of these sample path derived statistics. Realized variation can be split into parts originating from the canonical components of semimartingales for which many results have been proved especially in the general setting of Ito semimartingales.

In this paper a random function is defined out of sample path readings with the power p serving as argument: $p \rightarrow \sum_{i=1}^n |x_{t_{i+1}} - x_{t_i}|^p$. Its

properties and performance are studied eventually within a Banach space context wherein issues of stochastic equicontinuity ensure uniform convergence. This random function is being proposed as a general purpose method for investigating the nature of the generating process. Functionals derived from it could also be very revealing in the course of identifying the type of process one is dealing with and obtaining estimates of the relevant parameters. Statistical results and simulation runs are proposed and discussed.

**AN ADDITIVE ALGORITHM FOR SOLVING
MULTIOBJECTIVE LINEAR OPTIMIZATION PROBLEM
WITH BINARY VARIABLES**

Semenova N.V., Chayka D.O.

V.M. Glushkov Institute of Cybernetics of NAS of Ukraine

nvsemenova@meta.ua, dasha.chayka@gmail.com

We will consider the following multiobjective 0-1 linear problem

$$\sum_{j=1}^n c_{ij} x_j \rightarrow \min, \quad i \in Q = \{1, \dots, q\}, \quad (1)$$

$$\text{subject to} \quad \sum_{j=1}^n a_{lj} x_j \leq b_l, \quad l \in M = \{1, \dots, m\}, \quad j \in N = \{1, \dots, n\}, \quad (2)$$

$$\text{where} \quad x_j = \begin{cases} 0, & j \in N, \\ 1, & \end{cases} \quad (3)$$

$$c_{ij} \geq 0, \quad i \in Q, \quad j \in N.$$

Plenty of the applied problems described mathematical models with multi objective functions [1]. Considering the possible application we should note that successful planning and realization of any regional development program depends on selecting the correct set of projects to implement in order to achieve formulated aims while satisfying existing constraints. Described mathematical model can be applied in this case and its solution will provide sufficient information to facilitate decision-making process. The procedure of solving the problem (1) - (3) is suggested that by assigning to certain variables value 1 we will go through a part of all 2^n possible trial solutions of problem in order to achieve Pareto optimal solution or to demonstrate that there is no feasible solution. Essentially this approach is an examination of a binary tree. Using obtained during investigation information we can decide what parts of the tree to exclude. It can be completed in a finite number of steps [2].

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CONVERGENCE ANALYSIS OF COMBINED METHODS FOR SOLVING NONLINEAR EQUATIONS UNDER WEAK CONDITIONS

Shakhno S.M., Yarmola H.P.

Ivan Franko National University of Lviv, Ukraine
s_shakhno@lnu.edu.ua, h_yarmola@lnu.edu.ua

We are concerned with the problem of approximating a locally unique solution x^* of the equation

$$H(x) \equiv F(x) + G(x) = 0, \quad (1)$$

where F and G are nonlinear operators, defined on a convex subset D of a Banach space X with values in a Banach space Y . F is a Frechet-differentiable operator, while the differentiability of the operator G is not assumed. So, the well-known Newton's method cannot be applied. In this case the Newton-like or difference methods are used for solving the problem (1). In paper [1] there are investigated some of these methods.

For solving the equation (1) we proposed the new two-point iterative processes [2, 3]. One of them is built on top of the classical Newton and Kurchatov methods of linear interpolation. Another method is built on top of the two-step methods with convergence order $1 + \sqrt{2}$.

In this work we provide a semi-local convergence analysis of the proposed methods under weak conditions for Frechet derivate of the operator F and first order divided differences of the operator G . The linear convergence order of the methods is established and the uniqueness ball for the solution of the nonlinear equation is proved. Also we carry out the numerical experiments on test problems with nondifferentiable operator.

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AN ALTERNATIVE SYSTEM OF DISTANT EDUCATION (ASDE) «OMEGA»

Sharapov M., Kucherenko O.

Taras Shevchenko National University of Kyiv, Ukraine

boxus@ukr.net

The main idea of ASDE OMEGA <http://omega.univ.kiev.ua/> was to make it easier to create new distance education courses under the minimal weight of the shell.

There are three main types of ASDE OMEGA users. They are the tutor, the administrator and the student.

Essential characteristics:

- Personalized access (every user has an access only to a certain part of disciplines).
- Safety (registration, authorization, content protection).
- Control system (tests and control papers).
- Automatic test control and teacher-conducted control of control papers.

There are many different systems of distance education and each of them has its own advantages and disadvantages. The main disadvantage of known distance education systems is their bulkiness and rather difficult filling process. The mentioned ASDE OMEGA tries to overcome this disadvantage and to accumulate their main advantages.

ASDE OMEGA has been developed at the department of applied statistics (cybernetics faculty of Kyiv state university named after Taras Shevchenko) and was tested under following disciplines:

- Probability Theory.
- Data Analysis.
- Mathematical methods of sample surveys at socioeconomic processes.
- Actuarial Mathematics.
- Introduction to Mathematical Statistics.
- Finite stationary random sequences.
- Probabilistic foundations of imitation modeling method.

OPTIMAL ESTIMATION IN TASKS OF RANDOM PROCESSES EXTRAPOLATION IN HILBERT SPACE AND THEIR APPLICATIONS FOR SOME ISSUES OF NONLINEAR ECONOMY

¹Shatashvili A., ²Fomina T.

¹Batumi Shota Rustaveli State University, Georgia

²Donetsk M.Tugan-Baranowski National
University of Economics and Trade, Ukraine

The work deals with a type of a non-linear differential evolution equation in the abstract Hilbert space H :

$$\frac{dy(t)}{dt} - A(t)y(t) + A_1(t)y(t) + \alpha f(t, y(t)) = \xi'(t), \quad 0 \leq t \leq a, \\ y(0) = \xi(0) = 0 \pmod{p}, \quad (1)$$

where $A(t)$ and $A_1(t)$ are linear unbounded operators, but generate their evolutionary family of bounded operators, α - parameter, $\xi(t)$ - Gaussian processes. $f(t, y(t))$ is a nonlinear function defined on $[0, \alpha] \times H$ with values H . We establish sufficient conditions for the existence and uniqueness of solutions of the equation (1) $y(t)$ and explicitly calculate the density of Radon – Nikodim $\frac{d\mu_y}{d\mu_\xi}(z)$ or

$\frac{d\mu_y}{d\mu_x}(z)$, $z \in H$ where $x(t)$ is a solution of equation (1) without its nonlinear part. Then, these densities are used particularly in the economic price forecasting issues in the Walrasian theory, in the particular case, reducing the equation (1) to Walras equation:

$$\frac{dp(t)}{dt} + L \left[D(p(t), \beta) - S(p(t)) \right] = 0, \quad (2)$$

where $L(0) = 0$, $L'(t) > 0$, $p(t)$ is a price, β – a parameter, $D(p(t), \beta)$ and $S(p(t))$ are, respectively, supply and the market offer at time t . It is established that if the price of the product on the market is $p(t)$, observed prior to $t = T$, then if assuming in particular $p(t) = \mathbf{M}y(t)$, and $Y(t+h)$ is the best forecast of the solution of equation (1) $y(t)$ at

point $t = T + h$, its optimal prognosis at time $t = T + h$, $h > 0$, $p(T + h)$ is calculated by the formula:

$$\hat{p}(T + h) = Y(T + h) \begin{cases} \mathbf{M}y(t) = p(t) \\ \mathbf{M}y(t) = 0 \end{cases} \quad (3)$$

For a stationary Gause process with a predetermined range of the correlation operator, we have completely solved this problem. Since the equation (1) involves linear unbounded operators, then according to the extent of their impact in the environment conditions the formula (3) can be treated in an atmosphere of its stability, extreme or chaos in the dynamics of its evolution over time.

