

*Taras Shevchenko National University of Kyiv
(Faculty of Cybernetics)
Georgian Technical University,
Batumi Shota Rustaveli State University
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
Kyiv National Economic University named after
Vadym Hetman
Noosphere Ventures Corporation
Georgian Foundation for Development of Sciences and
Society "INTELLECT"*

***XXVII International Conference
PROBLEMS OF DECISION MAKING
UNDER UNCERTAINTIES***

dedicated to 70-th anniversary of Professor O. Nakonechnyi

(PDMU-2016)

May 23-27, 2016

ABSTRACTS

Tbilisi-Batumi, Georgia

**Київ
2016**

Надруковано за рішенням Вченої Ради факультету
кібернетики Київського національного університету імені
Тараса Шевченка (протокол № 10 від 25 квітня 2016 р.)

INTERNATIONAL PROGRAM COMMITTEE

A.Nakonechny (Ukraine) – Chairman

G.Chachanidze (Georgia) – Vice-Chairman

**S.Aliev (Azerbaijan Republic), M.Bratiychuk (Poland),
A.Chekriy (Ukraine), S.Dashkovsky (Germany),
Yu.Ermoliev (Austria), I.Herlin (France), A.Iskenderov
(Azerbaijan Republic), V.Kiguradze (Georgia),
V.Korolyuk (Ukraine), M.Khalvashi (Georgia),
J.Michalek (Czech Republik), A.Prangishvili (Georgia),
I.Sergienko (Ukraine), Yu.Shestopalov (Sweden),
O.Zakusylo (Ukraine)**

INTERNATIONAL ORGANIZING COMMITTEE

A.Anisimov - Chairman

**M.Bartish, I.Beyko, Ya.Chabanyuk, V.Donchenko,
F.Garashchenko, M.Glybovets, G.Gogichaishvili,
O.Iksanov, P.Knopov, I.Khanin, E.Lebedev, S.Lyashko,
S.Mashchenko, V.Marcenyuk, K.Nanobashvili,
M.Pratsiovytyi, V.Romanenko, N.Semenova,
S.Shakhno, G.Sokhadze, Z.Tsveraidze, N.Tsiklashvili,
A.Vlasyuk, Ya.Yeleiko**

LOCAL ORGANIZING COMMITTEE

P.Zinko – Chairman

I.Didmanidze – Chairman

**O.Kapustian, T.Korobko, M.Loseva, O.Lukovych,
A.Nikitin, Yu.Shusharin, T.Zinko, N.Akhvlediani,
Sh.Bakhtadze, Z.Beridze, G.Imnaishvili,
G.Ananiashvili, Z.Gasitashvili, G.Gvinepadze,
G.Surguladze**



OLEXANDER NAKONECHNYI'S 70th ANNIVERSARY!

The renowned scientist, an honored member of the education community, Laureate of the Ukrainian State Prize in Science and Technology, Distinguished Professor of Kyiv University of Taras Shevchenko, head of the department of system analysis and decision-making theory, Doctor of Science, Professor Olexander G. Nakonechnyi is celebrating his 70th anniversary in January 9, 2016.

All his life has been dedicated to Taras Shevchenko National University of Kyiv. Alexander has been working at the Faculty of Cybernetics since 1969; here from a software engineer he reached the status of a Professor, the head of the department.

Both teaching and doing scientific research, he successfully defended his PhD degree in physics and mathematics in 1973; the topic of the dissertation was "Moment functions of senior orders of random processes" and his scientific adviser was the Academician of the Ukrainian Academy of Sciences Anatoliy Skorokhod. Olexander Nakonechnyi defended his doctoral degree with "Minimax estimation of functionals of equation solutions with partial derivatives" in 1981.

Professor Nakonechnyi dedicates much efforts and energy to education, scientific and methodical activities. He is the head of the department of system analysis and decision-making theory since 1996, which is the base of systems analysis. As many as six Doctoral and nineteen PhD degrees were defended under the scientific supervision of Professor Nakonechnyi. He is the author of more than 280 scientific works; among them are seven monographs and six training manuals. Professor Nakonechnyi is the President of the Ukrainian Academy of Sciences of Higher School of Ukraine.

Professor Nakonechnyi is in the prime of his life when it comes to scientific research. His scientific and educational activities inspire colleagues and students, ensuring respect of both Ukrainian and foreign scientists. The PDMU Organizing Committee congratulates the program committee chairman Professor Nakonechnyi and warmly wishes him good health, happiness and more scientific achievements for the benefit of Ukraine.



MYKHAILO BARTISH'S 75th ANNIVERSARY!

On March 1, 2016 the famous scientist, Emeritus Professor of Ivan Franko National University of Lviv, Academician of the Academy of Higher School of Ukraine, Doctor of Physical and Mathematical Sciences, Professor Mykhailo Yaroslavovich Bartish marked his 75th anniversary.

The whole life of M. Bartish is associated with Lviv University. Since 1975 he is the Head of the Department of the theory of optimal processes; 1971-1974 – Deputy Dean of the Faculty of Mechanics and Mathematics, 1987-1996 - Dean of the Faculty of Applied Mathematics and Computer Sciences.

M. Bartish has created a scientific school of numerical methods for solving nonlinear functional equations and extremal problems. He has supervised one doctoral and seven PhD theses. He has published over 200 scientific papers.

Prof. M. Bartish is an experienced teacher and a wise leader. Under his leadership, the department provides training in the area of system analysis. He lectures on the courses "Methods of optimization", "Mathematical Economics", "Operations Research" and others and is the author of several textbooks and tutorials.

For many years, M. Bartish has been the member of specialized councils on dissertations defense, the member of the editorial collections and journals, the advisory council of HAC (SAC MES) of Ukraine on the examination of dissertations in computer sciences and cybernetics.

PDMU Organizing Committee congratulates Mykhailo Bartish and wishes him good health for many years and new research results for the benefit of the Motherland.

CONTENT¹

Aliyev S.A., Khalilov V.S., Rustamov Ya.I. On estimation of parameters of branching processes	14
Aliyev R. Asymptotic expansion for the ergodic distribution of the inventory control model of type (s,S) with subexponential distributed demands	15
Asanidze T., Naneishvili T., Maglakelidze G., Noselidze A. Training dose and duration of session as determinants in self_administration of drug (fentanyl)	17
Bakhrushin V.E. Public funding of higher education from the viewpoint of decision making theory	18
Bakhtadze Sh. About k-theory of homology based on regular partitions let LP_2 be a category of pairs of locally compacted paracompact spaces and their own mappings.....	19
Baliashvili S. China's "Political Priority" on improving rural education.....	20
Bartish V.Ya., Bartish M.Ya., Ogorodnyk N.P. Three-step descent method	22
Bayramov V., Aliyev R. Asymptotic behaviours of the expectation and the variance of the renewal-reward process.....	23
Bilynskiy A., Kinash O. Estimate of the probability of bankruptcy in case of subexponential distributions of payment	24
Bitsadze E., Topuria N. Design of internet portal of the oil companies network.....	25
Bondarchuk. Y.V. About technological perfection of DSS.....	26
Bondarenko V., Tertychna O. Idempotent-matrix models of finite networks	27
Budichenko V.O., Lebedev E.O., Ganzha R.O. Maximization of diagnosis process by multivariate analysis methods	28

¹ The abstracts are publishing in authors edition

Chachanidze G. Measuring the functions of education quality evaluation in the conditions of uncertainties	29
Chachanidze G., Eray O. The algorithmic support of rational decision making processes of academic mobility	30
Chachanidze G., Nanobashvili K. Functional analysis and evaluation of subject's potential abilities in the conditions of uncertainties.....	32
Chechelnytska K. The model of the stochastic dynamic of the investment cash flow	33
Chechelnytski A., Kucherenko O. The network models with the bivariate semi-Markov input flows.....	34
Cherniy D. Computing technologies of the discrete singularities method	35
Chkhitunidze M., Kereselidze Z., Dzhondzholadze N. Decision making of modeling of the frequency spectrum of magnetogradient waves in the equatorial magnetopause in the case of variable electric conductivity of the solar wind plasma	36
Chorny R., Kinash O. About determining an optimal amount of insurance fee in case f-model.	38
Diasamidze M., Samnidze N. Problematic issues in the learning process and the ways of dealing with them	38
Didmanidze I., Akhvlediani N., Didmanidze D., Khujadze N. The learning process and computer technologies	40
Didmanidze I., Bagrationi I. On the issues of cognitive biases of decision making in data-driven science.....	41
Didmanidze I., Beridze Z. Supporting automation system of wireless network security	44
Didmanidze I., Gorjeladze J. Information and communication technologies and foreign language teaching.....	45
Didmanidze I.Sh., Kakhiani G.A., Didmanidze D.Z., Donadze M.V. Discrete model of the neural network.....	46
Didmanidze I., Motskobili I. Conceptual model of prognosis	47
Didmanidze I., Nakashidze G., Imnaishvili G., Zakaradze Z. Algorithm development by sub-algorithms.....	48

Didmanidze I.Sh, Tsitskishvili G.D. Mathematical model to optimize loading-unloading operations on the vessel.....	49
Dincher Caner Scientific-innovative methods of decision making in the teaching process.....	50
Donchenko V.S. Objects as structure: mathematics and applications, heuristics	51
Donchenko V., Tarasova O. Matrix multiple regression with example of it's application on economics indexes.....	53
Donchenko V., Zinko T. Matrix corteges and cortege operators in grouping information problem for matrices	54
Dzhalladova I., Kamratov S., Khusainov D. Majorant estimates convergence the solutions of nonlinear systems.....	56
Eray Okan. Supporting decision making in academic student mobility process with information systems.....	58
Gadjiev T., Aliev S., Rasulov R. The linear degenerate elliptic-parabolic equations.....	59
Gadjiev T., Gasanova G., Kerimova M. Solvability of boundary problem for nonlinear degenerate elliptic equations.	60
Gadjiev T.S., Zulfaliyeva G.S. The estimates of solutions of degenerate nonlinear elliptic-parabolic equations	61
Galkin O. Consistency of depth functions in the space of classification functions	62
Garashchenko F.G., Matvienko V.T., Trebina N.M. Detection of chemical components in the plants	63
Garkusha N.I. About aftereffect peculiarities in dynamic systems	64
Gavardashvili A., Topuria N., Surguladze G. Determination of the ecological parameters of the black sea and designing its multimedia base based on the object-role modeling.....	65
Geladze D., Didmanidze M. Modern technologies in educations	68
Gnatyshyn O.P. Application of adaptive clustering methods for data analysis	69

Gogichaishvili G., Petriashvili L., Surguladze G. Decision support system for multimodal freight forwarding with risk management	70
Gorun P.P., Chabanyuk Ya.M. Asymptotic view of stochastic optimization in diffusion approximation scheme	72
Grinberg G.L., Lyubchyk L.M. Nonlinear dynamic system kernel based reconstruction from time series data.....	73
Grynenko O., Semenov V. On the problem of finding a path with optimal difficulty	74
Gvinepadze G., Tielidze Z. Interdisciplinary communication and electronic manuals	75
Iksanov A. On fractionally integrated inverse stable subordinators	78
Iskenderov A.D., Yagub G., Zengin M. Optimal control problem for a nonlinear schrödinger equation with a spesial gradient terms.....	79
Ivanchuk M.A., Ivanchuk P.R., Malyk I.V. Systems of common representatives application in clinical trials.....	80
Janelidze G. Marketing decisions research of the education service market	81
Jgenti Iuza, Meparishvili Badri, Janelidze Gulnara One approach to join sequence optimization for distributed query processing	82
Kaadze T. Enterprise risk management by coso's procedure.....	84
Kakashvili G. Systemic modeling contributing to the decision-making	84
Karkashadze I. Use of decision support system in airline development.....	86
Karkashadze M. New methods of operating social structure by the means of information technologies.....	87
Karkashadze M. Stream of information delivered by information technologies and ability of perceiving.....	88
Kasianiuk V.S., Malutenko L.M., Shkilniak O.S. Systems of logical reasoning in logics of partial predicates	89
Kharaishvili D., Meparishvili B., Janelidze G. Big data analytical technology to identify the diseases.....	90

Khimka U.T., Chabanyuk Ya.M., Swez O.I. Limited generator of random evolution in the asymptotic small diffusion scheme	92
Kinash A.V., Chabanyuk Ya.M., Khimka U.T. Asymptotic dissipativity conditions of the generalized lorenz system	93
Kotsur M., Nakonechniy O. Methods for optimal control of distributed parameter systems and application to transient thermoelectric cooling	94
Kotsiuba I., Yeleyko Y. Stop loss and stop buy calculation based on stocks data	95
Koval V.V., Velichko O.N., Golovnia M.V., Dorogobed V.V., Kalian D.O., Shkliarevskyi I.Y. Scientific and applied principles of creating united national synchroinformation system.....	96
Kovalchuk O. Three step method with memory based on method chord for solving system of nonlinear equations	98
Kozlov P.V. Intelligent decision support system for production scheduling in paper industry.....	99
Krak Iu., Kasianiuk V. System for automated of sign language translation	100
Kvachadze N. Success of chinese economical reforms.....	101
Kviralashvili A. Essence and tasks of decision-making in the regional economic systems' management	102
Lachashvili T. Innovative methods in binary digit system of counting	104
Lebedev Eu., Chechelnitski A., Livinska H. Diffusion and Gaussian properties of the multi-channel stochastic networks	106
Lysenko V., Dudnyk A., Komarchuk D. Control systems with neuro-information subsystem of decision making	107
Makhno M., Apanasenko D. On one hybrid model of a schedule theory problem.....	108
Manovytska D.O., Halytsya Y. I. Multi-criteria capacity expansion problem for alternative energy sources	109
Manzhos T., Kulyk A. The single-period inventory model for vertically integrated firm	110

Martsenyuk V.P., Andrushchak I.Ye. Coping with uncertainty in medical research with help of decision support system.....	111
Mashchenko S.O., Morenets V.I. A generalization of the concept of core games for fuzzy set of allowed coalitions.....	113
Melnyk O. The single-period inventory model with fuzzy triangular demand	114
Michalek J., Fusek M. Left-censored samples from weibull distribution–statistical inference and applications.....	115
Nakonechniy O. Inverse problems for linear variational equations with a parameter under uncertainties	116
Nakonechniy O., Demydenko S., Losieva M. Estimations of solutions of boundary value problems for second order differential equations under uncertainties.....	117
Nakonechniy O., Podlipenko Yu. Guaranteed estimation of solutions to the neumann screen problems for helmholtz equation with inexact data from their noisy observations at certain system of points or surfaces	119
Nakonechniy O.G., Zinko P.M. Optimal strategy in models with uncertainty, described by gompertzian equation	120
Nanobashvili K. Decision making issues in the process of higher education reform.....	122
Naumenko Y., Adzhubey L. About the approaches to modeling distribution processes and evaluating the effectiveness of advertising	123
Nenya O. I. About permanent conditions of a discrete predator-prey system.....	124
Nikitin A.V. Solving lyapunov-sylvester operator equations by convex programming methods.....	125
Okhanashvili S., Okhanashvili M., Okhanashvili I. Requirements in test design	127
Pankratova N.D. Modelling and mitigation of public response to catastrophes and accidents in conditions of uncertainties and multi-factor risks	128