THE QUALITATIVE ANALYSIS OF LUR'E-TYPE CONTROL SYSTEMS WITH UNCERTAINTY CONDITIONS

Shatyрко A.V., Khusainov D.Ya.

Taras Shevchenko National University of Kyiv, Ukraine

shatyрко.a@gmail.com, d.y.khusainov@gmail.com

The approaches of finite-dimensional Lyapunov functions and Lyapunov-Krasovskiy functionals applied to the qualitative analysis of the behavior of nonlinear Lur'e-type control systems with deviation argument of different nature and interval uncertainties are developed and improved in present work.

The sufficient conditions of absolute and absolute-interval stability of continuous direct and indirect control systems with delay and neutral type argument are constructed. The "critical" value deviation of the argument, at which the quality of the system behavior is remains, is obtained.

The similar problems of qualitative behavior of solutions of discrete Lur'e-type control systems are formulated and solved.

The problem of solutions stabilization to the state of absolute stability for direct and indirect nonlinear control systems with delay and neutral type argument are formulated and solved.

The optimization problems of constructing Lyapunov functions and Lyapunov-Krasovskiy functional from given class to solve the problem of absolute stability of nonlinear systems with deviating argument are posed.

Some of the results are published in the next articles [1-4].

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OPTIMIZATION OF COMPLEX SYSTEMS USING META-MODELS

¹Shcherbatyy M.V., ²Shcherbata I.V.

¹Ivan Franko National University of Lviv, Ukraine

²Lviv National Agrarian University, Ukraine

shcherbatyy@gmail.com

Solution of optimization problems for complex systems causes necessity of multiple solution of direct problem for different value of parameters. Complexity of mathematical models, which describe state and behavior of considered system leads to a big number of calculation for each solution of the problem of analysis (direct problem) and sensitivity analysis problem. Therefore, it is useful to develop simplified functions that have explicit forms in terms of model parameters. The explicit function is “model of the model” and is called a meta-model or surrogate model [1-3].

In this paper, we have applied meta-models for optimization problems of systems that are modelled by ordinary differential equations (ODEs) and by partial differential equations (PDEs) of parabolic type. For solution of PDEs semidiscrete finite element Galerkin approximations is used. ODEs are solved by using multistep variable

methods. For generating meta-models such approaches as interpolating (radial basis functions (RBF)) and non-interpolating (polynomial regression models of different orders) are selected. This paper is representing results of numerical experiments with application of different types of meta-models for solution of optimization problems for population dynamics (ODEs models) and for heterodiffusive processes (PDEs models).

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HARMONIZATION: INFORMATION FROM EDUCATION TO THE PROBLEM OF TRADITIONAL TEACHING

Shervashidze G., Ananidze S.

Batumi Shota Rustaveli State University, Georgia

Total quality management concept aims at the entire organizational activities of the organization and works to improve stakeholder's satisfaction through long-term success achievement mentioned concept in principle occupies an important place in the harmonization.

The essence of the principle of the education system and it is clear we believe the introduction of significant deeds.

Harmony of Greek philosophical and aesthetic category, consent agreement, proportionality, the opposite of chaos, the content of the regulated means high level of diversity .

Harmony includes:

- whole parts of the right consistency;
- simultaneous musical combination of natural tones sounding time;
- public life consensus, the implementation of co-existence.

Harmony beauty meets aesthetic criteria: " There is no beauty without harmony" (Plato); the beauty of the whole parts of the perfect symmetry of an organizational minds and noire of the cosmos.

Beauty perfect agreement itself is an icon of cosmic harmony, which reflects the greatness of the Creator of the universe and the beauty. Here is the problem of the harmonization of education, which is the teaching and learning process into a relief circumstance, if one of the icons of the energy spent on adults.

In Einstein's view, people searching for scientific ideas and fiction creates harmony, but humanity is not limited to the life of a non-existent harmony ideal formation, and he finds the transformed harmonic & daily search roads.

Our understanding of these ways is through education. Harmonization of education management integration of demand put on the agenda of the traditional teaching of the principles of problem-oriented teaching of information education change, which in turn, directly to the creative skills of the adolescent (the revival, creation, creativity) development of innovative activity, species, thinking and picture contacted images.

Harmonization of Education regulates educational system in collaboration with the process, to promote awareness of the object cognitive involvement of young people in the development of cognitive skills.

Generational exchange between critics of young researchers formed.

So change the logical reasoning skills, while acquiring new knowledge into an auditorium of the venue.

Harmonization of education excludes violence in the educational process; revive the learning process so that the memory is only an auxiliary function.

The arena will be given the knowledge of the experiment, to be considered a real -life problem, the rate will change many things in the life of faith and learning environment is optimistic favour of democratization, which is the basis for the democratization of society in the future.

Who will be able to carry out the process of harmonization of the educational space?

-Progressive teachers, which they consider the most important human development not only in terms of verbal and mathematical skills, but also creatively.

-Who will establish dull-discipline without violence;

-Who will replace the current system of classification and mark to include youths' involvement in the educational process and who will saturate the harmonization of educational space, science and the arts

into a perfect unity "Only a well-informed people must useless empty earth " - Philosopher Alfred vaitedi .

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OPTIMIZATION OF SOLUTIONS OF THE LINEAR DIFFERENTIAL EQUATIONS SYSTEM WITH RANDOM COEFFICIENTS AND RANDOM JUMPS OF SOLUTIONS

Shusharin Yu.V., Dehtiar S.V., Lutsyshyna G. V.

Kyiv National Economic University named after Vadym Hetman,
Ukraine

shusharin@meta.ua

Considering system of the linear differential equations with random coefficients

$$\frac{dX(t)}{dt} = A(\xi(t))X(t) + B(\xi(t))U(t), \quad (1)$$

$\xi(t)$ - finite-valued Markov process, defined by the differential equations system

$$\frac{dp_k(t)}{dt} = \sum_{s=1}^q \alpha_{ks} p_s(t), p_k(t) \equiv P\{\xi(t) = \theta_k\} \quad (k=1, \dots, q). \quad (2)$$

We suppose that, system solution (1) has jumps in random moments t_j ($j=0, 1, 2, \dots$), which coincide with the moments of jumps of a random process $\xi(t)$. If in the moment t_j process $\xi(t)$ moves from state θ_s to state θ_k , than assume

$$X(t_j + 0) = C_{ks} X(t_j - 0), \det C_{ks} \neq 0 \quad (k, s=1, \dots, q). \quad (3)$$

We suppose, by definition, $C_{kk} = E$ ($k=1, \dots, q$).

We are looking for the optimal control

$$U(t) = S(\xi(t))X(t), \quad (4)$$

which minimizes the value of the quadratic functional

$$v = \left(\int_0^{\infty} X^*(t) Q(\xi(t)) X(t) + U^*(t) L(\xi(t)) U(t) \right) dt. \quad (5)$$

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ABOUT RECURRENT LEAST SQUARES NON-STATIONARY PARAMETER ESTIMATION WITH LEAST DEVIATION NORM FROM ATTRACTION POINTS FOR LINEAR DYNAMIC OBJECTS UNDER UNCERTAINTIES

Slabospitsky A.S.

Taras Shevchenko National University of Kyiv, Ukraine

sl@univ.kiev.ua

The identification problem of unknown slowly time-varying parameter matrix A is considered for linear discrete dynamic system in situation when for A its 'attraction' point $A_*(N)$ is given at any moment N ($N=0,1,2,\dots$). The least squares estimate with variable forgetting factor $\lambda(k)$ is studied in non-classical case when this one may be not unique for linear discrete object:

$$x(k+1) = Ax(k) + \xi(k),$$

where $x(k)$, $\xi(k)$ are state and disturbance vectors respectively, vectors $x(k)$ are known, $A \in M_n(\mathbb{R})$, $\lambda(k) \in (0,1]$, $k \in \mathbb{N}$.

The set of above-mentioned estimate of non-stationary parameter matrix A under these assumptions is defined as $\text{Arg} \min_A Q(A, N)$,

where

$$Q(A, N) = \sum_{k=1}^N w(k, N) \|\xi(k)\|^2, \quad w(k, N) = \begin{cases} \prod_{i=k}^{N-1} \lambda(i), & \text{if } k = \overline{1, N-1}, \\ 1, & \text{if } k = N. \end{cases}$$

The estimate $\hat{A}(N)$ with least deviation norm from ‘attraction’ point $A_*(N)$ at moment N is proposed as unique estimate on last-named estimate set, viz.:

$$\hat{A}(N) = \tilde{X}_{2,N+1}^T (\tilde{X}_{1,N}^T)^+ + A_*(N) [E_n - (\tilde{X}_{1,N}^T)(\tilde{X}_{1,N}^T)^+], \quad N \in \mathbb{N},$$

where $\tilde{X}_{1+i,N+i}^T = (\sqrt{w(1,N)}x(1+i), \dots, \sqrt{w(N,N)}x(N+i))$, $i = \overline{0,1}$,

$(^+)$ – Moore-Penrose pseudo-inverse operator.

The recurrent representations for estimate $\hat{A}(N)$ and weighted residual sum of squares $q(N) = Q(\hat{A}(N), N)$ are obtained for linear discrete dynamic system under these non-classical assumptions without usage of matrix pseudo-inversion.

LOGISTICS CHAINS DESIGNING

Šmerek M.

University of Defence in Brno, Czech Republic

michal.smerek@unob.cz

I was approached to cooperate on the course Logistics Chains Designing by Head of the Department of Logistics at University of Defence. I came to know the basic features of this case study. Then I introduced a notation, created a mathematical model and proposed an algorithm to find the optimal solution.

There is transportation of four types of goods in the prescribed amounts from the six supply points to one destination. Capacities of supply points are limited. The total transport cost is to minimize. It takes into account the distance of the supply points, the weight of goods and transportation price for 1 km. Mathematical model was obtained

$$z = \sum_{i=1}^m \sum_{j=1}^n c_{ij} x_{ij} \rightarrow \min ,$$

$$\sum_{i=1}^m x_{ij} = P_j , \quad j = 1, 2, \dots, n ,$$

$$x_{ij} \leq k_{ij} , \quad i = 1, 2, \dots, m , \quad j = 1, 2, \dots, n ,$$

$$x_{ij} \geq 0 , \quad x_{ij} \in \mathbf{Z}_0^+ , \quad i = 1, 2, \dots, m , \quad j = 1, 2, \dots, n ,$$

where the symbols are explained in the table below:

$d_i, i = 1, 2, \dots, m$	distance supply point and destination,
$C_j, j = 1, 2, \dots, n$	transportation price for 1 km,
$c_{ij} = d_i \cdot C_j$	transmission rate = price for transporting of 1 piece of goods from supply point to a destination,
$P_j, j = 1, 2, \dots, n$	the required quantity of goods,
x_{ij}	quantity of goods transported from a supply point,
k_{ij}	capacity of goods at the supply point.

The model was solved using Solver add-in of MS Excel.

CONSTRUCTIN OF THE ARTIFICIAL UNIVERCES IS THE PATH TO NEW KNOWLEDGE AND DATA

Stolyarenko N.V.

International Research and Training Centre for IT and Systems, Ukraine
dep190@irtc.org.ua

The research problem is collaboration of two systems: the flexible manufacturing shop (system A) and computer center (system B). System A consists of such elements as: dispatcher, the number of flexible manufacturing modules, trucks (transport agents), warehouse. At dispatcher command the truck brings the parts from the warehouse to the concrete flexible manufacturing module (FMM) using circular route. The demands for the parts in the assembling shop is not regular.

It is necessary to build the mathematical models of the control system with the purpose to achieve the following aims:

- the activity of two systems (A and B) must be synchronized (aim 1);
- the system A must be reliable (aim 2);
- the equipment (FMM) of the system A should have the opportunity to work in the optimal mode (aim 3);
- specialist could diagnose the kind of the breakage in the system A (aim 4).

On the base of analysis of the setting information we establish a fact of existence of the uncertainties. We have not enough data and knowledge to build mathematical models. The exit of this problem is to construct artificial universes and have new information.

The suggested technology is:

- construction of the objects (structures, images) of artificial universe with the help of the artificial intelligent procedure “Pendulum”. The result is the number of the corteges of the quantum of time;
- formation of the transition blocks from the real universe to the artificial one for the lots of parts;
- calculation of the parameters of new structures and fixation of new knowledge.

Suggested approach give the opportunity to build the number of the optimum location models and organize their parallel calculation.

SYSTEM APPROACH TO FINANCIAL RISK MANAGEMENT AT THE ENTERPRISES

Syrmamiikh I.

Mariupol State University, Ukraine

siv.mgu@bigmir.net

Any activity of domestic enterprises related risk, as a need for modern mechanisms and methods of financial risk management using international experience and adapting it to the Ukrainian realities. According to the methodology, this was developed by the sponsor's Committee Organization called the Commission Tredveya «Risk management organization. The integrated model» (COSO ERM) process management foundation must be made according to the principles of system analysis and general principles of risk management.

In terms of system analysis to business decision-making process under conditions of risk must consistently take certain steps, which include: identification of risks (timely identification, description, classification and grouping risks that may prevent the company achieve its goals), risk assessment (sub clarification 'subjective probability implementation risks, consequences, building a matrix of risk assessment. calculation and setting risk zone), the choice of methods which influence the risk (to avoid risk, prevent loss, redistribution of risk, taking overrisk), the implementation of selected methods and

systematic evaluation of the results, improving the risk management system.

In order to conduct effective integrated risk analysis, it is necessary to collect and organize reliable information about the company, the environment, using various methods of quantitative assessment, to take into account the features of different risk types that were detected by qualitative analysis. The analysis of existing methods and models for assessing financial risks the company carries out: that none of methods can be recognized as the most effective one, but along with expert methods, quantitative assessment of risk, based on statistical criteria, will allow prediction. System approach to financial risk management at enterprises (not fragmented) will take into account the general objectives of the enterprise and carry out continuous monitoring of risk, which in turn will lead to effective management decisions.

THE SIMULATION OF THE DEVELOPMENT OF THE MARKET OF TOURIST SERVICES

Syrmamiikh V.