Pashko A.A. Analysis methods statistical simulation of atmospheric turbulence	129
Pashko A.A., Terenchuk S.A. Using simulation of random processes and fields in solving heat conduction problems	130
Piranishvili R. The conception of making marketing decision based on knowledge economics in the area of mass service	131
Platsydem M. Growth of analytic in the circle characteristic functions	133
Ponomarov V. On retrieval queues with constant state dependent retrieval rate	134
Polaychenko A.I., Galkin O. V., Veres M.M. The use of piecewise linear regression in forecasting problems.	135
Pryshchepa O.V. Optimization of retrieval queue with limited number of retrievals	136
Romanenko V.D., Milyavsky Y.L. Decision making method based on weights varying in cognitive maps impulse process models	138
Samoilenko I.V. Rate functional in a large deviations problem for discrete-time random evolutions	139
Semenov V.V. A strongly convergent method for variational inequalities over the set of solutions the equilibrium problems	140
Semenova N., Lomaha M., Samus Y. Application of lexicography to solving of vector problems with linear-fractional functions of criteria.....	141
Semenyuk S.A., Chabanyuk Ya. M., Budz I. S. Infinitesimal generator for the continuous hidden markov model	142
Shakhno S., Iakymchuk R., Yarmola H. On two-step Gauss-Newton type methods for solving the nonlinear least squares problem.....	143
Sharapov M., Kucherenko O., Lukovych O. Security system elements of asde OMEGA	143
Shatashvili A.D., Fomina T.A. About radon-nikodym densities, used for the measures, generated by stationary gaussian processes in hilbert space, under their nonlinear evolutionary transformations.....	144

Shchestyuk N. Student-like models for risky asset and concept of fractal market	146
Shevchuk Y. M. Non-stationary models of population dynamics in information confrontation.....	147
Shkilniak O.S. Modal transitional logics of partial quasiary predicates without monotonicity restriction.....	148
Shkilniak S.S., Volkovytskyi D.B. Quantifier-free functional and renominative logics of partial predicates.....	149
Shlykov M. Petunin ellipsoid robustness	152
Shusharin Yu. Solutions optimization of linear difference equations system with random coefficients.	153
Skotarenko F. Grouping information problem: linear discrimination of matrix ‘feature vectors’	154
Slabospitsky A.S. On-line parameter estimation with least deviation norm from ‘ATTRACTION’ points for linear objects under uncertainties.....	155
Stelia O., Sirenko I., Potapenko L. AIR drag functions interpolation using parabolic spline	156
Stelia O., Sirenko I., Potapenko L., Stelia I. Monotonic difference scheme for the unsteady convection-diffusion equation.....	156
Tevdoradze M., Lolashvili N., Bajiashvili A., Saltkhutsishvili M., Rukhadze T. Research, evaluation and improvement of management methods of educational process in higher educational institutions.....	157
Timashova L. Intellectualization problems of virtual enterprises	159
Timofeeva N.K. Finite and infinite combinatorial sets.....	160
Turkia E., Mgeladze Ju., Jibuti D. Automatic support systems for anesthesia practitioners.....	161
Tymashov O. Hil test stands and testing of tracked vehicles	163
Unrod V.I. System problems of ecological safety of nanotechnologies are in foods	164
Vadnyov D., Ivohin E. About the properties and application of the special prime numbers sequences.....	165

Varshanidze T. Team building within organization and the best alternative choosing problems	166
Vergunova I. Construction of adaptive growing crops agrotechnologies.....	167
Vlasyuk A.P., Tsvetkova T.P. Mathematical modelling of salt transfer in saturated-non-saturated soil mass in case of non-stationary moistening condition	168
Voloshchuk S.D. Modeling the density distribution of stock prices	169
Yagub G., Ibrahimov N.S., N. Yildirim Aksoy. On the initial-boundary value problems for the nonlinear schrödinger equation with a spesimal gradient terms	170
Yeleyko Y. I., Kushnir I.B. Some marginal distributions of disease duration.....	171
Zakariashvili M., Tchitchashvili I. Media technologies in education a new culture of teaching and learning.....	172
Zaychenko Yu.P. Fundamentals of fuzzy portfolio optimization theory under uncertainty	173
Zbroinska B, Yeleyko Ya. Some methods of evaluation transaction costs	174
Zirakashvili T. Dynamic analysis of planning the contingent of students at universities considering regional factors	175
Zhvania R., Menabde T. Technical realisation of procedures that calibrates the meters of natural gas consumption	177
Rafyan T.A., Karapetyan A.T. Features and problems of implementation of enterprise resource planning (ERP-systems)	178

ON ESTIMATION OF PARAMETERS OF BRANCHING PROCESSES.

¹Aliyev S.A., ¹Khalilov V.S., ²Rustamov Ya.I.

¹Institute of Mathematics and Mechanics of NAS of Azerbaijan

²Institute of Control Systems of NAS of Azerbaijan

soltanaliyev@yahoo.com

The problems of estimation of branching processes parameters and their distributions were considered by many authors. One can see a rather complete review of the papers in this area in [1].

In this paper, we cite some results for estimation of distribution of the number of direct descendants of one particle.

Let $\xi(t)$ be supercritical Galton-Watson process with one type particles and distribution of the number of direct descendants $\{p_i\}_{i=1}^d$, with mean quality of direct descendants of one particle $\rho = \sum ip_i$, and for simplification of the statement we will assume that $p_i > 0$, $i = \overline{1, d}$, i.e. the process doesn't degenerate with probability of unit.

We consider this process as branching with d types of particles $\xi^1(1) = (\xi_1^1(t), \dots, \xi_d^1(t))$, where the distribution laws of the number of direct descendants of all types of particles are identical, i.e.

$$P\{\xi_i(1) = je_j\} = p_j^i = p_j, \quad i, j = \overline{1, d}.$$

Then the general amount of particles in the introduced d type process $\xi^1(1)$ will coincide with $\xi(t)$, and the matrix of mean values for the process $\xi^1(1)$ will be $A = \|a_j^i\|$, where $a_j^i = jp_j^i = jp_j$. All the rows of the matrix are identical, and the sum of the elements of the row equals the mean number of direct descendants in the process $\xi(1)$; consequently, the perron root of the matrix the A equals ρ , and all remaining eigen values equal zero.

As estimations of "probabilities" $\left(\frac{p_2}{p_1}, \dots, \frac{p_d}{p_1}\right)$ we consider a functional of the process

$$p_j(t) = \frac{g_j'(t)}{j} = \frac{\xi_j^1(t)}{j\xi_1^1(t)}, \quad j = \overline{2, d}$$

that is some modified estimation of the left eigen vector of the matrix of mean values of multitype process suggested in [2].

The following theorem is proved.

Theorem 1. Denote

$$p_j^*(t) = \left(p_j(t) - \frac{p_j}{p_1} \right) \sqrt{\left| \xi^1(t) \right|} \frac{\xi_1^1(t) j}{\xi_j^1(t)}, \quad j = \overline{2, d},$$

then as $t \rightarrow \infty$, where

$$p^*(t) = (p_2^*(t), \dots, p_d^*(t)) \xrightarrow{\text{dis.}} N(0, \|\sigma_{ij}\|),$$

and $\sigma_{ij} = \frac{1}{p_1} (i \neq j)$, $\sigma_{jj} = \frac{1}{p_j} + \frac{1}{p_1}$, $i, j = \overline{2, d}$, $N(0, \|\sigma_{ij}\|)$ is function of $(n-1)$ - dimensional normal distribution with zero mean and covariance matrix $\|\sigma_{ij}\|$.

References

1. Valutin V.A., Zubkov A.M., Branching processes I.J. Soviet Math., 39 (1987), №1, p. 2431-2475.
2. Babalbaev I.S., Mukhitdinov A., Limit theorems for some functionals in multitype branching processes. Theor. veroy. i ee primen. 1989, vol.34, №4, p.753-757 (in russian).

ASYMPTOTIC EXPANSION FOR THE ERGODIC DISTRIBUTION OF THE INVENTORY CONTROL MODEL OF TYPE (s,S) WITH SUBEXPONENTIAL DISTRIBUTED DEMANDS

Rovshan Aliyev

Baku State University, Azerbaijan

aliyevrovshan@yahoo.com

Let $\{\xi_n\}, \{\eta_n\}, \{\theta_n\}$ and $\{\zeta_n\}$ are independent sequences of positive valued random variables defined on probability space $(\Omega, \mathcal{I}, P)$, such that variables in each sequence independent and identically distributed.

Let $F(x) = P\{\eta_1 \leq x\}$, $F(x) = P\{\eta_1 \leq x\}$, $F_1(x) = \frac{1}{m_1} \int_0^x \bar{F}(u) du$,

where $\bar{F}(u) = 1 - F(u)$, $m_k = E(\eta_1^k) < \infty$.

Define independent renewal sequence $\{T_n\}$ and $\{Y_n\}$ as:

$$T_n = \sum_{i=1}^n \xi_i, Y_n = \sum_{i=1}^n \eta_i, n=1, 2, \dots; T_0 = Y_0 = 0.$$

Define also sequence of integer valued random variables:

$$N_0 = 0, N_1 = N(z - s) = \min\{k \geq 1: z - Y_k < s\};$$

$$N_n \equiv N_n(\zeta_{n-1} - s) = \min\{k \geq N_{n-1} + 1: \zeta_{n-1} - (Y_k - Y_{N_{n-1}}) < s\}, n=2, 3, \dots$$

Thus the following stochastic process can be constructed:

$$X(t) = \max\{s, \zeta_{n+1} - Y_{\nu(t)} + Y_{N_n}\} \quad \text{as } \gamma_n \leq t < \gamma_{n+1}, n=0, 1, 2, \dots,$$

where $\nu(t) = \max\{n \geq 0: T_n \leq t\}$; $\tau_0 = 0$, $\gamma_0 = 0$, $\tau_n = \gamma_{n-1} + T_{N_n} - T_{N_{n-1}}$, $\gamma_n = \tau_n + \theta_n, n=1, 2, \dots$

Definition ([2]). A distribution F on $[0, \infty)$ is said to belong to the class $\mathbf{S}^*$, if $F(x) > 0$ for all $x > 0$, $m_1 = \int_0^\infty \bar{F}(x) dx < \infty$ and

$$\int_0^x \bar{F}(x-t) \bar{F}(t) dt \sim 2m_1 \bar{F}(x), \text{ as } x \rightarrow \infty.$$

Theorem. Let the following conditions be satisfied: 1) $E\xi_1 < \infty$, 2) $F(x)$ is non-singular and $F_1 \in \mathbf{S}^*$, 3) ζ_1 has the uniform distribution on $[s, S]$. Then for the each $x \in (0, 1)$ as $\beta \rightarrow \infty$ the following asymptotic expansion for the ergodic distribution of process $W_\beta(t) \equiv \frac{1}{\beta}(X(t) - s)$ can be written:

$$Q_{W_\beta}(x) = x(2-x) + B(x) \frac{1}{\beta} + 2(1^* \bar{G}_1(\beta(1-x))) \frac{1}{\beta^2} +$$

$$O\left(\frac{1^* \bar{F}_1(\beta(1-x))}{\beta^2}\right),$$

where $B(x) = 2(1-x)(Km_1(1-x) - m_{21}x)$, $\overline{G}_1(x) = \int_x^{\infty} \overline{F}_1(u) du$,

$$m_{21} = m_2 / 2m_1, \quad \beta = S - s.$$

References

1. Aliyev R.T. On moments of the model type of (s, S) with a heavy tailed distributed demands having finite variance // PDMU-2013, Ukraine, May, 13-17, 2013. – P.19-21.
2. Geluk J.L., Frenk J.B.G. Renewal theory for random variables with a heavy tailed distribution and finite variance // Statistics and Probability Letters. – 2011. - 81. – P.77–82.

TRAINING DOSE AND DURATION OF SESSION AS DETERMINANTS IN SELF ADMINISTRATION OF DRUG (FENTANYL)

T.Asanidze, T.Naneishvili, G.Maglakelidze, A. Noselidze

Batumi State University, Batumi, Georgia;

I.Beritashvili Institute of Physiology, Tbilisi, Georgia

tamasa1975@mail.ru

Research of drug self-administration in rats is used for prevention of compulsive drug taking by humans. Frequency of drug response depends on pharmacological effect of drug and complex interaction of behavioral effects. Dose-effect curve is one of the complex factors of assessment of drug self-administration experiments. Low doses of drug as confirmatory cause weak response or no response. Confirmatory action of opiates in laboratory animals is researched, but contextual properties of interaction of session duration and training dose is not researched. 0.0012 mg/kg dose of fentanyl during 4-hour session provides the constant level of response, although lower doses cause such forms of response, which are typical for administration of various drugs in short-time with big intervals. Quantity of infusions during session time is not decreased, if heroin doses are high. The received data point that response lowering during session time is caused with confirmatory properties of low doses of fentanyl. It was showed that in the second group of rats administration of 0.0006 mg/kg with 4-hour session administration of double doses (0.012 mg/kg) at 3 hour increase of infusions quantity. Finally, dose-response interaction between frequencies of fentanyl-caused confirmation and response depends on session period and fentanyl dose.

PUBLIC FUNDING OF HIGHER EDUCATION FROM THE VIEWPOINT OF DECISION MAKING THEORY

Bakhrushin V.E.

Zaporizhia National Technical University, Ukraine

Vladimir.Bakhrushin@gmail.com

Recently, the Ministry of Education and Science of Ukraine has presented for public discussion a draft law amending the procedure for public financing of higher education [1]. An essential element of new mechanism is the formula of block funding, which involves assessment of the quality of universities based on a set of indicators of their core activity. The formula will obviously be constructed as a weighted sum of the individual indicators. Their composition and weighting factors are yet to be clarified.

Using of such formula assume the definition of target. In the context of the problem – it must be a formalized integrated indicator of the university quality. It can be specified as a model

$$I = \alpha_1 I_1 + \alpha_2 I_2 + \dots + \alpha_k I_k,$$

which gives the best approximation to a set of university scores obtained by expert estimation.

Total number of indexes that can be used to assess the universities is at least several dozen. However, many of them are strongly correlated, while for some others there is a high error in the determination of numerical values or significant impact of the variation throughout the year on the final result. In this regard, it is need to select at the first stage the independent indexes, which then can be used in the formula of university assessment. Considering the nature of scores distribution in the TOP-200 and the Compass ratings, it can be assumed that the experts will be able to estimate more or less reliably not more than 20 – 30 universities. Therefore it is not expedient to use in the formula more than 5 – 7 indicators.

References

1. Draft Law of Ukraine "On amending some Laws of Ukraine on funding of higher education (regarding economic relations in higher education)". <http://mon.gov.ua/citizens/zv%E2%80%99yazki-z-gromadskisty/konsultacziyi-z-gromadskisty/gromadske-obgovorenniya-2016.html>

ABOUT K-THEORY OF HOMOLOGY BASED ON REGULAR PARTITIONS LET LP_2 BE A CATEGORY OF PAIRS OF LOCALLY COMPACTED PARACOMPACT SPACES AND THEIR OWN MAPPINGS

Bakhtadze Sh.

Batumi Shota Rustaveli State University, Georgia

bakhtadze.shalva@yandex.com

For the pairs $(X, A) \in LP_2$, arbitrarily chosen locally-finite fixed simplicial (cell) complex K , arbitrary Abelian additive group G and any integer $n \in \mathbb{Z}$, there is built so-called n -dimensional K group of projection K -chains $C_n^K(X, A; G)$ of spaces pairs (X, A) over a group of coefficients G , based on regular partitions, and at the same time, a chain complex of groups $C_* = \{C_q(X, A; G), \partial\}_{q \in \mathbb{Z}}$, where K -- boundary operator ∂ , is defined as follows [see 1,3]:

If $x = \{x_\tau\} \in C_n^K(X, A; G)$, then suppose that:
 $(\partial x)_\tau = \partial(x_\tau) + (-1)^{\dim x_\tau} \delta x_\tau$, where $\delta x_\tau = \sum [\tau : \sigma] x_\sigma$,

$\dim \sigma = \dim \tau - 1$, and an incidence coefficient is designated as $[\tau : \sigma]$. From the definition it follows that $\partial x \in C_{n-1}^K(X, A; G)$. It is easy to check that $\partial \circ \partial = 0$. Let

$\text{Ker}(\partial : C_n^K(X, A; G) \rightarrow C_{n-1}^K(X, A; G)) / \text{Im}(\partial : C_{n+1}^K(X, A; G) \rightarrow C_n^K(X, A; G))$

Factogroup denote by $H_n^K(X, A; G)$ and name n -dimensional by K -group of Baladze-Chogoshvili homology of pairs $(X, A) \in LP_2$ over a group of coefficients G , based on regular partitions.