Vadym Hetman Kyiv National Economic University, Ukraine
victoriya1312@yandex.ua

Significant changes in volumes and directions of tourist flows on the background of the consequences of the political situation in Ukraine influenced the need to search for fundamentally new approaches to management decision-making in this area. To control appropriate, to use a systematic approach that provides for the construction of a model that should describe relationships between variables and reflect the impact of independent variables on the level of performance. Install and explain the nature of relationships in the development of events will allow correlation and regression models, with better use multifactor correlation and regression models that allow you to examine immediately the impact of several factors. To facilitate the modeling, improvement of homogeneity of the sample and ease of use of models in practice, the development of the market of tourist services it is necessary to consider three major items of tourist flows: domestic, inbound, and outbound tourism. As a result, it becomes necessary to use systems of regression equations:

$$\begin{cases} Y_1 = f_1(X_1, X_2, \dots, X_m) + E_1 \\ Y_2 = f_2(X_1', X_2', \dots, X_r') + E_2, \\ Y_3 = f_3(X_1'', X_2'', \dots, X_k'') + E_3 \end{cases} \quad \text{where: } Y_1 - \text{the number of}$$

domestic tourists, which significantly affect factors $X_1, X_2, \dots, X_m$ (for example, the number of tourist enterprises, the average cost of permits, and other); Y_2 – the number of incoming tourists, which significantly affect factors $X_1', X_2', \dots, X_r'$ (for example, the average number of employees in tourism, the number of enterprises of hotel type, the average cost of permits, and other); Y_3 – the number of visiting tourists, which significantly affect factors $X_1'', X_2'', \dots, X_k''$ (for example, the average monthly salary, the average cost of permits, and other); E_1, E_2, E_3 – error of the models.

The result obtained in the result of a simulation allows us to study the quantitative interrelation, interdependence modeling system, to carry out the forecasting, thereby, to understand the modelling process for improvement and further development.

MODERN TEACHING AND LEARNING METHODS AND INFORMATION TECHNOLOGIES

Tavdgiridze L., Sherozia N.

Batumi Shota Rustaveli State University, Georgia

Development of modern societies depends on the use of information technology and telecommunications methods. Information Technology expands human opportunities. Teacher's use of information technologies in teaching theories is considered as modern approach – in modern classrooms focus is done from passive knowledge into active learning, knowledge creation and construction. ICT provides teacher with special assistance which leads to implementation of constructivist approaches. National curriculum identifies nine priorities of cross-cutting competence, which is crucial in today's world for self-realization and establishment of the proper venue. One of them is media literacy. As a result of communication technology development, in the modern world, together with the traditional texts, an important place takes the multimedia texts - the texts, which simultaneously use the language, sound and visual means. In addition, the media is the most powerful cultural tool of the modern world, which deals with all areas of human life. Therefore, on the one hand, it is necessary for students to have

ability of perception-understanding, interpretation, use and creation of the new style, and various forms of multimedia texts, and on the other hand, orientation in the media world, making the right choice (information "filter") and receiving critical estimation. In this sense, media literacy helps to develop critical thinking; By using modern approaches, it can lead teaching process to the following main direction: student orientation - student-centered learning is an approach that focuses on the students' needs, abilities, interests and learning styles; Increase in learning motivation and constant stimulation, including the use of information technology; the use of variety learning tools and resources - teacher uses not only boards and printed resources, but also the electronic resources, including information and communication technologies; Active Learning Teaching – in learning process students actively cooperate with each other, use electronic information and other sources, make independent conclusions; Learning-teaching which is based on critical analysis – many opinions are formed, discussed, justified and coherence is made in decision-making; Authentic learning – themes, material, the learning process and the environment is related to the students' lives, their immediate environment with the current events, the real needs.

By using technology, teachers give students opportunity to obtain high-quality information. They will be able to make difficult and complex concepts easily accessible for students, increase their motivation and interest, and provide the same information in different ways for students by considering their interests.

FINANCIAL MARKET FORECASTING USING THE FRACTAL ANALYSIS

Timashova L.A., Skachko I.O.

International Research and Training Centre for IT and Systems, Ukraine
tnessik@gmail.com

There are many ways to analyze the events taking place in the markets. They include technical analysis, fundamental analysis, the Elliott Wave Principle and many other less known methods. However, one method is uniquely placed among all others due to its simplicity and originality. It is called fractal analysis.

The basic tool for fractal analysis of time series is the algorithm of R/S analysis. The methodology of the R/S analysis was developed in the middle of the XX century by the British hydrologist Hurst, who was

studying the time series of river flow volumes. While testing the hypothesis that these series were governed by the normal law, Hurst defined a new statistic - the Hurst exponent (H). In the course of his research, Hurst measured fluctuations of water in the reservoir relative to the average over time and introduced the dimensionless ratio by dividing the amplitude of R by the standard deviation S . This method of analysis was called the rescaled range method (R/S-analysis). Hurst found that most natural phenomena, including river flows, temperatures, precipitation, sun spots follow a “biased random walk” - a trend with noise.

A program system was suggested for carrying out the R/S analysis. The system allows conducting a fractal analysis of the dynamic data and creating a forecast of the *ARFIMA*-class model, based on the previously obtained results. As an example of a time series, we will examine the dynamics of the MSFT stock. The time series being used in this work is a sequential sample (of the n volume) for the period from January 3, 2005 to November 20, 2015 of the market statistics. Each element of the time series corresponds to the trading result for this specific financial instrument over one trading day. For each time series $Z \in \{Z_1, Z_2, \dots, Z_\tau\}$, a sequential R/S-analysis was conducted. As a result, the Hurst exponent ($H(\tau)$) was calculated for each sequential segment of the time series Z of the length τ , and the H - and R/S-trajectories of the corresponding time series were built. Using the R/S-analysis, we proved that time series with long-term correlation structures existed, which allowed us to rationalize the use of synergic methods for forecasting time series of such kind.

REDUCTION OF THE PROBLEM OF CONSERVATION ENVIRONMENTAL TO THE PROBLEM OF GAME TYPE

Timofeeva N.K.

International Research and Training Centre for IT and Systems, Ukraine
tymnad@gmail.com

A problem of conservation environmental consider as a game of two players: 1) moral of society, 2) enriching of society (in particular enriching of his ruling layer). We assume that it is criteria which an objective function is optimized. A problem consists in finding between these criteria of such equilibrium, that society and nature coexisted

comfort, that the numerical value of the objective function determines a health of environment, man and society level on the whole [1].

As known from experience, on the certain stage of enriching of society his moral begins to go down. A moment comes, when for the sake of enriching neglected natural laws, accordingly and laws of moral which results in destruction of nature and society on the whole. As a result society loses all accumulated financial values. In literature a similar situation which is called the “tragedy of Commons” is described.

Modeled this problem within the framework of theory of combinatorial optimization, it is possible to see that she is dynamic and an argument of objective function in her is selections of different types. Scilicet an objective function depends on two variables which is combination without a reiteration. Unlike other problem of combinatorial optimization, which on this sign are divided on subproblems with successive their decision, a solution of this problem find simultaneously on two combinatorial sets. An introduction coefficient δ determines a minimum value at which nature and society exists comfort, welfare of society is used on his development and an environment does not collapse.

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ON A METHOD FOR GROUP DECISION MAKING WITH FEEDBACK BASED ON INCOMPLETE PAIR-WISE COMPARISONS USING SCALES WITH DIFFERENT NUMBERS OF GRADES

Tsyganok V.V.