In order to study basic properties of the developed K - theory of Baladze-Chogoshvili homology H_*^K , on the basis of complex K and chain complex $C_* = \{C_q(X, A; G), \partial_q\}_{q \in \mathbb{Z}}$ there is build a bigraded complex $C_{*,*} = \{C_{p,q} \mid p, q \in \mathbb{Z}\}$ and its total complex. Further, the spectral sequence is constructed on a decreasing filtering of the total complex. It has been established that the second member of this sequence is as follows: $E_{p,q}^2 \approx H^p(K; H_q(X, A; G))$. The given

theory verifies the validity of Eilenberg-Steenrod axiom and two Milnor axioms with the help of comparison theorem (see 4). K - theory of Baladze-Chogoshvili homology represents an extraordinary theory.

References

1. Sh. Bakhtzde. Abstracts of XI mathematician Conference. Georgia. Kutaisi. 1986. - p.91-92
2. Sh. Bakhtadze. Bulletin of Georgian Academy of Sciences, 169, №2, 2004. - p. 259 – 262.
3. D. Baladze. Researches on the Homology Theory. Ed. "Ganatileba". Tbilisi, 1984.

CHINA'S "POLITICAL PRIORITY" ON IMPROVING RURAL EDUCATION

Sofia Baliashvili

Georgian Technical University

Moira_s@hotmail.com

China has the world's largest number of people receiving formal education. A multi-level education system involving formal schooling, vocational training and lifelong learning is rapidly becoming complete. The popularization of education drives the advance of science and technology now having reached or nearing the international advanced levels.

As a populous country, China attaches great importance to basic education. It has implemented compulsory gratis education in both urban and rural areas, with the funds being fully guaranteed by national exchequer. This is a historic change in China's education system, realizing the centuries-old ideal that "in education there should be no distinction of social status." The Outline of the National Program for Education Reform and Development (2010-2020) is China's first educational plan in the 21st century. It provides guidelines for China's education reform and development. The Outline emphasized equal access to education for all. China will establish a basic public education system covering both urban and rural areas, achieve the equalization of basic public education step by step, and narrow the gaps among regions.

China's rural education reform started in 1984, and experiences a milestone in 2006 when the Chinese government made primary school and the first three years of secondary school free for all rural children and started to support their living costs. China's primary school education provision has today already reached more than 99 percent of

all children, but the biggest challenge going forward is the provision of good quality education in some rural areas, because good teachers tend to go to urban schools. Inequality of good teachers between poorer and richer regions is one even existing in developed countries, proving how hard it is for China to achieve such reform. Another challenge is that despite substantial improvements in standards of living, the Chinese countryside is largely lagging behind. Rural-urban disparities in income and services and subsequent migration trends pose great challenges to sound development. Rural China is home to more than 150 million school-aged children. The children of rural China suffer the negative consequences of the country's economic boom: their parents often move to the cities as migrant workers and they are left to fend for themselves. The Chinese government's recent strategy, "Building a New Socialist Countryside" and related reforms, represent an innovative approach to tackling these challenges and have brought substantial investments in rural areas.

The Chinese central government has invested 61.8 billion yuan (\$10.1 billion) improving schoolhouses and educational facilities in rural areas over the past five years. Ministries of education and finance and the National Development and reform Commission jointly worked out a plan on improving the level of education in poor areas at the end of last year. The plan aims at completing six major tasks in three to five years, including improving basic school facilities, promoting digital teaching methods and improving the quality of teaching staff. The ministry will try to ensure better compulsory education and care for millions of rural left-behind children at school age, who stayed alone or with their relatives while their parents go to cities to make a living.

Having ensured schooling for almost all children, the government is turning to deal with the unbalanced allocation of compulsory education resources: to give preferential treatment to rural, ethnic minority, border and poverty-stricken areas in allocation of education resources nationwide or within a province (autonomous region or municipality); and give preferential treatment to disadvantaged schools within a city or country to achieve a balanced allocation of teachers, equipment, books and school buildings. Although the imbalance in compulsory education cannot be redressed immediately due to the great economic and social disparities between different regions, the Chinese government spares no effort to promote educational equality.

The Chinese government's "political priority" on improving rural education and its ability to draw up a national plan on education are key

driving forces behind China's success in increasing education access, and this can be learned by other emerging countries.

References

1. Cecily Liu - China's rural education. China Daily. (2014). <http://www.chinadaily.com.cn/china/2014>.
2. Education Law of the People's Republic of China. <http://www.chinaeducenter.com/en/edulaw.php>.
3. Li W., Education and Science. Beijing: China Intercontinental Press. (2015), pp.196-223.
4. China spends billions on rural education. Xinhua press. (2014).
5. <http://www.chinadaily.com.cn/business/2014>.

THREE-STEP DESCENT METHOD

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

Lviv National University named Ivan Franko, Ukraine

ogorodnyk.nataly@gmail.com

We will consider the optimization problem

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

We define:

$$\text{- vector } a_{k,j} = (a_{k,j}^1, \dots, a_{k,j}^n)^T, \text{ where } a_{k,j}^i \in \left\{ 0, \frac{\partial f'}{\partial x^i}(x_{k,j}) \right\},$$

$$k = 0, 1, \dots, i = \overline{1, n};$$

$$\text{- set } I = \{1, 2, \dots, n\} \text{ and subset } I_{k,j} \subseteq I, \text{ which satisfying}$$

$$\text{conditions } I_{k,j} \neq I_{k,i}, \bigcup_{j=1}^p I_{k,j} = I, \text{ where } j = \overline{0, p}, p \leq n.$$

The next algorithm can be used for solving (1)

$$x_{k,j+1} = x_{k,j} - \alpha_{k,j} a_{k,j}, \quad (2)$$

$$f(x_{k,j+1}) - f(x_{k,j}) \leq -\varepsilon \alpha_{k,j} \|a_{k,j}\|^2, \varepsilon \in (0, 1), \quad (3)$$

where $j = 0, \dots, p-1, k = 0, 1, \dots; x_{k,p} = x_{k+1,0} = x_{k+1}$.

Using the idea of three-step methods, we propose the new three-step descent method for solving (1), which is based on (2)-(3)

$$u_{k,j} = x_{k,j} - \alpha_{k,j} a_{k,j}, \quad (4)$$

$$v_{k,j} = x_{k,j} - \beta_{k,j} a_{k,j+1}, \quad (5)$$

$$x_{k,j+1} = \arg \min_{\gamma} f \left(u_{k,j} + \gamma (v_{k,j} - u_{k,j}) \right), \quad (6)$$

where $j = 0, \dots, p-1$, $k = 0, 1, \dots$; $x_{k,p} = x_{k+1,0} = x_{k+1}$, $\alpha_{k,j}, \beta_{k,j} > 0$ – step factors..

As the practical research method (4) - (6) shows better results in terms of number of calculations than the gradient method, especially for problems of large dimensions.

ASYMPTOTIC BEHAVIOURS OF THE EXPECTATION AND THE VARIANCE OF THE RENEWAL-REWARD PROCESS

Veli Bayramov¹, Rovshan Aliyev^{1,2}

¹Baku State University, Azerbaijan

²Institute of Control Systems, Azerbaijan

veli_bayramov@yahoo.com, aliyevrovshan@yahoo.com

We consider a renewal-reward process $C(t) = \sum_{i=1}^{N(t)} X_i$, where $N(t) = \max \{n : S_n \leq t\}$ is a renewal process, $S_n = \sum_{i=1}^n T_i$, $\{(T_i, X_i), i \geq 1\}$ is a sequence of independent and identically distributed random vectors with possibly dependent coordinates. In Brown and Solomon [1] asymptotic expansions as $t \rightarrow \infty$ with the reminder term $o(1)$ for the mathematical expectation and variance of the renewal-reward process has been derived. Under some conditions we generalize these results and derive asymptotic expansions as $t \rightarrow \infty$ with the reminder term $o(t^{-k})$.

References

1. Brown M., Solomon H. A. Second-order approximation for the variance of a renewal reward process // Stochastic Processes and their Applications, 1975, 3. – P. 301–314.
2. Ross S. M. Stochastic Processes, 2nd ed. - New York: John Wiley and sons, 1996.

ESTIMATE OF THE PROBABILITY OF BANKRUPTCY IN CASE OF SUBEXPONENTIAL DISTRIBUTIONS OF PAYMENT

Bilynskiy A., Kinash O.

Ivan Franko National University of Lviv, Ukraine

andrii.bilynskiy@gmail.com

Classical risk theory assumes that large insurance claims and, therefore, large insurance payments are rare, with exponentially small probabilities. However, many situations are related to extreme events. Due to this fact, the true size of payments is more adequately represented by random variables distributed with "heavy tails".

Note that the class of distributions with "heavy tails" is wide enough. In particular, it includes so called subexponential distributions.

Review of the theory of subexponential distributions and applications in risk theory in sufficient detail is considered in work of Zinchenko [1].

Consider the examples of calculating the probability of bankruptcy in the case of "heavy tails", that is, when payments are large.

Consider payments distributed by Weibull distribution with parameter $0 < \gamma < 1$, with distribution function

$$F(x) = 1 - \exp(-cx^\gamma), \quad c > 0, 0 < \gamma < 1, x > 0$$

then for $\gamma = \frac{1}{2}$ the asymptotic of the probability of bankruptcy $\phi(u)$ ratio is

$$\phi(u) \sim \frac{\lambda}{c_1 \cdot c^{\frac{1}{\gamma}} - \lambda \Gamma\left(1 + \frac{1}{\lambda}\right)} \left[\Gamma\left(1 + \frac{1}{\gamma}\right) - 1 + \exp\left(-cx^{\frac{1}{\gamma}}\right) \left(c x^{\frac{1}{\gamma}} + 1 \right) \right],$$

by $u \rightarrow \infty$.

References

1. Zinchenko N.M. Mathematical methods in risk theory: a tutorial - publishing center "Kyiv University". - 2008.

DESIGN OF INTERNET PORTAL OF THE OIL COMPANIES NETWORK

Elza Bitsadze, Nino Topuria

Georgian Technical University

eliza-bitsadze@mail.ru, nintopuria@gmail.com

At the present time there is a rapid development of petrol stations nets in different regions of Georgia. The interaction between the oil companies, petroleum storage depots and between petrol stations is carried out via e-mail.

Many companies are now actively creating infrastructure that allows to use Internet not only as a mean of communication, but also as one of the main tools of business. Timeliness of the use of information from employees, partners and customers, it is one of the determining factors of the company's success in the market. [1-3].

In this paper, we propose the design of a corporate portal based on Microsoft SharePoint Server, enabling people in the organization to get quick access to business information, publication of documents, workflow automation. Internet-applications, enable the company to provide relevant information to their customers and employees, as well as the timely processing of information which are received from them (orders, offers, etc.). To configure access to databases (SQL Server) which allows to make its data available from the external list of the company portal site, they use SharePoint Designer, and Business Connectivity Services. External Content Type contains the metadata that describes the structure of the internal data based on which will be generated external list on a SharePoint site.

References

1. Surguladze G., Petriashvili L., Topuria N., Surguladze G. Modeling of Building a Conceptual Scheme for Multimodal Freight Transportation Information System. <http://www.waset.org/Publications>.
2. Deployment guide for Microsoft SharePoint-13. (2014). Microsoft corporation. - 1156 p.
3. Jamison S., Hanley S. (2014). C. Bortlik. Essential SharePoint 2013. Pearson Education. -745 p.

ABOUT TECHNOLOGICAL PERFECTION OF DSS

Bondarchuk Y.V.

Taras Shevchenko National University of Kyiv, Ukraine

byv@univ.kiev.ua

In [1, 2] it is proposed to consider the place of DSS among the software systems. The main difficulty in the analysis of DSS is to formalize the notion of a *decision* that should be considered as a separate object. [3] Respectively, DSS life cycle is a cycle of solutions support while the methods are secondary.

Technological excellence is proposed to consider as the degree of separation of the DSS from a decision and its data. Respectively, the maximum separation corresponds to the maximum technological excellence. The following components of such perfection are offered below.

1. Solutions' exchange. The minimum required is the accumulation of decisions base. Most of DSS only support the formation of current decision.

2. A response to the DSS external inquiries. Is one of the forms of display of consistency.

3. Recognition of such systems in order to coordinate actions [3] in decisions' support and solutions' sharing.

4. Consistency of actions as participation in the imported DSS distributed scenario.

5. Full lifecycle of solution, when it exists as an independent object for reuse, exchange or new solutions formation. So, the perfect DSS is a solutions designer.

References

1. Бондарчук Ю.В. Щодо модифікації парадигми СППР // Системи підтримки прийняття рішень. Теорія і практика (СППР-2013): Збірник доповідей наук.-практ. конф. –Київ: ІПММС НАНУ, 2013. - С. 9-11.
2. Bondarchuk Y.V. Version of the DSS abstraction // XXIV International conference "Problems of decision making under uncertainties" (PDMU-2014). 1-5.9.2014, Cesky Rudolec, Czech Republic, - P. 20-21.
3. Бондарчук Ю.В. Патерни взаємодії СППР // Системи підтримки прийняття рішень. Теорія і практика (СППР-2015): Збірник доповідей наук.-практ. конф. –Київ: ІПММС НАНУ, 2015. - С. 9-12.

IDEMPOTENT-MATRIX MODELS OF FINITE NETWORKS

¹Bondarenko V., ²Tertychna O.

¹Institute of Mathematics of NAS of Ukraine, Kyiv

²Vadym Hetman National Economic University of Kyiv, Ukraine

vitalij.bond@gmail.com, olena-tertychna@mail.ru

In the study of networks and models, there are widely used various algebraic structures and objects: graphs, matrices, quadratic forms, groups, etc. Continuing this trend, we introduce and study the notion of an idempotent-matrix model for finite networks using our results on the theory of representations, summarized in the thesis [1] (the supervisor was the first author). By a network we mean a connected digraph without loops and multiple arrows.

Let R be the field of real numbers and M_m the algebra of all $m \times m$ matrices over R . Given a finite ordered family $P = (P_1, P_2, \dots, P_n)$ of idempotent matrices from M_m , we associate the *generated digraph* $G = G(P)$ which has the vertices set $V = \{1, 2, \dots, n\}$ and the arrow set $A = \{i \rightarrow j, i \neq j \mid P_i P_j \neq 0\}$. The subalgebra $M_m(P) = M_m(P_1, P_2, \dots, P_n)$ of M_m generated by the matrices $P_1, P_2, \dots, P_n$ will be called the *idempotent-matrix model for G of dimension m* , generated by P , or simply an *idempotent-matrix model for G* .

Theorem. Let $G = (V, A)$ be an acyclic network, and let $|V| = n > 1$. Then the G has an idempotent-matrix model $M_m(P_1, P_2, \dots, P_n)$ of some dimension m satisfying the following conditions:

- 1) P_i is diagonal for all input (or all output) vertices i ; 2) $P_i \neq P_j$ if $i \neq j$;
- 3) for any oriented path $i_1 \rightarrow i_2 \rightarrow \dots \rightarrow i_s$ ($s > 1$), $P_{i_1} P_{i_2} \dots P_{i_s}$ is not an idempotent matrix;
- 4) if paths $i_1 \rightarrow i_2 \rightarrow \dots \rightarrow i_s$ and $j_1 \rightarrow j_2 \rightarrow \dots \rightarrow j_k$ are different, then $P_{i_1} P_{i_2} \dots P_{i_s} \neq P_{j_1} P_{j_2} \dots P_{j_k}$.

References

1. Tertychna O. M. Matrix representations of semigroups generated by idempotents with partial null multiplication. – Thesis for the degree of Candidate of Physical and Mathematical Sciences. – Kyiv National Taras Shevchenko University, 2009. – 168 p.

MAXIMIZATION OF DIAGNOSIS PROCESS BY MULTIVARIATE ANALYSIS METHODS

Budichenko V.O., Lebedev E.O., Ganzha R.O.

Taras Shevchenko National University of Kyiv, Ukraine

BoodyVo@gmail.com

Research in medical statistics are very important for humanity, because in general the treatment of diseases depends on it. An important field of applications of statistical methods is the processing of medical information in such a way as to maximize the probability of the correct diagnosis.

This paper deals with the following problem: there are control and experimental samples which describe observations of patient groups with the fixed number of factors for which it is supposed that they are related with the given disease. We want to determine the most influential factors from the given set for a diagnosis of the disease. For solving of this problem it is proposed to use the F-distribution and the Mahalanobis distance. Starting from this point we construct the normalized distance between the control and experimental samples and suggest an algorithm of selection of the most influential factors.

Software created in our work operates with data in excel format and performs all calculations (calculation of the Mahalanobis distance, values of the F-distribution function and construction of the normalized distance). To speed up we use the methods of parallel programming ([1]) because most calculations can be performed independently of the other.

Our approach will be used for treatment of medical data in diagnosis process of heart disease to make the most accurate diagnosis. Thus, using the proposed method we can reduce extra factors that make noise in the sample.

References

1. Palach J. Parallel Programming with Python / J. Palach
<http://104.197.11.51/parallel-programming-with-python-palach-jan.pdf> -
2014. - 103 p.

MEASURING THE FUNCTIONS OF EDUCATION QUALITY EVALUATION IN THE CONDITIONS OF UNCERTAINTIES

Guram Chachanidze

Georgian Technical University

guramchachanidze@yahoo.com

Credit system of education quality assurance is the main determinant of the higher educational institution's efficiency. The high education quality is greatly depended on the students' and professors' mobility quality within the credit system. The students' and professors' mobility contributes to the joint preparation process of high qualified specialists.

We have measured the functions of quality evaluation in the conditions of uncertainties.

Here are given the following marks:

N – the number of the students and Doctoral students of the target high educational institution, which were and are still involved in the educational and scientific-research programs of world's leading high educational institutions while measuring the functions in order to collect the credits during T_1 time (T_1 – a week, a month, a year);

M - the number of the students and Doctoral students of the world's leading high educational institutions, which participated and still participate in the educational and scientific-research programs of a research high educational institution in a different way during T_2 time;

U – the total number of Doctoral students of the target high educational institution;

S – the total number of students of the target high educational institution;

H^1 – the total number of professor-teachers of the target high educational institution, which are gone on business trip from the university or do the pedagogical and research works at the world's leading higher educational institution during T_3 ;

H^2 - the total number of professor-teachers of the target high educational institution.

With the above-mentioned marks, we have made the formalization of participation quality evaluation in the joint preparation process of specialists.

1. The ratio of the number of students and Doctorate students of the participant higher educational institution of the scientific-research programs to the actual number of students and Doctorate students of the

target higher educational institution is calculated with the following formula:

$$K = \frac{NT_1 + MT_2}{S + U};$$

2. The ratio of the total professor-teachers went on the business trip from the target higher educational institution to the foreign higher educational institutions to the actual number of professor-teachers of the target higher educational institution is calculated with the formula:

$$L = \frac{\sum H^1 T_3}{H^2};$$

3. Quality evaluation function (P quantitative characteristic) is calculated with the formula:

$$P^1 = \frac{K}{\sum K_k}; \quad P^2 = \frac{L}{\sum L_k}; \quad P = \frac{P^1 + P^2}{2};$$

$$E^1 = \frac{eK}{\sum K_j}; \quad E^2 = \frac{eL}{\sum L_j}; \quad E = \frac{E^1 + E^2}{2}.$$

4. Evaluation analysis of function is proceeded in a following way:

- a. if $P > 1$, then the quality of the research higher educational institution is more than average level;
- b. if $E > 1$, then the participation quality of the research higher educational institution is more than the average indicator of last e year.

THE ALGORITHMIC SUPPORT OF RATIONAL DECISION MAKING PROCESSES OF ACADEMIC MOBILITY

Guram Chachanidze, Okan Eray

Georgian Technical University

guramchachanidze@yahoo.com, okaneray@hotmail.com

In the process of formulating academic mobility of students, during both – internal and external mobility, we have to deal with preparing enormous number of documents. As a rule, we are using excessive amounts of informational documents that are less structured during decision making process of academic mobility formulation. In external mobility, when students move from one educational institution

in one country to another institution in another country, various problems arise. One of the problems is that documents are not structured and are present in different formats and in different languages.

One of the major problems in the academic mobility planning is the process of formulating documents, during which credit system evaluation of educational programs and similarities and differences of competences in various higher education institutions are taking place. During this process we direct our attention to comparison of program contents and credits in order to choose educational discipline. Differences in document structure makes the process of document evaluation and decision making more complicated.

It must be highlighted that when we have structured documents in the processes of evaluation and decision, we might employ information technologies while we could not do so with non-structured documents. This report will focus on several issues concerning the development of informational systems assistance methods to make rational decisions during students' academic mobility. These issues affect different positions, such as:

- **Determination of educational discipline.** Subtracting those disciplines $-D_i$, that has been learned from a student in his/her own higher education institution from the total sum of disciplines $-D_j$, $D_j \subset D_i$, that are taught in host higher education institution. The quantitative comparison of credits and content of discipline occur after determining the discipline.
- **Choosing future educational discipline.** During the process of choosing, a student makes a comparison of competencies. Comparison happens by multiplying competencies of total sum of given disciplines $D_a^k \approx D_i^k$, where $-D_a^k$ is competency of subjects that are to be chosen, and is in accordance with product of disciplines chosen by host institution, " $\approx$ " is operation of comparing competencies.

Furthermore, another position in the algorithm to be discussed is: comparative analysis of competencies of educational programs at home and host higher education institutions; rational selection of disciplines and inputting it in corresponding document of academic mobility. All these help in rational decision making process during academic mobility.

FUNCTIONAL ANALYSIS AND EVALUATION OF SUBJECT'S POTENTIAL ABILITIES IN THE CONDITIONS OF UNCERTAINTIES

Guram Chachanidze, Ketevan Nanobashvili

Georgian Technical University,

David Aghmashenebeli University of Georgia

guramchachanidze@yahoo.com, qeti.nanobashvili@gmail.com

We have divided all the indicators of the educational credit system into two classes while describing the normative-classified model of education's quality; these are the potential indicators and efficiency indicators. This division is a conditional consent, and we do not have any object to demand it categorically.

In this work, we explain what function each of them has.

With the potential indicator, we mean the potential ability of a subject, it does not matter it is a human being, technical machine, program complex, educational-pedagogical technologies, etc. The most important point is that the subjects are acquired with their potential abilities for implementing their functional or performing activities.

The efficiency is determined, whether in fact, we implement those potential abilities in practice.

Here are given the marks:

W_i – i- subject's/object's potential abilities towards the scope of work, which is given with the following marks - $i = 1, 2, \dots, n$;

Z_i - i- subject's/object's efficiency according to the performed work, which is given with the same marks - $i = 1, 2, \dots, n$;

R_i -i – subject's/object's benefit according to the performed work, which is given with the same marks - $i = 1, 2, \dots, n$;

Then, the i- subject's/object's optimal profit formalulation is:

$$R_i = (W_i - Z_i) \Rightarrow \min$$

We have analyzed the given model.

It easy to understand that $W_i - Z_i$ gives us the i – subject's/object's useless, unused or left potential abilities; and as less distinction results higher R_i profit of i- subject/object. In the ideal condition, when $R_i = (W_i - Z_i) = 0$, the profit reaches to the maximum, or W_i potential ability of i- subject/object is completely used, which is practically impossible.

We should highlight the fact that these indicators create the uncertainties with their conditional character; for this reason, the result of decision-making is unknown.

In the thesis, on the basis of potential and efficiency indicators' classification, we analyze the main functions and their content of credit system of high education quality assurance according to the mentioned indicators and evaluation criteria. As a result of analysis, we define the deviation of actual data from normative or desired result, which gives us the possibility to make the relevant evaluation.

THE MODEL OF THE STOCHASTIC DYNAMIC OF THE INVESTMENT CASH FLOW

Kateryna Chechelnytska

Taras Shevchenko National University of Kyiv

kchechelnytska@gmail.com

We consider the stochastic model of the investment income is very important component of insurance and many others types of business. We assume that the moments of investment payments are the moments of the jumps of a 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 $g(s)$. The intervals of investments are independent exponential distributed with rate μ 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:

$$p(t) = \begin{pmatrix} p_1(t) \\ p_2(t) \end{pmatrix} = \sum_{k=1}^{\eta(t)} \xi_k I_k(t), \quad \text{where} \quad I_k(t) = \begin{pmatrix} ie^{\delta_1 t} + (1-i)e^{-\nu t} \\ je^{\delta_2 t} + (1-j)e^{-\nu t} \end{pmatrix}$$

with probability $p_{ij}(t)$, $i, j = 0, 1$,

$$p_{ij}(t) = e^{-(i\mu_1 + j\mu_2)t} \left(1 - e^{-\{(1-i)\mu_1 + (1-j)\mu_2\}t} \right), \quad i, j \neq 0,$$

$$p_{00}(t) = (1 - e^{-\mu_1 t})(1 - e^{-\mu_2 t}),$$

where $\eta(t)$ is a Poisson process with rate λ , δ 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:

$$\varphi(s, t) = Ee^{-\langle s, p(t) \rangle} = \exp \left\{ -\lambda \left(t - \sum_{i,j=0}^1 \int_0^t g(\langle s, I_1(t-u) \rangle) p_{ij}(t-u) du \right) \right\}$$

Reference

1. Hipp C., Plum. Optimal investment for insurance. Insurance, Mathematics, Economics, 2000, 27. - 215-222.

THE NETWORK MODELS WITH THE BIVARIATE SEMI-MARKOV INPUT FLOWS

Chechelnitski A., Kucherenko O.

Taras Shevchenko National University of Kyiv

che@unicyb.kiev.ua

Stochastic models whose input flows are depended arise naturally in different researches. We will consider two systems of the type $[SM/M/\infty]$ with a bivariate input flow customers $(v_1(t), v_2(t))$, where $v_i(t) = y_i(t) + y_3(t)$, and $y_i(t), i=1,2$ are independent Poisson processes with rate $\lambda_i, i=1,2$ and $y_3(t)$ 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.

$$n^{-1/2} (y_3(nt) - \beta nt) \rightarrow \sigma w(t), n \rightarrow \infty$$

For sequence of processes

$$\xi_n(t) = (\xi_n^1(t), \xi_n^2(t)), \quad n \geq 1, \quad t \in [0, T],$$

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

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

$\alpha_1 = (\lambda_1 + \beta) / \mu_1, \alpha_2 = (\lambda_2 + \beta) / \mu_2$, 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

$$(a_1(x), a_2(x)) = (-\mu_1 x, -\mu_2 x), \quad B = \begin{pmatrix} 2\lambda_1 + \sigma^2 + \beta & \sigma^2 \\ \sigma^2 & 2\lambda_2 + \sigma^2 + \beta \end{pmatrix}$$

References

1. Griffiths R.S. and Milne R.K. A class of bivariate Poisson process. I. Multivar. Anal., 1978, 8. – P. 380-396.

COMPUTING TECHNOLOGIES OF THE DISCRETE SINGULARITIES METHOD

Cherniy D.

Taras Shevchenko National University of Kyiv, Ukraine

D_Cherniy@ukr.net

We consider computational technology of the discrete singularities method in aerohydrodynamics. The problem relating to the approximation of continuous boundaries by the ordered discrete vortex system is discussed (*Fig.1, Fig.2.*)

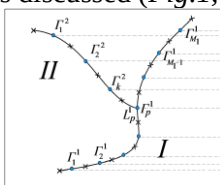


Fig.1.

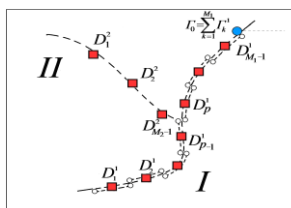


Fig.2.

$$\Phi(z) = \sum_{j=1}^{M_1} \frac{\Gamma_j^1}{2\pi i} \ln(z - \omega_j^1) + \sum_{j=1}^{M_2} \frac{\Gamma_j^2}{2\pi i} \ln(z - \omega_j^2) \quad \Phi(z) = \sum_{j=1}^{M_1-1} \frac{D_j^1}{2\pi i(z - \omega_j^1)} + \frac{\Gamma_0}{2\pi i} \ln(z - \omega_{M_1}^1) + \sum_{j=1}^{M_2-1} \frac{D_j^2}{2\pi i(z - \omega_j^2)}$$

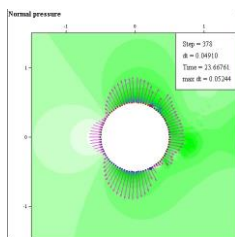


Fig.3.

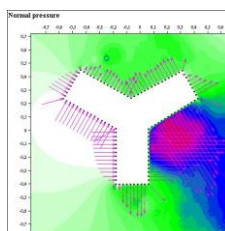


Fig.4.

Dynamic characteristics of flow depend on the time derivative (1).

$$c_p = 1 - \frac{(\nabla\phi)^2}{\bar{V}_\infty^2} - \frac{2}{\bar{V}_\infty^2} \frac{\partial\phi}{\partial t} \quad (1)$$

The transformation formulas (from *Fig.1* to *Fig.2.*) allow to calculate (1) dynamic characteristics for complex geometry designs in vortex flows (*Fig.3, Fig.4.*).

References

1. Dovgiy S.O., Lifanov I.K. The method of singular integral equations. Theory and Application. -Kiiv, "Naukova Dumka", 2004. – 510 p.
2. Cherniy D.I. On the problems of the definition of local and integral characteristics for solving initial value problems with moving boundaries. // Proceedings of the XIII International Symposium MDOZMF 2007, Kharkiv, Kherson, 2007. - P.315-318.

DECISION MAKING OF MODELING OF THE FREQUENCY SPECTRUM OF MAGNETOGRADIENT WAVES IN THE EQUATORIAL MAGNETOPAUSE IN THE CASE OF VARIABLE ELECTRIC CONDUCTIVITY OF THE SOLAR WIND PLASMA

Chkhitudidze M., Kereselidze Z., Dzhondzholidze N.

M.Nodia Institute of Geophysics,

I Javakhishvili State University of Tbilisi,

I.Gogebashvili State University of Telavi

**marina_chxitunidze@yahoo.com, z_kereselidze@yahoo.com,
nino.bej@gmail.com**

It is known that after a bow shock in front of the day-side of the magnetosphere, i.e. in the magnetosheath, the solar wind flow decelerates. Therefore, the solar wind an anomalous resistance develops, which causes an increase in the magnetic viscosity of the plasma. This effect is especially felt in the focal area of the magnetosheath (the stagnation zone before the magnetosphere) where, according to our discussion, unlike in the peripheral areas of the magnetosheath, the approximation of single-fluid magnetic hydrodynamics (MHD) is not correct. This is especially characteristic of the base of the stagnation zone, which is the central area of the Earth's magnetic boundary layer (the magnetopause). Thus, it will be correct to describe the large scale

motion of the solar wind plasma, having finite electric conductivity, with an equation system of double-fluid magnetic hydrodynamics. Generally, working out self-consistent analytical solutions to the magnetic and velocity fields, except in extremely simple cases, is impossible due to mathematical complications. However, there is a solution to this problem in the case of the flow around of the magnetosphere as due to violent deceleration of the solar wind. In the focal area of the magnetosheath it is possible to determine the flow topology in the kinematic approximation. Such a solution enables to solve the equation of the magnetic induction, constituent of the MHD equations system and corresponding to the magnetopause, by analytical approximation methods. Among different kinematic models, which include the solar wind deceleration effect near the critical point of the magnetosphere, Parker's plane (two dimensional) kinematic model for incompressible medium is especially simple [1]. This model and its spatial modification were effectively used in different tasks [2]. We made decision for obtaining the magnetosphere parameters in quasi-stationary approximation by means of different models of variations in time of the magnetic viscosity of the solar wind [3,4].