Institute for Information Recording of the National Academy of
Sciences of Ukraine, Kyiv, Ukraine

tsyganok@ipri.kiev.ua

To improve the reliability of the information obtained from experts in decision making process at weakly-structured domains it is desirable to use a group of experts. Consistency of individual expert estimates is an important aspect of group decision-making. In order to achieve the

level of consistency of individual pair-wise comparisons, provided by experts, which would be sufficient for aggregation of these pair-wise comparisons, it is necessary to organize feedback with experts. Well-known approaches used for aggregation of individual expert estimates include: aggregation of individual judgments (AIJ) and aggregation of individual priorities (AIP). The disadvantage of these methods is that they envision the two-phase aggregation process that does not allow organizing systematic feedback for improve agreement; i.e, they do not allow to tell, which experts need to be re-addressed in the case when consistency level is insufficient, and which particular comparisons are they need to change. A new one-phase method for aggregation of expert estimates in small groups, using combinatorial enumeration of spanning trees, obtained based on the individual incomplete matrix of pair-wise comparisons, is proposed. It allows to derive priority vector based on group incomplete pair-wise comparisons and to organize feedback with experts in order to achieve agreement. For agreement check (and, if necessary, improvement) original the Double Entropy Agreement Index is developed and suggested for use. Another advantage of the proposed method is that it allows us to use verbal scales with different numbers of grades for every single pair-wise comparison. Every expert is given an opportunity to use the scale, in which the degree of detail (number of points/grades) most adequately reflects this expert's competence in the issue under consideration. An experimental study, involving real experts, and targeted at validation of the method is described.

USING HIL SIMULATION IN THE DEVELOPMENT OF EMBEDDED SYSTEMS

Tymashov O.

Glushkov Institute of Cybernetics NAS of Ukraine

alex_timashov@mail.ru

Problem Statement

Complex machines containing multiple embedded systems create unique and diverse testing challenges: availability of product and/or test system for testing; cost / time to build a system prior to testing; High cost to test (capital, facilities, maintenance, manufacturing time, scrap, redesign, etc.); time consuming testing, especially for extensive regression testing; system validation challenging due to complexity. unable to test to limits and beyond; Repeatability challenging for large

physical systems;high cost of failure (production test, field, customer issues, etc.).

HIL Allows Modeling of Machines

HIL allows a product development or product test engineer the ability to mimic (or model) the behavior of the Plant using a combination of electronic hardware and software. HIL replaces the Plant under control with a software model of the physical Plant and all related dynamic systems. Modeling improves test and development through simulating the use of real world systems. Models also allow for rapid design iteration, and validation at much lower cost. These models are then "interfaced" with an electronic control system through the use of an HIL hardware test system and associated software to simulate actuators, sensors, etc.

Quality of Model-based Testing

HIL increases the speed and scope of testing while reducing risk and cost. Ideally an embedded control system is tested against the real Plant: However frequently the real Plant imposes limitations or risks on the scope of the testing; For example, in the case of an electronic control system, certain testing may lead to dangerous test conditions:

Testing at or beyond the range of the certain control system parameters or Plant capabilities; Testing and verification of the system at failure conditions and beyond ('corner cases'); HIL provides an efficient and safe environment where the test or application engineer can focus on the functionality of the controller without risk to himself or the Plant.

ON COLLABORATION FORMS BETWEEN PRIVATE OWNERSHIP AND THE MARKET ECONOMIC SYSTEM

Varshanidze T.

Batumi Shota Rustaveli State University, Georgia

tako.varshanidze@mail.ru

“Men keep agreements when it is to the advantage of neither to break them”

(Solon, 630-560 BC, Greek statesman and poet)

The present paper outlines the various ways in which organizations collaborate, their motives for doing so and the advantages and disadvantages of collaboration. It also talks about the problems

experienced by many organization, when they merge or take over other organizations.

It is known that globalization has created a market dynamic that fosters new competition and new forms of collaboration. Collaboration is fashionable way. Global collaboration entails linking the right people to the right projects at the right time. Competitive advantage is increasingly tied to collaborative advantage. More than ever before, companies are choosing to work with each other at both, national and international level. One explanation for the big increase in collaboration is the globalization of knowledge.

The paper emphasizes that globalization and market economy have a regular relationship, because a market economy is an economic system in which economic decisions, the pricing of goods and services are guided solely by the aggregate interactions of a country's citizens and businesses. Also there is little government intervention or central planning. This is opposite of a centrally planned economy, in which government decisions effect most aspects of a country's economic activity. Also private ownership has big meaning – the fact of being owned by a private individual or organization, rather than by the state or a public body.

The paper mentions that in evaluating the success of a collaborative arrangement between enterprises it is worth looking at the competitive potential: the organization's ability to develop skills which form the basis for the development of a future generation of products. In most enterprises, product quality is an important indicator of future competitive success. There is a difference between collaborative ventures involving organizations that are in competition with each other, and a situation where organizations have products or services that complement each other. However, both types-collaboration between potentially competitive and between non-competitive organizations - can be described as a network.

The paper points out that outsourcing can be seen a form of collaboration between organization. Outsourcing is a practice used by different companies to reduce costs by transferring portions of work to outside suppliers rather than completing it internally. It is an effective cost-saving strategy when used properly. Sometimes it is more affordable to purchase a good form companies than to produce the good internally.

The paper concludes that a growing number of organizations are singing cooperative agreements, and these have a variety of goals. In the

future, agreements are most likely to be made for reasons of creating knowledge. Some of the biggest problems faced related to culture, personnel and expectations. A lot of attention needs to be paid to the implementation phase that follows the merger.

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TWO APPROACHES FOR DESCRIPTION MATHEMATICAL MODEL OF FLUID FILTRATION IN THE GROUND

¹**Venherskyi P.**, ²**Trofymchuk O.**, ¹**Kokovska Y.**

¹Ivan Franko National University of Lviv, Ukraine

²Institute of telecommunications and global information space NAS of Ukraine

petro.vengersky@gmail.com , itelua@kv.ukrtel.net

To describe the filtration process are two main approaches: hydraulic and hydrodynamic [1,2].

In the hydraulic approach in the field of filtration the elementary volume is allocated for which is written balance equation inflow and outflow of water. For equation that describes the filtration process using boundary transition when the selected volume of soil tends to zero. Using this equation can be found scalar characteristic flow filtration - piezometric pressure. To describe the partial types of filtration based on the equation of Bussinesk build its simplified formulations known in the literature as equations planned and profile filtration.

In the hydrodynamic approach laws of continuum mechanics are applied to the description motion of the medium [1]. These equations are called basic equations of filtration. Unknown variables included in the equation is the piezometric pressure, speed and density of flow filtration. Important that this model takes into account the density of

fluid filtration that is unknown variables at research of filtration compressible watershed flows.

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MULTIGRIDS METHOD FOR THE NUMERICAL SOLUTION OF EQUATION OF MASS TRANSFER IN THE SYSTEM OF HYDROTECHNICAL RAMPARTS-TERRACES

Vergunova I.

Taras Shevchenko National University of Kyiv, Ukraine

vergunova@bigmir.net

The use of grid method with multi-level building sequence of grids allows to get increasing the accuracy for selected difference schemes through a combination of grids with different frequency.