References

1. Parker E.N. Comments on the reconnection rate of magnetic fields // J. Plasma Physics, 1973, v.9. p.1. - P.49-63.
2. Pudovkin M.L., Semenov V.S. The reconnection theory and interaction of solar wind with the Earth's magnetosphere. Moscow, "Nauka", 1985. - 125 p. (in Russian).
3. Kereselidze Z., Kirtskhalia V., Chkhitunidze M., Kalandadze I. On Modeling of Magnetic Boundary Layer on the Dayside Magnetosphere. Georgian International Journal of Sci. and Tech., 2008, ISSN1939-5925, vol.1 №3. - P.249-256.
https://www.novapublishers.com/catalog/product_info.php?products_id=13354.
4. M. Chkhitunidze, N. Dzhondzoladze. The Magnetic Boundary Layer of the Earth as an Energy-supplying Channel for the Processes inside the Magnetosphere. J. Georgian Geophys. Soc., Issue (B), Phys. of Atmosphere, Ocean and Space Plasma, 2012, v.15. - P.95-108.

ABOUT DETERMINING AN OPTIMAL AMOUNT OF INSURANCE FEE IN CASE F-MODEL

Chornyy R., Kinash O.

Ivan Franko National University of Lviv, Ukraine

rostykchornyy@gmail.com

Let N - an amount of insurance contracts in our insurance portfolio, is a random variable. S_j - insurance amount and Y_j - claim amount of contract j . X_j - claim that calculated per 1 unit of insurance amount. We also consider that random variables X_j and S_j - independent that is a gist of F-model [1,p.248]. It is obvious that claim amount can be represented as : $Y_j = X_j * S_j$. We call factorized all the claim that satisfy previous condition. We also assume that insurance fee Z_j for every insurance contract defines as : $Z_j = z * S_j$, where z - some constant for all insurance contracts (insurance wager). We consider that all claims are factorized, random vectors (S_j, X_j) and random variable N are independent in total. Let the sum of fees collected from insurance portfolio equals $\bar{Z}$ and the sum of claims equals $\bar{Y}$. If initial capital equals u_0 then final insurance fund equals :

$$U = u_0 + \bar{Z} - \bar{Y} \quad (1)$$

It is considered for (1) an example of defining z_0 - a such low edge of z that let us achieve condition of “final bankruptcy”.

References

1. Korolev V.Y. Mathematical foundations of risk theory./ V.Y.Korolev, V.E.Bening, S.Y.Shorgin. – M.:Fizmatlit, 2011. – 620 p.

PROBLEMATIC ISSUES IN THE LEARNING PROCESS AND THE WAYS OF DEALING WITH THEM

Diasamidze M., Samnidze N.

Batumi Shota Rustaveli state University, Georgia

medea.diasamidze@yahoo.com

There are problems that the teachers have to face in the classes. One of them are the students of different levels- some with competent English, some whose English isn't very good, while others are starters.

These are the classes of mixed ability groups where individuals are at different levels. The teachers can cope with this problem if they know their students well; with forming different groups of students, working on the different tasks, they are treated differently by the teachers. For example one group can work on a piece of language study while the other group might be reading a story. We should encourage students to do different tasks depending on their abilities. Some teachers adopt a strategy of peer help and teaching so that the better students can help weaker students, they work in pairs or groups, but the main thing is that this should be done in a supportive and non judgmental manner.

In big classes it is difficult for the teacher to make contact with the students at the back. It is not possible to organise dynamic and creative teaching and learning sessions. Despite the problems of big classes, there are things which teachers can do. As for example: using worksheets for different tasks; using pair work and group work that maximise the students participation. Using chorus reaction, it is especially useful in lower levels.

Students prefer to use their own language in most situations, they often do so because they want to communicate in the best way they can, almost without thinking. If we want to activate their English they will not be helped if they talk in a different language instead. In order to avoid this problem teachers should make it clear by their behaviour that they want to hear English.

Working on homework is very good for students, more time they spent working with English the better they get at it. But students don't show special enthusiasm to work on it. Sometimes teachers don't show enough enthusiasm to mark the homework and students sense this. The students need to know that the effort they make in doing the tasks will be reciprocated by the teacher, students should be encouraged to correct the mistakes and correct each others homework.

These discussed issues are just the part of learning process that can be solved appropriately using appropriate teaching techniques.

THE LEARNING PROCESS AND COMPUTER TECHNOLOGIES

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

Batumi Shota Rustaveli state University, Georgia

ibraimd@mail.ru

The purpose of this paper is to analyze the role of computer technology in the management of learning process.

The usage of computer technology provides the learners with deep understanding of the material. It also enhances their interest in solving the tasks of any complexity independently. It helps the searching process of solving rational algorithm realizing the problematic tasks and speeds up the process of problem solving.

Despite the fact that computer technology is actively used in learning process we always have to bear in mind that this is the means of modern didactic aids only.

In traditional learning process a teacher was a lead figure, whereas, in modern computer technology classes and auditoriums teachers have the role of facilitator. Moreover, the teacher has already appeared as a specialist with deep knowledge of multimedia resources of certain subjects.

In teacher-student relationship the teacher was the main source of information transmission. However, completely different picture is seen in the educational process carried out with the help of modern computer technology. The main feature that distinguishes this process from the traditional one is the opportunity which allows effective dialogue between man and machine through interactive application.

The usage of computer learning systems through interactive learning programs gives the opportunity to obtain the primary information and helps those with proper competencies significantly to acquire the subject of any of these issues.

Nowadays, students can get consultations independently using different sources of getting information under the unlimited conditions of time and space, which also increases the motivation of cognitive learning activities and shapes its creative nature.

Modern computer systems should facilitate the study of solid knowledge and logical thinking.

Proper attention should be paid to specific features of a particular task while creating computer programs. It is necessary to take student / pupil intellectual capacity into consideration as well.

ON THE ISSUES OF COGNITIVE BIASES OF DECISION MAKING IN DATA-DRIVEN SCIENCE

Didmanidze I., Bagrationi I.

Batumi Shota Rustaveli State University, Georgia

ibraimd@mail.ru irmabag@yahoo.com

The present scientific report deals with the basic aspects of cognitive biases of decision making in Information Science which primarily concerned with the analysis, collection, manipulation, storage, movement, dissemination and protection of information. Here it needs to be noticed, that Information Science incorporates not only aspects of computer science, but often diverse fields such as cognitive science and social sciences.

The report points, that we know, the scientific community has witnessed increased interest in data-driven decision making - making it a mantra of scientists from the institution to the lecture-room. Data-driven decision making in higher education refers to lectures, principals, and administrators systematically collecting and analyzing various types of data, including input, process, outcome and satisfaction data, to guide a range of decisions to help improve the success of students.

The report seeks to clarify the ways in which multiple types of data are being used in organization by synthesizing findings from recent research conducted by the High Education Corporation. Unlike past studies of data use in universities, this report brings together information systematically gathered from large, representative samples of scientists at the lecture-room levels in a variety of contexts. The report further provides a comprehensive examination of the many facets of current data-driven decision making policies and practices and suggests a research agenda to advance the field.

The general part of the report is divided into four sections. Section one describes what is meant by data-driven decision making, including its origins, a theoretical framework for thinking about its implementation in Information Science, and a brief overview of existing literature. Section two draws on crosscutting findings to answer four fundamental questions about data-driven decision making. The final two sections present emerging policy implications and suggested direction for future research.

The report emphasises, that notions of data-driven decision making in Data-driven Science are modeled on successful practices from

information industry, such as Cybernetic Technology Management, Organizational Learning and Continuous Improvement, which emphasize that organizational improvement is enhanced by responsiveness to various types of data, including input data such as software product costs, process data such as production techniques, outcome data such as automation and autothreal, and satisfaction data including technical and mechanical opinions.

As we see from the report, cognitive biases usually creep into decision-making processes. There are commonly debated questions about biases of decision-making in remainder of the work:

Cognitive inertia is unwillingness to change existing thought patterns in the face of new circumstances.

Selective perception: scientists actively screen out information that they do not think is important. In one demonstration of this effect, discounting of arguments with which one disagrees was decreased by selective activation of right prefrontal cortex [3].

Wishful thinking is a tendency to want to see things in a certain - usually positive - light, which can distort perception and thinking [3].

Choice-supportive bias occurs when scientists distort their memories of chosen and rejected options to make the chosen options seem more attractive [3].

Recency: scientists tend to place more attention on more recent information and either ignore or forget more distant information. The opposite effect in the first set of data or other information is termed primacy effect [3].

Repetition bias is a willingness to believe what one has been told most often and by the greatest number of different sources [4].

Anchoring and adjustment: Decisions are unduly influenced by initial information that shapes our view of subsequent information [4].

Role fulfillment is a tendency to conform to others' decision-making expectations [4].

Underestimating uncertainty and the illusion of control: scientists tend to underestimate future uncertainty because of a tendency to believe they have more control over events than they really do [4].

Reference class forecasting was developed to eliminate or reduce cognitive biases in decision-making [4].

The report discusses the point of view of American Economist, Professor of the University of Pennsylvania, forecasting and marketing expert Jon Scott Armstrong, who writes: "data-driven decision making acknowledges that the presence of raw data does not ensure its use.

Rather, once collected, raw data must be organized and combined with an understanding of the situation through a process of analysis and summarization to yield information. Information becomes actionable knowledge when data users synthesize the information, apply their judgment to prioritize it, and weigh the relative merits of possible solutions” [1]. At this point, actionable knowledge can inform different types of decisions that might include. These decisions generally fall into two categories: decisions that entail using data to inform, identify, or clarify and those that entail using data to act. Once the decision to act has been made, new data can be collected to begin assessing the effectiveness of those actions, leading to a continuous cycle of collection, organization, and synthesis of data in support of decision making.

The report outlines the worldview thinking of a Professor of the University of Pennsylvania, in the science of decision-making Jonathan Miller Baron, who points out, that “data-driven decision making must be understood within a larger context. First, the types of data that are collected, analyses that are performed, and decisions that are made will vary across levels of the educational system: the classroom, school, and district. Second, conditions at all of these levels are likely to influence the nature of the data-driven decision making process. For example, at a particular level of the system, the accuracy and accessibility of data and the technical support or training can affect educators’ ability to turn data into valid information and actionable knowledge. Without the availability of high-quality data and perhaps technical assistance, data may become misinformation or lead to invalid inferences” [2].

The authors conclude that the work addresses four fundamental questions: What types of data are scientists and researches using? How are scientists and researches using these data? What kinds of support are available to help with data use? What factors influence the use of data for decision making? To answer these questions the authors relied on results from surveys, observations and reviews of documents collected by the academic practice.

References

1. Armstrong, Jon Scott, Role Playing: a Method to Forecast Decisions // Principles of Forecasting: a Handbook for Researchers and Practitioners, International Series in “Operations Research & Management Science”, Boston, “Kluwer Academic Publishers”, 2001. - 272 p. (In English).

2. Baron, Miller Jonathan; Thinking and Deciding, 4th Edition, Cambridge-shire, "Cambridge University Press", 2007. - 281 p.
3. Monahan George, Management decision making: spreadsheet modeling, analysis, and application, New York, "New York City Press", 2000. – 314 p. (In English).
4. Naqvi, Nasir; Shiv, Baba; Bechara, Antoine, The role of Emotion in Decision Making: a Cognitive Course in Decision Making, Journal "Current Directions in Psychological Science", №9 (October), Vienna, Published by "Sage", 2006. - 140 p. (In English).

SUPPORTING AUTOMATION SYSTEM OF WIRELESS NETWORK SECURITY

Didmanidze I., Beridze Z.

Batumi Shota Rustaveli state University, Georgia

ibraimd@mail.ru

The elaboration of the main tasks for the Automation System begins with the examination of data manual procedures in order to generalize and investigate the difficulties encountered by customers. Initially, a general analysis of existing management procedures is held, and thereafter an each task of the management, which should be automatized, is examined separately.

The quality of service and security in wireless networks has become an object of active and important researches, that is caused by an increasing demand for data transfer packages support. Without an adequate security the organizations avoid to use wireless networks. The security issues in wireless networks represent a major obstacle for a widely adaptation of such 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 objective of the given work is to develop a series of activities, which would increase the safety of wireless networks; that would allow, in its turn, to provide a remote workplace management.

As it is seen from the above mentioned goals the research focuses on the solution of the following issues:

- the growth of the security of information packages routing in wireless networks;
- the strengthening of encryption and authentication mechanisms;

- the analysis of different communication canals in wireless networks and the development of new methods for security enhancement;
- the administration of distant workplaces (local or regional offices) and their management by means of wireless networks;
- the administration and remote control of hardware device options, used in the system;

After the above mentioned procedures and activities there would be developed a program complex of the automation system and its structure. There would be established classes, constructors, procedures, functions and methods of the program complex.

INFORMATION AND COMMUNICATION TECHNOLOGIES AND FOREIGN LANGUAGE TEACHING

Didmanidze I., Gorjeladze J.

Batumi Shota Rustaveli State University, Georgia

ibraimd@mail.ru

Foreign language learning is impossible without information and communication technologies (ITC). The need for approximation of the educational environment to the real conditions of the target language and culture functioning is certainly one of the actual tasks of foreign language teaching methodology.

The recent requirements for education, the main part of which is students' independent work, force a high school to use effective and useful teaching methods and forms of work organization, which develop the ability to learn, to find the necessary information, to use different information sources and develop cognitive independence of students. Modern pedagogical science tends to use the new technologies in education.

In foreign language teaching ICT can be used at a lesson in different ways: frontally (computer + projector + interactive board), in micro groups (computer class, by students individually (single computer), for homework (computer).

The majority of the wide variety of interactive educational programs in foreign language learning is aimed at the independent elaboration of phonetic and grammatical aspects and bringing them to the automatism in usage. The peculiarities of such programs are interactive dialogues, systems of speech recognition and pronunciation visualization, animated videos that demonstrate the articulation of sounds, exercises for the development of all types of language skills, videos with translation, monitoring the own learning outcomes.

Since the purpose of foreign language teaching is a communicative activity of students, i.e. a practical language acquisition, a teacher's task is to strengthen the performance of each student in the educational process, to create a situation for their creative activity. The use of modern tools, such as information programs and Internet-technologies, as well as cooperative learning and project methodology, allow us to solve these problems.

All the above mentioned tasks are the focus of our attention in the given work.

DISCRETE MODEL OF THE NEURAL NETWORK

Didmanidze I.Sh., Kakhiani G.A., Didmanidze D.Z., Donadze M.V.

Batumi Shota Rustaveli State University

ibraimd@mail.ru

Our Paper deals with a neural network which consists of “ n ” neurons. Let's characterize a condition of the “ i ”- th neuron by $x_i(t)$, $i = \overline{1, n}$ function, which dynamics is described by the following system of differential equations.

$$x_i'(t) = h_i(x(t)) + \sum_{j=1}^n [w_{ij}^0 + w_{ij}(t)] g_j(x(t)), i = \overline{1, n} \quad (1)$$

Given there $h_i(x)$, $g_j(x)$ are continuously differentiable functions with $\mathbb{R}^n$, $x(t)$ is a continuous function, w_{ij}^0 and $w_{ij}(t)$ are weight coefficients, characterizing the impact of “ i ”- th neuron on “ j ”-th neuron in the initial conditions of $x_i(0) = a_i, i = \overline{1, n}$.

(1) The system of differential equations can be written in the following vector form:

$$x_i'(t) = h(x(t)) + (W_0 + W(t))g(x(t)) \quad (2)$$

with the following conditions:

$$x(0) = a \quad (3)$$

Here $a = (a_1, a_2, \dots, a_n)$; W_0 is a constant $n \times n$ matrix, which consists of w_{ij}^0 elements; $W(t) = w_{ij}(t)$ is a matrix of $n \times n$ dimension, consisting of the weight coefficients, which lately will be considered as management functions and which can be extended to the following restrictions: $w_{ij}(t) \leq A_{ij}, i, j = \overline{1, n}$. Let's select the optimal values of the neural network weight coefficients from the condition of a target function (4) minimum:

$$J(w(\cdot)) = \Phi(x(T)) + \int_0^T \left[Q(x(t)) + \frac{1}{2} \sum_{i,j=1}^n r_{ij} w_{ij}^2(t) \right] dt \quad (4)$$

In the given model the process time $T > 0$ is fixed, $Q(x)$ and $\Phi(x)$ are the scalar continuously differentiable functions, while $r_{ij} \geq 0, i, j = \overline{1, n}$ coefficients produce a positive symmetrical R-matrix.

The task of the artificial neural network optimal control is to select such $w_{i,j}(t), i, j = \overline{1, n}$ weight coefficients which would help an expression (4) to obtain a minimum value. This task belongs to the class of optimal control problems. Let's discuss what weight coefficients can be used from the theorem of optimality necessary conditions as management functions.

The Paper analyzes the neural network, which consists of n neurons. We have substantiated the optimal control task of the artificial neural network.

The work deals with the discrete model of the neural network

CONCEPTUAL MODEL OF PROGNOSIS

¹Didmanidze I., ²Motskobili I.

¹Batumi Shota Rustaveli state University, Georgia

²Batumi state maritime Academy, Georgia

ibraimd@mail.ru

Studying and farther systematization of labour market takes major part of the following problem during the searching conception. On the basis of factual analysis of the requiring specialists in the labour market, arises prognosis goals, which are organically connected with the educational politics of the country.

It's clear that the age of informational technologies significantly changed existing methods and therefore today's reality requires to look through and change existing methods and skills. They must be relevant to the laws of market and economic rules and arising the prognoses of requirement of qualified personnel must be adapted to the educational system.

It's natural to arise the question, how and in which conditions must be implemented creation of rational and effective structure for preparing specialists of higher education. The answer to the question is one of the main factor of creating conceptual model of prognosis of specialists' requirement and supplying.

Prognosis process must be carried out before creating intensive forms of perspective plan in growing professional personnel. As a result

of the prognosis of different branches of the economic development of the region must be studied, main factors which influence on it, which creates basis for taking controlling decision. On the basis of different branches of economic development of the region and influence factors it must be worked out economic conception politics of the region development. Accordingly the problem of implementing this politics of prognosis of supplying with high qualified specialists will be settled.

It's impossible to plan effective perspectives of the region development, because these perspectives outcomes from the proportion of temps of the region development.

Therefore, concrete hypothesis of connection characteristics, relationships and appropriateness give us opportunity to use significantly different from one another methods.

ALGORITHM DEVELOPMENT BY SUB-ALGORITHMS

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

Batumi Shota Rustaveli state University, Georgia

Batumi state maritime Academy, Georgia

ibraimd@mail.ru

Actually, a solution of any task with sufficient complexity can be presented by a combination of sub-algorithms. During the program writing the sub-algorithms form the sequence from separate constituents of the whole algorithm, which follow one another (of course, in the case of relevant condition satisfaction).

In order to decompose the algorithm into sub-algorithms we use the so-called Atom method, which has been successfully used as a method of discrete mathematics in the field of informatics (and not only informatics) for the solution of various tasks.

The essence of the Atom method can be expressed in the following way:

There is given the fields set $A = \{ a_i, i = 1, 2, \dots, n \}$ and it is also known the compilation of the requirements for the field subsets $R = \{ r_j, j = 1, 2, \dots, m \}$, where $r_j \subseteq A$.

It is required to divide set A into sub-sets of fields with no common elements, each of which is called an atom; such a sub-set is developed into fields according to a request or is not expanded at all.

The above described method of discrete mathematics may be used for solution of various tasks.

Each program, entering into the given program complex, uses a certain sub-set from the algorithm set. At the same time, the result of an

algorithm performance can be used, if necessary, by the other programs entering the complex.

Because of some reasons, it is necessary to group the sub-sets, obtained by using the atom method, in a certain way.

By means of atoms the requirement of each program complex, during the transformation into algorithm sub-sets, can be presented by various atom combinations already of the obtained algorithms (sub-algorithms).

The results of the atom performance can be used by the other program (programs). So, at first glance, we are dealing with the most optimal performance of the program complex in terms of memory and time spending. However, some certain “deviations” from the general rules always happen during the task raising-solving in a real situation.

MATHEMATICAL MODEL TO OPTIMIZE LOADING- UNLOADING OPERATIONS ON THE VESSEL

Didmanidze I.Sh, Tsitskishvili G.D.

Batumi Shota Rustaveli state University, Georgia

Batumi state maritime Academy, Georgia

ibraimd@mail.ru

During the transportation for the selection of a route there are a few options to be chosen, as it's impossible to run a different route for the same maritime transport means. Besides, we choose one optimal option to optimize loading-unloading operations on the vessel from different schemes, as in this case, it's also impossible to implement several schemes simultaneously.

Let us note that we might not have majority of alternatives at the first stage, where we should choose. Obviously, firstly we should create variety of options, where we can choose. Exactly this is the first stage of problem solution, which is called “formation of variety of alternatives”.

Certainly, variety of alternatives doesn't have any structure; it's so called nonstructural and each element is retrieved or offered by chance and it hasn't been discussed and it's not sorted by priority. Coming out of this, we can conclude which alternative is better and which is less preferred. If we want to solve the task concerning choosing the variety of alternatives, we should structure mentioned alternatives in any way.

We intend to choose preferred option from the variety of alternatives (in our case from different options of loading-unloading operations on the vessel); to take the best (optional) decision.

Classification in this case is the bases, as choosing is based on selection of certain class, to which alternative could be addressed. Stratification and ranging gives us wide range of choices to make reasonable selection, to take decision which will be optional for the time being and circumstance. These methods could be used with the equal strength for taking decision to manage current processes in any subject area.

Selection of optimal option to optimize loading-unloading operations of the vessel should be done form the variety of alternatives which are received by using any kind of methods. In my opinion method of linear and integer programing is the best option for this case.

The appropriate mathematical model is described in the paper according to the considerations above.

SCIENTIFIC-INNOVATIVE METHODS OF DECISION MAKING IN THE TEACHING PROCESS

Caner Dincher

Tunceli University, Turkey

canerdincer@tunceli.edu.tr

Scientific-innovative methods of decision making in the teaching-learning process enhances the quality of knowledge obtained by teachers and raises the level of their competences and professional development.

Scientific-innovative methods of decision making should meet the requirements of changes and challenges that take place within the integrated European Educational System; should determine professional requirements of academic personnel and educational requirements for students; enhance professional development, provide effective and transparent monitoring and assessment system of the teaching process.

Scientific-innovative methods of decision making must be utilized in order to detect powerful and weak sides of teachers, as well as of students and in case of need, maximum support should be given in terms of eliminating weaker points.

The main function of Scientific-innovative methods of teaching is creating ground for attitude and readiness in learners, creating motivational factors and realization of benefits and outcomes of obtained knowledge. These methods should include factors of detection and empowerment of teaching-learning processes that should be based on modern educational technologies, scientific and innovative fundamentals, as the basis for its development and effectiveness.

We already have enough examples of usage of Scientific-innovative methods and tools in teaching process. These are existing software programs; educational games; smart boards and alike. All these tools, as emotion-genic factors and means of visual perception, play an important role in learning process, activates learners mind, develops ability of overcoming learning difficulties, provides an opportunity for reveling ones intellectual abilities and feel satisfaction with achieved results.

As some educational programs are of a „virtual” character and are as realistic as possible, learners do better understand the actual content that is to be learned. In addition to that, by the help of a „virtual contructor“ learner conducts different experiments independently, analyses obtained results and draws relevant conclusions by exploration and research.

Despite of the above mentioned, based on analysis done by us, it turned out that after some time learners/students adapt to the above mentioned technologies, some kind of integration takes place and they start losing interest in those technologies and methods.

The main objective in utilizing of scientific-innovative methods in the teaching/learning process is examining and presenting the above mentioned problem from the new perspective.

In the given presentation we basically focus on the essence of scientific-innovative methods of decision making: how to make learning material interesting for learners; what content should the learning material have in order to help them acquire all the necessary skills and competences; how to create an educational process so that it is in accordance with the intellectual capacities of the current generation which is fully integrated with the modern technologies.

OBJECTS AS STRUCTURE: MATHEMATICS AND APPLICATIONS, HEURISTICS

Donchenko V.S.

Taras Shevchenko National University of Kyiv, Ukraine

voldon@bigmir.net

The objects of investigation in Mathematics after Georg Cantor are the mathematical structures: the sets plus “ties”, “links”, “relations”, - between its elements. Thus, the use 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: comment about the principal feature that distinguishes the fundamental mathematics of applied mathematics. Such fundamental feature is necessarily the presence in applied mathematics possibility of establishing correspondences between "elements" and "relations" in objects and "components" and "relations" in mathematics. This conformity is called the interpretation.

So, the question of critical importance in math modeling is which math objects represents “parts” and which - “ties” ones. The “parts” are considered to be “representatives” of the object under modelling. These “representatives” should be chosen in such a way that variety of math structuring means were sufficient to convey the object structure. Standard interpretations are 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 math este, lish 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). As a rule, corresponded admissible statements have the form of equations with the formulas in both its sides. So, each next statement in the sequence-proof of the terminal statement is produced by previous member of sequence (equation) by changing some part of formulas in left or right it side on another: from another side of equations-axioms or equations premises. 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. “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. Examples of this method include using a "rule of thumb", an educated

guess, an intuitive judgment, or common sense”. We mention opportunely the authors of the “heuristic” from Polya [6] through A.Newell&J.C. Shaw& H.A.Simon [5] to D. Kahneman [7].

References

1. Донченко В.С. Неопределённость и математические структуры в прикладных исследованиях (Uncertainty and math structures in applied investigations). Human aspects of Artificial Intelligence International Book Series Information science & Computing.– Number 12.– Supplement to International Journal “Information technologies and Knowledge”. –Vol.3.– 2009. – P. 9-18.
2. Donchenko V. Conditional distributions and Fuzzy sets // Bulletin of Kiev University. Series: Physics and Mathematics. - 1998. - №3.
3. Donchenko V. Probability and Fuzzy sets // Bulletin of Kiev University. Series: Physics and Mathematics. - 1998. - №4.
4. [Electronic resource] -Wikipedia: <http://en.wikipedia.org/wiki/Heuristic>
5. Newell A., Shaw J. C., Simon H. A. Empirical Explorations of the Logic Theory Machine: A Case Study in Heuristic. // J. Symbolic Logic. - 1962. – Vol. 27, Issue 1.- P. 102-103.
6. Polya G. How To Solve It: A New Aspect of Mathematical Method.- Princeton, NJ: Princeton University Press. - 1945.-ISBN 0-691-02356-5 ISBN 0-691-08097-6
7. Kahneman D.// https://en.wikipedia.org/wiki/Daniel_Kahneman.

MATRIX MULTIPLE REGRESSION WITH EXAMPLE OF IT’S APPLICATION ON ECONOMICS INDEXES

Donchenko V., Tarasova O.

Taras Shevchenko National University of Kyiv, Ukraine

voldon@unicyb.kiev.ua, olga_ta@bigmir.net

The class of matrix functions with set matrix arguments (matrix multiple regression) is proposed for formulation and successive solution of prediction problem on the base of Least Square Method (LSM).

Singular Value Decomposition (SVD) and Moore-Penrose pseudo inverse technique [1-3] has been developed within the framework of the concept of cortege operators in order to provide constructive applying of LSM in the proposed case of matrix multiple regressions. Also, algorithm of parameter estimation was proposed, as well as it its application was demonstrated on empirical data. Conception of cortege operators (CoOp’s techniques) make it possible to extent in constructive way correspondent methods on matrixes Euclidean spaces.

This work represents the results of implementing CoOp-conception for row-matrixes corteges of column matrixes corteges. These results are the foundation of matrix multiple regression theory also represented below, as well as the results of applications of the theory for prediction and forecast in TV-viewing and consumer price index. In this example TV media is viewed as the business and the part of the Ukrainian economy. Results of prediction of consumer price index and TotalTV rating index show necessary level of accuracy.

References

1. Moore E.H. On the reciprocal of the general algebraic matrix, Bulletin of the American Mathematical Society. - 1920. - №26. - P.394-395.
2. Penrose R. A generalized inverse for matrices, Proceedings of the Cambridge Philosophical Society. – 1955. - №51. - P.406-413.
3. Albert A.E. Regression and the Moore-Penrose pseudoinverse. - Academic Press, 1972. - 180 p.

MATRIX CORTEGES AND CORTEGE OPERATORS IN GROUPING INFORMATION PROBLEM FOR MATRICES

Donchenko V., Zinko T.

Taras Shevchenko National University of Kyiv, Ukraine

voldon@bigmir.net

Using the Euclidean spaces of R^n in applications is determined on the one hand – by the richness of ties within these spaces: operations, inner product, norm, distance – and by the variety of constructive means in operating in such structures on the other. Linear subspaces and hyper planes (shifted subspace) are fundamental linear multitude structures within R^n . Another fundamental structures of multitude type are, for example, ellipsoids or ellipsoidal cylinders. Single type structures correspond to these multitude ones are appropriate matrices: of linear operators or quadratic forms. Thus two type structures are in use in Euclidean spaces R^n : multitude and single-type ones. And vice versa, matrix of linear operator, for example, naturally generates two subspaces: operator range and operator core. Another example of the multitude structures is set of all solutions or pseudo solutions for system of linear equations (SLE). This type structure is hyper plains. Also ellipsoidal cylinders and matrices being multitude structures have single type structure: matrix, which them uniquely defines. Efficiency and constructive using of these basic structures are largely determined by the means of handling them, in particular, the possibility of transition from

single to multitude type and vice versa. These opportunities are implemented through SVD and Moore-Penrose Pseudo Inverse (PdI). The comprehensive solution of SLE can be represented through the using of these facilities in particular. SVD and PdI are the base of constructing the orthogonal projectors on the subspaces and hyper planes which are generated by the sets of vectors: to construct single type structure by multitude ones. Note that in applications such collection sets of vectors are learning samples. Thus, such transition implements the possibility of effective calculating the distances from multitude entities (subspaces, hyper planes) produced by the sets collections of vectors. Similarly, SVD and PdI realize opportunities for effective description of matrix of quadratic forms to define ellipsoids "covering" a specified set of vectors optimally in some way. The above link between multitude and single type structures, provides opportunities of constructive description for first ones. This property is crucial for meaningful descriptions including the class of problem, which can be denoted by the term "Grouping Information Problem" (GIP). GIP are a class of the problems consisting of function fitting and classification-clusterization problem.

However GIP-problems are important not only when the objects under grouping are vectors: feature vectors. A typical example of GIP-problems with non vector representatives is the problem of audio signals recognizing. Matrices of spectrograms are such representatives in this case as well as the matrices are the such ones in an image processing. Using of matrix objects as "generalized feature vectors" is constrained by underdevelopment of operating techniques in the matrix Euclidean spaces. Thus the development of such technology for matrix objects is the urgent and important problem for applications. This problem can be solved by designing and investigating the special class of linear operators: so called "cortege" operators for matrixes corteges (see., e.g, the paper of authors [1]). The level of computing complexity for matrixes Euclidean spaces under approach proposed does not exceed the counterparts for R^n .