Discretization of differential task, which is a two-dimensional model of mass transfer with taking into account the construction of surface of ramparts-terraces, namely

$$Zu \equiv \frac{\partial u}{\partial t} + Lu \equiv \frac{\partial u}{\partial t} - \sum_{i=1}^2 \frac{\partial}{\partial x_i} \left(D(x) \frac{\partial u}{\partial x_i} \right) + \sum_{i=1}^2 V \frac{\partial u}{\partial x_i} = -\lambda u_0 \phi(x) \delta(t-0)$$

in the area $Q = \Omega \times (0 \leq t \leq T)$, $\Omega \subset R^2$ with piecewise smooth surface $\partial\Omega$, with boundary and initial conditions elected for five and seven point templates gives for each subdomain a certain difference operator $L_h u_h$ (the matrix of which is not symmetric) with the order of approximation $O(h^2)$. The systems of difference equations for each

templates $\frac{\partial y}{\partial t} = \tilde{A}y + \phi$ on the sequence of nested grids

$\Omega_h, \Omega_{2h}, \Omega_{4h}, \Omega_{8h}$ is the basis for execution of iterative procedures. The solution on a rough grid used for correcting of amendments decision in more dense grid and is the initial approach to the solution in more dense

grid. In the case of transition from a dense grid to a rough grid obtained an amendment to the equation on the rough grid. For grids are constructed extension operators (the transition from a rough grid to more dense grid) and restriction operators (the transition from a dense grid to more rough grid) of the first order (that provides the convergence of multigrid method for second order task). Multigrid V-cycle are used.

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NANOSURFACE – A TOOL FOR COMPUTER MODELING OF MASS TRANSFER PROCESS IN CATALYTIC POROUS MEDIA

¹**Vlasyuk A.P., ²Zhukovskyy V.V.**

¹Private Higher Education Establishment Academician Stepan Demianchuk International University of Economics and Humanities,
Ukraine

²National University of Water Management and Nature Resources Use,
Ukraine

A.P.Vlasyuk.rv@gmail.com, zeonET@gmail.com

With the development of computer technology scientists are improving their software products. New software packages for computer modeling of underground mass transfer processes are appearing: NADRA-3D, ORCHESTRA, PHREEQC, HPX, HYDRUS, TOUGHREACT, HYDROGEOCHEM, MIN3P, PFLOTRAN [1]. NanoSurface is one of them. It is a cross-platform software tool for the computer modeling of mass transfer processes in saturated catalytic porous media (see Fig. 1).

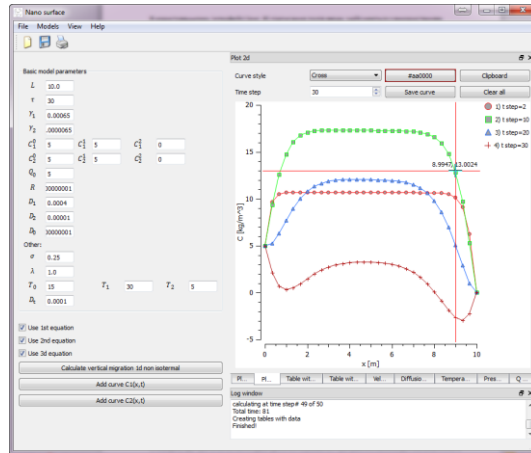


Fig. 1. NanoSurface user interface

The application have a graphical user interface (GUI) that allow users to enter the required initial data (diffusion coefficients, boundary conditions, etc.), select appropriate mathematical model, perform necessary calculation and analyze received data using 2D/3D curves and concentration tables ($c_1(x,t)$, $c_2(x,t)$, $c_3(x,t)$, $q(x,r,t)$). User can easily export all received data for future processing, compare curves of different mathematical models at same plot.

There are several basic mathematical models at current moment:

- mathematical model of vertical migration of radionuclides in linear one-dimensional case [2];
- mathematical model of radionuclides vertical migration in non-linear case [3];
- mathematical model of pollutant vertical migration in non-linear and non-isothermal case;
- mathematical model of radionuclides vertical migration in porous media with traps in linear case [4].

Parallel computing allow us optimally use modern multi-core and multi-processor computers. Despite on specialized parallel computer architectures, clusters and grids multi-core single machine become available to every researcher.

Numerical calculations are implemented with OpenMP API for multi-platform shared-memory parallel programming in C/C++. There are three implementations of the sweep method: general, oncoming and block. User may select one of them according to CPU's core count. The

results of experiments showed that parallel calculation significantly important area of research connected with computer modeling. E.g. dual-core numerical experiments become faster for more than 40000 discretization steps in mathematical modeling of vertical migration of radionuclides in catalytic porous media with traps in linear case.

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THE DIRICHLET PROBLEM FOR A CLASS OF NONLINEAR FOURTH-ORDER ELLIPTIC EQUATIONS*

^{1,2,3}**Voitovych M.V.**

¹Institute of Applied Mathematics and Mechanics of National Academy
of Sciences of Ukraine, Sloviansk, Ukraine

²Mariupol State University, Mariupol, Ukraine

³Donetsk National University, Vinnytsia, Ukraine

voitovichmv76@gmail.com

We consider the Dirichlet problem for nonlinear fourth-order equations of the form:

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$$\sum_{|\alpha|=1,2} (-1)^{|\alpha|} D^\alpha A_\alpha(x, \nabla_2 u) + A(x, u, \nabla_2 u) = 0 \text{ in } \Omega, \quad (1)$$

where $\nabla_2 u = \{D^\alpha u; |\alpha| = 1, 2\}$ and Ω is a bounded open set of R^n . The coefficients A_α and A satisfy the Carathéodory conditions and the following main structural inequalities:

$$\sum_{|\alpha|=1,2} A_\alpha(x, \xi) \xi_\alpha \geq c \left\{ \sum_{|\alpha|=1} |\xi_\alpha|^q + \sum_{|\alpha|=2} |\xi_\alpha|^p \right\} - g_1(x),$$

$$|A(x, s, \xi)| \leq a(|s|) \left\{ \sum_{|\alpha|=1} |\xi_\alpha|^q + \sum_{|\alpha|=2} |\xi_\alpha|^p \right\} + g_2(x),$$

where $c > 0, p \in (1, n/2), q \in (2p, n), a: R_+ \rightarrow R_+$ is a nondecreasing continuous function, $g_{1,2} \in L^r(\Omega), \tau > n/q$, and $g_{1,2} \geq 0$.

In the talk we discuss the questions on the existence and Hölder continuity of bounded generalized solutions to the given problem.

The results are partially published in [1,2].

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MATHEMATICAL MODELING OF THE OPTION PRICE WITH DISCRETE SURVEILLANCE

Voloshchuk S.

Vadym Hetman Kyiv National Economic University, Ukraine

sr.voloshchuk@gmail.com

Options are derivative securities, which are based on some financial assets. The owner of the option has the right to buy (or sell) a financial asset at the time and by price which are specified in the option. In [1] we examined the Black-Scholes model of dynamic option price on finite price interval of a financial asset and finite time interval $[0, t^*]$, where t^* – is the time of purchase of a based financial asset. Continuous functions are additional conditions of the model. They determine the

price of the option at the time $t = t^*$ and by price of a financial asset $x = X_1$. In this paper we consider the model of Black-Scholes with discrete observations with additional conditions:

$$\frac{\partial w(x,t)}{\partial t} + \frac{1}{2} \sigma^2 x^2 \frac{\partial^2 w(x,t)}{\partial x^2} + r x \frac{\partial w(x,t)}{\partial x} - r w(x,t) = 0, x \in [X_1, X_2], t \in [0, t^*],$$

$$w(x_i, t) \Big|_{t=t^*} = 0, x_i \in [X_1, x^*], w(x_i, t) \Big|_{t=t^*} = \varphi_i, x_i \in [x^*, X_2], i = \overline{1, n},$$

$$w(x, t_j) \Big|_{x=X_1} = 0, t_j \in [0, t^*], j = \overline{1, m},$$

where x^* – the price of a financial asset which is fixed in the option, σ – the volatility, r – the risk-free interest rate, $w(x, t)$ – the option price.

We propose to make change of variables: $w(x, t) = e^{rt} v(x, t)$, $z = \ln(x) + Ct$, $\tau = t^* - t$, $C = -r + \sigma^2 / 2$, $y(z, \tau) = v(e^{z-C(t^*-\tau)}, t^* - \tau)$.

In a result this model is simplified to a homogeneous parabolic models:

$$\frac{\partial y(z, \tau)}{\partial \tau} - \frac{1}{2} \sigma^2 \frac{\partial^2 y(z, \tau)}{\partial z^2} = 0, z \in S = [\ln(X_1), \ln(X_2) + Ct^*], \tau \in [0, t^*],$$

$$y(z_i, \tau) \Big|_{\tau=0} = 0, z_i \in S_0^{(1)} = [\ln(X_1) + Ct^*, \ln(x^*) + Ct^*],$$

$$y(z_i, \tau) \Big|_{\tau=0} = \varphi_i e^{-\pi^*}, z_i \in S_0^{(2)} = [\ln(x^*) + Ct^*, \ln(X_2) + Ct^*],$$

$$y(z_i, \tau_j) \Big|_{z_i \in S_\Gamma} = 0, S_\Gamma = [\ln(X_1), \ln(X_1) + Ct^*], \tau_j \in [0, t^*],$$

where $z_i = \ln(x_i) + Ct_j$, $\tau_j = t^* - t_j$, $i = \overline{1, n}$, $j = \overline{1, m}$.

The resulting model can be represented in integral form due to the use of the fundamental solution of a parabolic equation according to the method which was proposed in [2]. The solution of this system $y(z, \tau)$ will meet the additional conditions of model by the mean-square criterion.

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NONLINEAR NORMALIZATION OF GENERATOR OF MARKOV PROCESSES

Yarova O.

Ivan Franko National University of Lviv, Ukraine

oksana-yarova@rambler.ru

The study of Markov random evolutions and their approximations is a subject of many scientific papers, among which are the works of V. Koroliuk[1], H. Chernoff [2], J. Feng[3]. In particular in [3] processes with independent increments in Poisson approximation schemes and approximation of Levi are studied. These processes are without diffuse component. And between the jumps there is Markov process. In Poisson approximation and Levi approximation schemes the generators are normalized by a linear factor[1]. However, in some cases, this normalization is not appropriate. Therefore we need to consider normalizing factor as a nonlinear function. The purpose of this work is to find parameters that normalize the generator of random process with independent increments.

Let's consider the family of Markov processes with independent increments $\eta_1^\varepsilon(t) = \eta(\frac{t}{g_1(\varepsilon)})$, $t \geq 0$, which are defined by a

generator $\Gamma^\varepsilon \phi(u) = (g_1(\varepsilon))^{-1} \int_R [\phi(u+v) - \phi(u)] \Gamma^\varepsilon(dv)$.

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SOME STOCHASTIC MODELS OF TRANSACTION COSTS

¹Zbroinska B., ^{1,2}Yeleyko Ya.

¹Jan Kochanowski University, Poland

²Ivan Franko National University of Lviv, Ukraine

Yikts@yahoo.com

Transaction costs - indirect costs that don't take part in considered economic process and they are not taxed. Known Coase theorem states, that investment is most effective if transaction costs are equal zero. Should be noted, that this problem is not enough studied, there are only some publications in this direct. Transaction costs are considered in [1], investments X and investment costs x_i are fixed. Interest rate r_i and investment time m_i are fixed too. In this case we consider, that X -random variable with average value a and variance b^2 , x_i - random variable with average value c and variance d^2 . So, real interest rate is

equal $r_0 = \sqrt[m]{\frac{X}{X - x_i}}(1 + r) - 1$ is a random variable. Thus, we need to

evaluate average value and variance for this variable.

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DATA ASSIMILATION FOR ADVECTION DOMINATED FLOWS BY INTERCONNECTED LOCALISED FILTERS

¹Zhuk S., ²Zayats M., ²Hartnett M., ³Nakonechnyi O., ¹Ragnoli E.

¹IBM Research, ²NUI Galway, Ireland

³Taras Shevchenko National University of Kyiv, Ukraine

sergiy.zhuk@ie.ibm.com, michael.hartnett@nuigalway.ie

a.nakonechniy@gmail.com, emanuele.ragnoli@ie.ibm.com

In this study the problem of Data Assimilation for linear advection dominated flows is considered. In order to solve this problem a strategy which combines minimax filter and adaptive Dirichlet-Neumann domain decomposition is proposed. Namely, original problem as well as observation equation together with errors constraints are geometrically split between local subproblems. Then, global estimate is recast from a

local counterparts computed by iterative Schwartz approach. The efficacy of the proposed method is demonstrated on academic numerical experiments.

The classical minimax filter has the following drawbacks. First, it is a L^2 -type filter, i.e., it has been designed for L^2 -type model errors and measurement noises, and, hence, it does not apply directly to the case of L^∞ -noises considered here. A straightforward way to apply the classical minimax filter in the considered case is to approximate L^∞ -ellipsoid by L^2 -ellipsoid which is very much like approximating a rectangle by the minimal ellipsoid which contains it. This approximation is quite crude, especially if the measure of the computational domain or/and the estimation horizon are large. Second, the minimax filter is very demanding computationally. While a study of the computational costs of the minimax filter do not seem to be present in the literature, its computational costs and scalability can be easily estimated to be at least of the same order as the Kalman filter, therefore making it computationally disadvantageous for large scale systems like the one investigated here.

In this work, the aforementioned issues are resolved by introducing interconnected localised minimax filters. Specifically, the computational domain of the problem is geometrically decomposed into smaller subdomains. Then the underlying PDE and observation equation are restricted to the introduced subdomains by means of a suitable Domain Decomposition (DD) technique. DD techniques have several advantages: the computational cost can be optimally managed, different geometric forms of subdomains can be exploited, various patterns of the physical solution can be captured using different numerical schemes in corresponding subdomains and the resulting subproblems can be solved independently. Finally, L^∞ -ellipsoids are restricted to the introduced subdomains, and a localised state estimation problem is formulated for each of the restricted PDEs. Note that L^∞ -ellipsoid is local in that it imposes pointwise restrictions on its elements. This is in a good agreement with the aforementioned domain decomposition. In addition, the error of approximating L^∞ -ellipsoid by L^2 -ellipsoid on a small subdomain can be made quite small. The latter observation is used to construct a continuous local L^2 -minimax filter for each local subproblem. These local filters are interconnected by means of DD

information exchange mechanisms taking care of the continuity of the local estimates across the subdomain interfaces.

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DETECTION AND ANALYSIS OF POSITIVE OPINIONS IN SOCIAL NETWORKS

Glybovets M.M.