References

1. Донченко В.С., Зінько Т.П., Скотаренко Ф.М. Концепція кортежності для лінійних операторів та її реалізація для матричних кортежів // Журнал обчислювальної та прикладної математики: Серія "Прикладна математика". - 2015. - №3. - С. 127–140.
2. Donchenko V., Zinko T., Skotarenko F. "Feature vectors" in grouping information problem in applied mathematics: vectors and matrixes //

MAJORANT ESTIMATES CONVERGENCE THE SOLUTIONS of NONLINEAR SYSTEMS

¹Dzhalladova I., ²Kamratov S., ²Khusainov D.

¹Vadym Hetman National Economic University of Kyiv, Ukraine

²Taras Shevchenko National University of Kyiv, Ukraine

idzhalladova@gmail.com, khusainov.d.y.@gmail.com

One of the main requirements for the mathematical models of dynamic systems is studied of trajectories stability. At the same time, the establishment of single fact sustainability often is not enough. For example, the solution of a linear system of two differential equations

$$\dot{x} = -x + \alpha y, \quad \dot{y} = -y$$

is always stable for an arbitrary value of the parameter α . However, depending on the parameter, solutions can "make very strong emissions", is not always acceptable in application problems. Thus, the study of systems is important not so much the finding of a sustainable, how to obtain quantitative estimates of stability, in particular, to obtain estimates of convergence solutions to the equilibrium position.

One of the universal methods of investigation of dynamic systems is the second Lyapunov method. Estimates of convergence solutions for linear time-invariant systems

$$\dot{x} = Ax \tag{1}$$

can be obtained using the method of Lyapunov quadratic functions [1]. The Lyapunov function is taken as a quadratic form $V(x) = x^T H x$, where H - the symmetric positive definite matrix is a solution of the Lyapunov equation

$$A^T H + H A = -C.$$

With Lyapunov function for arbitrary solution $x(t)$ of system (1) next estimation

$$|x(t)| \leq |x(0)| \varphi(H) \exp \left\{ -\frac{\lambda_{\min}(C)}{2\lambda_{\max}(H)} t \right\}, \quad \varphi(H) = \sqrt{\frac{\lambda_{\max}(H)}{\lambda_{\min}(H)}}$$

is received.

Consider a system with quadratic right-hand side, rewriting "in the universal vector-matrix form"

$$\dot{x}(t) = Ax(t) + X^T(t)Bx(t). \quad (2)$$

The guaranteed stability regions of the zero equilibrium position is inside of a Lyapunov function of the level surface $V(x) = r > 0$ and lying within the region

$$G_0 = \{x \in R^n : C - B^T XH - HX^T B > \Theta\},$$

where under the expressions

$$C - B^T XH - HX^T B > \Theta$$

we denote a positive definite matrix.

We have the following result.

Theorem. Let the matrix of the linear part of the system (2) is asymptotically stable. Then the zero solution of the system is asymptotically stable and its solution satisfying the initial conditions

$$|x(0)| < \frac{\gamma(H)}{2|B|\varphi(H)}, \quad \varphi(H) = \frac{\lambda_{\max}(H)}{\lambda_{\min}(H)}, \quad \gamma(H) = \frac{\lambda_{\min}(C)}{\lambda_{\max}(H)},$$

we have the following convergence estimate

$$|x(t)| \leq \frac{\gamma(H)\sqrt{\lambda_{\min}(H)}|x(0)|}{\left[\gamma(H) - 2|B|\varphi(H)|x(0)|\right]e^{\frac{1}{2}\gamma(H)t} + 2|B|\varphi(H)|x(0)|}.$$

In future research, we consider systems in the next form

$$\dot{x} = Ax + R(x), \quad |R(x)| \leq N \|x\|^\alpha, \quad \alpha > 1.$$

We get a guaranteed estimate of the range of stability of the zero equilibrium position and majorant estimation of the convergence of solutions in this area. We consider stochastic systems and we can using reserve estimates for researching the hysteresis of unemployment on Ukrainian labour market in crisis conditions.

Reference

1. Dzhalladova I.A, D.Y Khusainov. Quadratic system with delay // Problems of control and informatics. - 2013. - №1. - P.5-13.

SUPPORTING DECISION MAKING IN ACADEMIC STUDENT MOBILITY PROCESS WITH INFORMATION SYSTEMS

Okan Eray

Georgian Technical University, Georgia

okaneray@hotmail.com

This report encompasses the issues related to managerial task of students' academic mobility, along with the information systems support realized by object oriented local database. Besides, information enquiry occurs through a common information medium.

In the traditional client-server applied tasks, during the formation of the database, problems occur in the condition of several databases combination due to data search inadequacy which also means acquired data is not always appropriate as demanded. In most cases, there are duplicated, useless or redundant data.

In this case, to ensure information systems support, following tasks have to be solved:

- ❖ Preparing of standardized database,
- ❖ Standardization of the data that is placed in the different database,
- ❖ Placement of the received standardized data in the standardized data field,
- ❖ Ensuring of the enquiring information in the standardized data field,
- ❖ Inform users in its acceptable form.

For solving these tasks is necessary:

- Construction of a knowledge base;
- Obtain of the user's requested information from other databases;
- Connection of the new databases;
- Outputting of the information in the user's acceptable form.

It has to be mentioned that the data integration in the semantic level gives the chance of standardization of the data that is placed in different databases. Enquiring of the information occurs by using the system of the logical resolutions.

At that time, standardization of the data takes place by combination of different databases' ontologies and then by construction of common ontologies.

The information transmission to the user occurs with an interface on using client program that is connected with agents' managerial system. Program complex enables users to receive necessary, complete and actual information for them.

Standardization of the data in the united information systems space is guaranteed by standardization of different ontologies in a global ontology.

Enquiring of the information is ensured by logical resolutions' system. Data delivery for users' is ensured by client program that is connected with an agent managerial system.

It has to be mentioned that data standardization by ontology is really simple and always implementable mechanism. There is no threat of losing existing information in the global ontology.

This is conditioned by the distributed and saved information with the agent programs. Global ontology characterizes high cooperativeness of updating information, since that it is not necessary for agents to synchronize with parent database. During enquiring time on the using the logical resolutions it is easy to enquire data. Unique thing that we could consider as a defect of the ontology is the using much time for the enquiring. This is compensated by other positive characteristics.

In this report, Global Ontology is discussed regarding the model of making information support system of standardized data space to make decision of managing students' mobility.

THE LINEAR DEGENERATE ELLIPTIC-PARABOLIC EQUATIONS

Tahir Gadjiev, Soltan Aliev, Rafiq Rasulov

Institute Mathematics and Mechanics, Baku, Azerbaijan

tgadjiev@mail.az

In the work boundary value problem for second order linear degenerate elliptic-parabolic equations is considered. The apriori estimates and solvability of boundary-value problem are established.

Let Ω be a bounded set in R^n , $Q_T = \Omega \times (0, T)$.

$$\sum_{i,j=1}^n a_{ij}(x,t) u_{x_i x_j} + \varphi(x,t) u_u^2 + c(x,t) u = 0 \quad (1)$$

$$u(x,t)|_{\Gamma(Q_T)} = f(x,t), \quad (x,t) \in \Gamma(Q_T) \quad (2)$$

where $\Gamma(Q_T)$ -parabolic boundary, $\varphi(t,x)$ -weighted functions. We introduce weighted space $W_{2,\varphi}^{2,2}(Q_T)$ and generalized solution from this space is considered.

Theorem. Let some conditions related of coefficients and weighted function is satisfied. Then there exists unique strong solution of problem (1), (2) from space $W_{2,\varphi}^{2,2}(Q_T)$.

SOLVABILITY OF BOUNDARY PROBLEM FOR NONLINEAR DEGENERATE ELLIPTIC EQUATIONS.

Tahir Gadjev, Gunel Gasanova, Mehriban Kerimova
Institute Mathematics and Mechanics, Baku, Azerbaijan
tgadjev@mail.az

Solvability of boundary problem for nonlinear degenerate elliptic equations is established. Before we some apriori estimates for generalized solutions is obtained.

Let Ω be a bounded set in R^n , $Q_T = \Omega \times (0, T)$, $\partial\Omega \in C^{1,\alpha}$, $0 < \alpha < 1$. We consider the initial boundary value problem

$$\frac{\partial u}{\partial t} - \sum_{i,j=1}^n \frac{\partial}{\partial x_i} \left(a_{ij}(x, t, u) \frac{\partial u}{\partial x_j} \right) - \psi(x, t) \frac{\partial^2 u}{\partial t^2} + c(x, t)u = 0, \quad (1)$$

$$u(x, t)|_{\Gamma(Q_T)} = f(x, t), \quad (x, t) \in \Gamma(Q_T), \quad (2)$$

where $\Gamma(Q_T)$ -parabolic boundary. Let the coefficients of problem (1)-(2) satisfy

$$\gamma |\xi|^2 \leq \sum_{i,j=1}^n a_{ij}(x, t, u) \xi_i \xi_j \leq \gamma^{-1} |\xi|^2, \quad \xi \in R^n, \quad (3)$$

$\gamma \in (0, 1)$, $\psi(x, t)$ - weighted function.

Theorem. Let satisfying some conditions related coefficients and weighted functions. Then problem (1), (2) have unique solution from $W_{2,\psi}^{1,1}(Q_T)$.

THE ESTIMATES OF SOLUTIONS OF DEGENERATE NONLINEAR ELLIPTIC-PARABOLIC EQUATIONS

¹Gadjiev T.S., ²Zulfaliyeva G.S.

¹Institut Mathematics and Mechanics, Baku, Azerbaijan

²Sumgait State University, Sumgait, Azerbaijan

tgadjiev@mail.az, z.gulnara1991@mail.ru

In the paper boundary value problem for second order nonlinear elliptic-parabolic equations is investigated. The apriori estimates of generalized solutions are proved. By help this estimates can be the solvability of problem are established. Let Ω a bounded set in R^n , $Q_T = \Omega \times (0, T)$. We consider the initial boundary value problem.

$$\begin{aligned} \frac{\partial u}{\partial t} - \sum_{i,j=1}^n \frac{\partial}{\partial x_i} \left(a_{ij}(x, t, u) \frac{\partial u}{\partial x_j} \right) - \Psi(x, t) \frac{\partial^2 u}{\partial t^2} + \sum_{i=1}^n b_i(x, t) \frac{\partial u}{\partial x_i} + \\ + C(x, t)u = 0, \quad (t, x) \in Q_T, \end{aligned} \quad (1)$$

$$u(t, x) = f(t, x), \quad (t, x) \in \Gamma = \partial\Omega \times (0, T), \quad (2)$$

$$u(t, x) = h(x), \quad x \in \Omega. \quad (3)$$

Let $\partial\Omega \in C^{1,\alpha}$, $0 < \alpha < 1$. $\Psi(x, t)$, ω - weighted functions. The coefficients of equations, the functions $f(t, x)$ and $h(x)$ some conditions satisfied. We introduce weighted space $W_{2,\Psi}^{1,1}(Q_T)$ and generalized solution from this space is considered.

Theorem: Let some conditions related of coefficients and weighted function is satisfied. Then hold following estimate

$$\int_Q \left[\omega(x) \left| \frac{\partial u}{\partial x} \right|^2 + \Psi(x, t) \left| \frac{\partial u}{\partial t} \right|^2 \right] dx dt \leq C,$$

where C constant which depending only on known parameters.

CONSISTENCY OF DEPTH FUNCTIONS IN THE SPACE OF CLASSIFICATION FUNCTIONS

Galkin O.

Taras Shevchenko National University of Kyiv, Ukraine

galkin.o.a@gmail.com

This work is devoted to the issue of selection hypothesis $h \in H$ to effective generalization on the class of hypotheses H which is distributed with respect to the posterior probability P in the process of studying binary classification problems. We use such concepts of multivariate statistics as a multidimensional weighted average value and depth functions. The proposed approach consists in analysis of depth functions that operate in the dual space (the space of classification functions) [1]. The depth function which determines the consistency of function h with a weighted majority voting on z will always have a high degree of consistency with its prediction function in the class H .

Relative depth function h with respect to P is defined as

$$E_P(h|z) = \underset{c \approx P}{P} [c(z) = h(z)],$$

where H is the class of functions and P - probability measure on H .

We use the concept of ω -efferent depth h with respect to P and ε which is defined as

$$E_P^{\omega, \varepsilon}(h) = \sup_{Z' \subseteq Z, \varepsilon(Z') \leq \omega} \inf_{z \in Z'} E_P(h|z),$$

where H is the class of functions and P - probability measure on H . The function of ω -efferent depth establishes a high degree of consistency in the class H of function h on the whole set of models with the probability mass ω . Using the proposed concepts we have the possibility of generalizing the estimates for the depth hypotheses [2]. Threshold properties of weighted average value were analyzed as part of the proposed approach whereby it was found their dependence on the depth.

References

1. Herbrich R. Bayes point machines / R. Herbrich, T. Graepel, C. Campbell // The Journal of Machine Learning Research, 2001. - 1. - P.247–271.
2. Zuo Y. General notions of statistical depth function / Y. Zuo, R. Serfling // The Annals of Statistics, 2000. - 28(2). – P.464–480.

DETECTION OF CHEMICAL COMPONENTS IN THE PLANTS

Garashchenko F.G., Matvienko V.T., Trebina N.M.

Taras Shevchenko National University of Kyiv, Ukraine

Fedir47@gmail.com, Matvienko.vt@gmail.com

Let's show constructiveness and effectiveness of the proposed approach primarily based on spectral data processing of the plants contaminated with chemical elements. We assume that plants pollution is generated by some chemical elements and its spectral data received. They are considered as basic for recognition of them in new experimental data. Let us designate basic spectral functions $\varphi_1(t), \varphi_2(t), \dots, \varphi_n(t)$, $t_0 \leq t \leq T$, which represent the spectral data of plants pollution by known chemical elements.

Let $\varphi(t), t \in [t_0, T]$ the measured spectral function contaminated by an unknown chemical element. The function $\psi(t, \alpha)$ will choose as a linear combination of $\psi(t, \alpha) = \sum_{j=1}^n \alpha_j \varphi_j(t)$. System of ordinary differential equations for this case will be [1]

$$\frac{d\alpha_i}{dt} = -2 \left(\sum_{j=1}^n \alpha_j \varphi_j(t) - \varphi(t) \right) \varphi_i(t), \quad i = 1, 2, \dots, n.$$

Let write it in vector-matrix form $\frac{d\alpha}{dt} = A(t)\alpha + f(t)$, $t \in [t_0, T]$.

In the case of consideration of discrete signals, solution of system could be represented as following [2]

$$\alpha(i+1) = \alpha(i) + (A(t_i)\alpha(i) + f(t_i))\Delta t, \quad t \in [t_0, T],$$

where $\Delta t = t_i - t_{i-1}$ – quantization on a time.

Depending on a type of experimental data to improve the detection of signs of chemical contaminants contribution it is needed to hold some mathematical conversions.

Reference

1. Garashchenko F.G., Shvets O.F., Degtiar O.S. Adaptive signals approximation models in structural-parametric classes of functions // Journal of Automation and Information sciences. - 2011. - N 2. - P. 69-77.
2. Bublyk B.N., Garashchenko F.G., Kirichenko N.F. Structurally-parametrical optimization and sustainability of beams dynamic. - Kyiv: Naukova dumka, 1985. - 304 p.

ABOUT AFTEREFFECT PECULIARITIES IN DYNAMIC SYSTEMS

Garkusha N.I.