National University “Kiev-Mohyla Academy”, Ukraine

glib@ukma.kiev.ua

Social networks (SN) along with open sources of information (OSI) is an extremely interesting object of researches that opens up opportunities for analysis of social interactions between people, prediction of their behaviour, classification and typology of social behaviour, modelling of information flows in networks, development of business projects. SN (OSI) is an ideal experimental platform for contemplating of social behaviour, approbation of advertising and influence technologies, promotion of modern business projects, aggression detection [1].

Study will consist of the following stages.

The problem of large data analysing from SN (OSI) by constructing inverted index and machine learning will be investigated. The architecture and software implementation of system for positive statements detection in social networks using technologies MapReduce will be proposed.

Software system will provide in real time a list of posts, which are related to issues of security threats, left by SN (OSI) users. The system should classify the results into two classes: threat and neutral.

The features of the work with SN (OSI), obtaining of the information about the user, his preferences, information about participation in events, groups, organisations, receiving his recent statements will be investigated at this stage. The method of evaluation of statements by means of the emotional colouring analyser and algorithm for determining the text subject using TF-IDF figures will be proposed.

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AUTOMATED CONSTRUCTION OF E-PORTRAIT FOR PERSON (COMMUNITY) BASED ON ANALYSIS FROM OPEN SOURCE DATA

Glybovets A.M.

National University “Kiev-Mohyla Academy”, Ukraine

andriy@glybovets.com.ua

Social data is an inexhaustible source of information about the personal lives and interests, preferences and behaviour of real people and communities [1]. Relevance of user preferences analysis is that after studying those mentioned preferences, modelling social, economic, political processes and creation of new services, business solutions and software products can be based on SN (OSI).

However, today there aren't any software solutions that enable analyzing user statements in SN (OSI). There are no clear criteria and approaches to statement analysis in the context of SN (OSI). Target of this study consists of development and implementation of complex approach to statement analysis of SN (OSI) users and selection of technological solutions to implement software prototype for analysis control and results-based electronic portrait of a person.

Therefore, in this study we will develop: theoretical approaches to mine and analyse data in SN (OSI); search algorithm for relations and dependencies on web-pages and offer a software prototype that will allow to collect and analyse user statements from SN (OSI) in real time; define the filtering criteria of user statements that will reduce the amount of useless statements; apply naive Bayes classifier with machine learning for primary message analysis; use supervised learning to improve the performance of analyser.

Study will consist of the following stages:

1. Usage of machine learning techniques to analyse user statements in social networks
2. Development of Web-prototype for analysis of user statements in social network Twitter

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ON A MODEL OF VISCOUS FLOWS

Cherniy D.

Taras Shevchenko National University of Kyiv, Ukraine

d_cherniy@ukr.net

The new solutions for layer flows are achieved in approximation of viscous incompressible fluid is considered. . The proposed model allows solve the problem of unsteady vortex flows in case then the convective components are comparable to the viscous components. An application of vortex methods to modeling of the flow for a shallow channel with complex geometry of boundaries is considered.

The three-layered viscous incompressible fluid flow inside narrow layer of height h is considered. The main equations described this flow is Navier-Stokes equation

$$\frac{\partial \vec{V}}{\partial t} + (\vec{V} \nabla) \vec{V} = -\frac{\nabla p}{\rho} + \vec{F} + \frac{\mu}{\rho} \Delta \vec{V}, \quad (1)$$

$$\nabla \vec{V} = 0, \quad (2)$$

with the following boundary condition in the top and bottom surface, accordingly.

$$\vec{V}(x, y, 0, t) = \vec{V}_0(x, y, t), \quad \vec{V}(x, y, h, t) = \vec{V}_h(x, y, t). \quad (3)$$

But, the equations (1) under mentioned before assumptions have a solution, which can be written in the integral form

$$\begin{aligned} \frac{\partial}{\partial t} \phi(x, y, z, t) + \frac{1}{2} \left(\left(\frac{\partial}{\partial x} \phi(x, y, z, t) \right)^2 + \left(\frac{\partial}{\partial y} \phi(x, y, z, t) \right)^2 \right) + \\ + \frac{P(x, y, t)}{\rho} - \frac{\mu}{\rho} \frac{\partial^2}{\partial z^2} \phi(x, y, z, t) = q(z, t). \end{aligned} \quad (4)$$

The solution of the hydrodynamic problem is reduced to the mathematical problem for $\varphi = \varphi(x, y, z, t)$ in for layer flows. For the initial-boundary problem of unsteady vortex flows, when the convective components are comparable to the viscosity components, we can write the equation

$$\frac{\partial \varphi}{\partial t} = \frac{\mu}{\rho} \frac{\partial^2 \varphi}{\partial z^2} - \frac{1}{2} \left(\left(\frac{\partial \varphi}{\partial x} \right)^2 + \left(\frac{\partial \varphi}{\partial y} \right)^2 \right) - \frac{P}{\rho} + q \quad (5)$$

with boundary conditions ($z = 0; h$):

$$\left(\frac{\partial \varphi}{\partial x}, \frac{\partial \varphi}{\partial y}, 0 \right) \Big|_{z=0} = \vec{V}_0(x, y, t), \quad (6)$$

$$\left(\frac{\partial \varphi}{\partial x}, \frac{\partial \varphi}{\partial y}, 0 \right) \Big|_{z=h} = \vec{V}_h(x, y, t), \quad (7)$$

and initial condition $t = 0$:

$$\varphi(x, y, z, 0) = \Phi(x, y, z). \quad (8)$$

Using different approximation of convective terms in the steady flow, the different laws of motion of the boundaries and the contribution of various terms, we get different types of the flows. As a result, we can obtain the classical solutions J. Poiseuille, M. Couette and H.S. Hele-Shaw.

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THE DEVELOPMENT OF PROFESSIONAL COMPETENCES IN MEDICINE BASED ON DECISION SUPPORT INFORMATION SYSTEM

^{1,2}Martsenyuk V., ³Andrushchak I., ⁴Kotsyuba R.

¹University of Bielsko-Biala, Poland

²Ternopil State Medical University, Ukraine

³Lutsk National Technical University, Ukraine

⁴Institute of Information Technologies and Learning Tools
of NAES of Ukraine

marцениuk@yahoo.com, 9000@lntu.edu.ua

A healthcare professional competence is an underlying characteristic of an medical professional which enables him/her to deliver healthcare in a given situation. Competences consist of clusters of knowledge, attitude and skill set. For example, interpersonal or communication skills play an important role in healthcare organization.

Here we would like to present our results in field of application of system analysis methods to problem of gaining professional competences in medical education and research. We emphasize effects

of uncertainty that should be taken into account in such complex processes.

The skilled health care professionals are at the heart of any health system. Preparing health care professionals to take on task of medical science and practice requires a common vision across the professions centered on a commitment to, first and foremost, meeting patients' needs.

We used T.Saati's method of hierarchy analysis to solve problem of priorities of innovative methodologies used in medical education.

Medical system research require information support system implementing data mining algorithms resulting in decision trees or IF-THEN rules. Besides that such system should be object-oriented and web-integrated. The aim of this study was to develop information support system based on data mining algorithms applied to system analysis method for medical system research. System analysis methods were used for qualitative analysis of diseases mathematical models. Algorithms such as decision tree induction and sequential covering algorithm were applied for data mining from learning data set.

We observed the complex qualitative behavior of population and diseases models depending on parameters and controllers even without considering probabilistic nature of the most of quantities and parameters of information models.

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NOTES