Taras Shevchenko National University of Kyiv, Ukraine

ngarkusha@gmail.com

The particularities of aftereffect in the dynamic systems can be studied on the example of population dynamics models in the ecological systems. The first mathematical model of Malthus T. is a linear scalar differential equation with constant coefficients

$$\dot{x}(t) = \gamma x(t), \quad x(0) = x_0.$$

The next step was the inclusion of resources limits, which led to the Verhulst logistic equation. It was a non-linear equation with quadratic right side

$$\dot{x}(t) = ax(t)[K - x(t)]/K,$$

These studies were continued in the works of V. Voltaire, P. Leslie, J. Smith, A.N Kolmogorov, A.D. Bazykin. One of the models of population dynamics is described by a system of two differential equations

$$\dot{x}(t) = \left[\frac{ax(t)}{N + x(t)} - by(t) \right] x(t), \quad \dot{y}(t) = -[c - dx(t)]y(t). \quad (1)$$

The report examines the model, which is a system of equations (1), containing the delay caused by the time of maturing individuals.

$$\dot{x}(t) = \left[a \frac{K - x(t - \tau)}{K} - by(t - \tau) \right] x(t), \quad \dot{y}(t) = -[c - dx(t - \tau)]y(t). \quad (2)$$

The system (2) has the same equilibrium position as the system (1). The interest is the stability of the equilibrium position, located in the first quadrant. It is proved that the condition of asymptotic stability of the equilibrium position is that the inequalities

$$-\frac{\pi}{2\tau} < t_1 < 0, \quad -\frac{\pi}{2\tau} < t_2 < 0. \quad t_{1,2} = -\frac{ac}{2dK} \pm \sqrt{\left(\frac{ac}{2dK} + 1 \right)^2 - (a+1)}.$$

DETERMINATION OF THE ECOLOGICAL PARAMETERS OF THE BLACK SEA AND DESIGNING ITS MULTIMEDIA BASE BASED ON THE OBJECT-ROLE MODELING

Gavardashvili Ana, Topuria Nino, Surguladze Gia

Georgian Technical University

a.gavardashvili@gmail.com, nintopuria@gmail.com,

gsurg@gmx.com

The problem field of our research is the ecological system of the Black Sea, in particular, designing the database of the Black Sea [1,2]. At the initial stage, the objects describing the principal parameters of the Sea ecosystem in a syntactic and semantic ways must be identified [3]. Based on the systemic analysis performed by us in the current reporting period the following objects were identified:

Sea (SeaID, Name, Length_EastWest,
Length_NorthSouth, Area, Water_volume, Average_depth, Max_depth)

River (RiverID, River_name, Catch_basin_area km², Absolute_level, m, River_length_inGeorgia, km, Mean_slope, i, Average_basin-height_along the section, m, Mean_flow_module, l/sec.km², Mean-annual_flow m³/sec)

Estuary (EstuarID, RiverID, CoordGPSx, CoordGPSy, Area,)

Vulnerable_area(Vulnerable_districtsID, CoordGPSx,
CoordGPSy, Area, T1/T2, pH, TDS)

GPS_coordinates (CoordGPSx, CoordGPSy)

Sensitive_area (SensitiveAreasID, CoordGPSx, CoordGPSy)

District (DistrictID, Name, CoordGPSx, CoordGPSy, Area,
T1/T2, pH, TDS)

Water_test_factors (WaterTestID, WaterT1, AirT2, Water_acidityPH, WaterSalinityTDS)

Ecological_parameter (...)

Quantitative_indicator (...)

Qualitative_indicator (...)

Ecological_problems_of the Black Sea (...)

Eco-safety_measures (ActionID, Name, DateBegin,
DateEnd, ...)

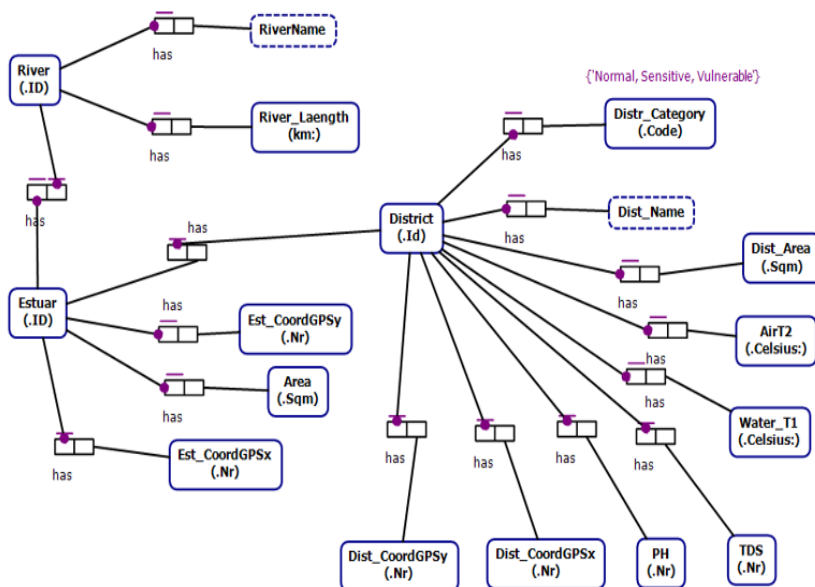


Fig. 1. A fragment of the conceptual model of the Black Sea ecological base (ORM – Object Role Model)

He knows the essence, objectives and functions of the problem field, and therefore, following some minor consultations, he can easily work in NORMA environment and transfer his knowledge to the computer. As a result, an ORM model of the database is gained (Fig.2)

The database must be designed based on the object-role modeling instrument and its principles [4,5]. We use Natural ORM Architect tool as an instrument, which is compatible with Visual Studio.NET Framework integrated system. A conceptual model (ORM) or a scheme is the set of the objects in the study field and relationships between them, which reflect the business processes and business rules of the study field. Theoretically, it is based on a joint use of the categorial approach (language grammar rules) and mathematical logics (algebra).

Such an approach is embedded in instrument NORMA, which transforms the client-user's knowledge about the design objects to so called objects, their properties and predicates (binary,... n-th).

The user describes the objects through the work interface of NORMA tool, and first, the first object is fed, then the second, etc.

We have described three objects for illustration purposes: “River”, “Estuary” and “District”. The links between them are built with predicates „has“ („is“, „works“, etc.).

Predicates are the facts, e.g.: f1: River has River Name; f2: River has River Length; f3: River has Estuary; f4: Estuary has River; . . .f15: District has Category; f16: District Category is Normal or Sensitive or Vulnerable, etc. An object has “Area” the parameter “Area - category”, which is the value from the set {normal, sensitive, vulnerable}. The concrete area depends on the values of its ecological parameters (Fig.1).

It may be said that by using the ORM-modeling instrument, the first-level conceptual plan can be built even by a user, who is not a programmer (i.e. is unaware of the techniques to design databases).

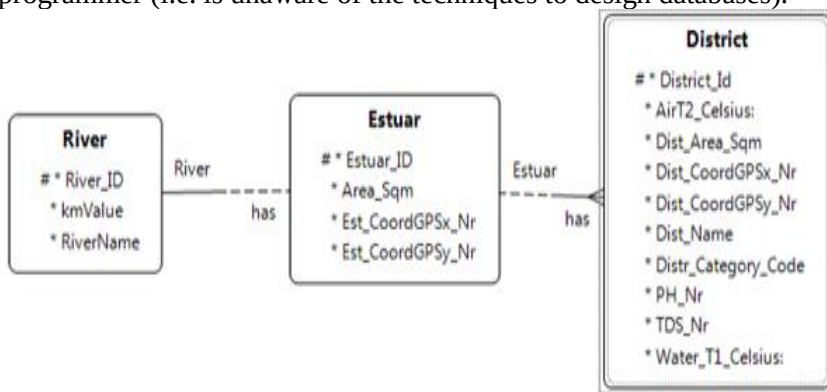


Fig.2. Conceptual model of the barker (Barker ER view)

So, by using the above-described object role modeling, at the next stage it will be possible to assess the reliability of the sensitive areas in the Black Sea area and ecological risk of the Black Sea coastline.

References

1. Gavardashvili A.G. (2013). The Program Software to Create United Database of Black Sea Ecological Characteristics. Collected Papers of Water Management Institute of GTU, N68,Tbilisi, Georgia, p. 27-32.
2. Gavardashvili A.G. (2015). Results of Field Research in the Black Sea Coast Line within the Borders of Georgia in April. V Int. Scien. and Techn. Conf. “Modern Problems of Water Management, Environmental Protection, Architecture and Construction”. Tbilisi, Georgia, p. 13-29.

3. Gavardashvili A.G. (2015). Results of the field-and-scientific study in the water area of the estuaries of the major rivers of the Black Sea and sea ports on the territory of Georgia. 17th Int.conf. on Environmental Sciences and Engineering. Paris, France.
4. Halpin T.(2005).ORM 2 Graphical Notation, Neumont University. [http:// www.orm.net/pdf/ORM2_TechReport1.pdf](http://www.orm.net/pdf/ORM2_TechReport1.pdf).
5. G. Surguladze, N. Topuria, G. Meladze (2007). Designing the structure of the database management systems ORM/ERM, Ms SQL Server. TSU, Tbilisi. <http://www.gtu.edu.ge/katedrebi/kat94/pdf/OrmErm-31.pdf>

MODERN TECHNOLOGIES IN EDUCATIONS

Geladze D., Didmanidze M.

Batumi Shota Rustaveli State University, Georgia

darejan66@mail.ru

Nowadays integration of informational technologies is the part of Education and is not one's insistence but the way of solving new educational tasks. Furthermore it's impossible to separate education and technologies. Currently it's not only the additional instrument of Educational system but the new rule in functioning Educational system. When planning education development it is one of the main request and priority of institutional structure. At the present time technologies have covered all the fields of education. On the one hand it's connected with unlimited Internet connection, important educational information can be placed on its server. On the other hand it can create new methods of teaching and learning process and without these modern attitudes it wouldn't be possible to solve developing tasks in education.

Rising interest towards technologies and E-resources is characteristic for Modern age. From economical and political points of view present difficult times coincides with the process of "informational revolution", which is accompanied with implanting computer technologies in all fields of scientific and social lives. Technology is becoming inseparable part of teaching. When the tasks in teaching are defined clearly it's obvious that technology will take its part and role. We could state that increasing role of technologies into teaching is causing bigger problem - the problem of realizing learning and teaching process in a different way.

Because of intensive development of informational technologies priority of Georgia should be mastering in technologies, we should identify exactly which mechanism is necessary for specific problem and then solving problem using the identified method. We should take into

consideration that it's possible to solve one and the same problem with different ways. New dimensions in teaching is being brought by digital era, which need new corresponding skills and one of the first skills to be developed are: establishing communication, working co-operatively and using computer net. Traditional methods should be changed after analyzing new ways in teaching and learning processes, constructive learning process should take place, students should take responsibilities for their knowledge and learning process.

APPLICATION OF ADAPTIVE CLUSTERING METHODS FOR DATA ANALYSIS

Gnatyshyn O.P.

Ivan Franko National University of Lviv, Ukraine

gnatlesya@gmail.com

The goal of clustering is to catch out the existing structures. Apriori such structures are unknown. To solve the problem of choosing the best partitioning clustering algorithm we add the adaptive mechanism for choosing the optimal solution among the multitude of the enabled solutions. This approach, proposed in [1], was used to solve the problem of cluster analysis of data on the environmental security of the region.

Set X - the threat of ecological safety of the region included 16 items, among them - the emissions of pollutants and greenhouse gases from stationary sources of pollution (solid, gaseous and liquid, sulfur dioxide, carbon monoxide, nitrogen oxides, etc.), sanitation (reset) wastewater, emissions of road, rail, aviation, water transport and production equipment and a number of others.

The results on clustering of districts and cities of regional subordination Lviv region in terms of environmental threats to security have been submitted. In the development of these studies, according to the method, presented in [2] by applying the analytic hierarchy process, we can select alternatives to reduce the impact of these risks.

The input data for this numerical experiments were used from the open official source of statistical information [3]. Time period 2010-2014 biennium. The corresponding dendrograms and graphics have been presented.

References

1. Барсегян А.А. Технологии анализа данных: Data Mining, Visual Mining, Text Mining, OLAP // Барсегян А.А., Куприянов М.С.,

Степаненко В.В., Холод И.И. – Санк-Петербург. «БХВ-Петербург» 2007. - 376 с.

2. Качинський А. Екологічна безпека України: Системний аналіз перспектив покращення. Київ., 2001. – 253 с.

3. <http://www.lv.ukrstat.gov.ua>

DECISSION SUPPORT SYSTEM FOR MULTIMODAL FREIGHT FORWARDING WITH RISK MANAGEMENT

George Gogichaishvili, Lily Petriashvili, Giorgi Surguladze

Georgian Technical University

gggia1941@gmail.com; l.petriashvili@gtu.ge;

gsurguladze@gmail.com

The present article discusses problems of managing business processes of multimodal freight transportation. Multimodal transportation means using two or more transport modes during a shipment process [1,2].

As there are several modes of transport involved in the above mentioned type of shipments, strengths as well as weaknesses inherent in each mode of transport will have certain influence on a shipment process. We should not suppose that because of a shipment being multimodal, the risks inherent in each mode used would somehow diminish. Currently, situation in operations area at many freight forwarding companies decisions made may often turn ineffective which is a hampering factor in proactive and information based decision making.

The present article emphasizes improvements to business process modeling and automation at a freight forwarder based on modern information technologies.

Process-oriented BPMN diagram was developed for multimodal transportations. Respective infrastructure scheme was designed based on analysis of business requirements. Structure of MIS for managing problem area has been developed involving distributed database, monitoring and decision making blocks (Figure 1).

Transport modes (Road, sea, air) differ from each other in terms of technical as well as economic perspective. As there is no ideal mode of transport, in international freight forwarding area often questions arise as to which mode or a combination of modes should be used in a specific shipment. As a result, many factors come into play that help managers make optimal decisions.

Among the factors mentioned above are shipment and cargo value, transit time, transportation reliability, regularity of shipments, accessibility of transport modes, etc. In general, in a shipment process, assessment of a transport mode is done based on expert knowledge and experience. With the goal of doing research to optimize the dynamic process of transportation, developing a simulation model is proposed using graphical-analytical instrument of Colored Petri Nets, covering risks related to transportation based on a stochastic model.

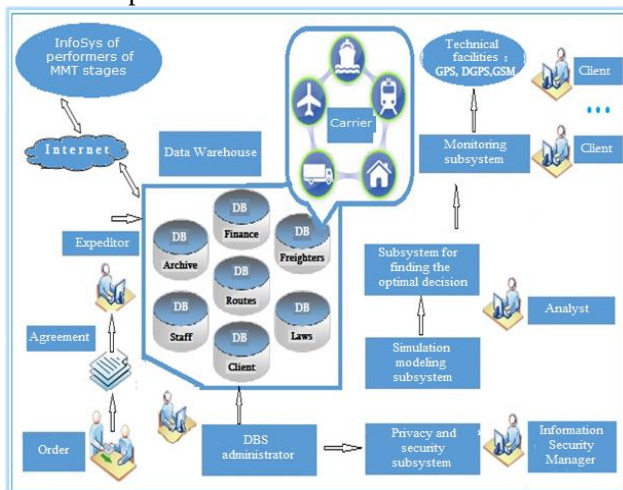


Fig.1. Multimodal shipment infrastructure model

GPS – Global Positioning System, DGPS - Differentiated Global Positioning System, GSM - Global System for Mobile Communications

References

1. Surguladze Gia, Petriashvili Lily, Topuria Nino, Surguladze Giorgi. Modelling of Designing a Conceptual Schema for Multimodal Freight Transportation Information System / World Academy of Science, Engineering and Technology International Journal of Computer, Electrical, Automation, Control and Information Engineering, Vol:9, No:11, 2015. P. 2074-2077.
2. Gogichaishvili G., Surguladze G. Concept of Automated Management of Multimodal Freight Transportation Business Processes / Transactions of Georgian Technical University. Automated Control Systems /2014, No 2(18). - P.45-50.
3. Surguladze Giorgi. Infrastructure and simulation model of business process management for multimodal freight forwarding / Transact. of Georgian Technical Univ. "Automated Control Systems" / 2015, No 2(20). - P.108-123 (in georgian).

ASYMPTOTIC VIEW OF STOCHASTIC OPTIMIZATION IN DIFFUSION APPROXIMATION SCHEME

¹Gorun P.P., ²Chabanyuk Ya.M.

¹Lviv Polytechnic National University, Ukraine

²Lublin University of Technology, Poland

pavlo.gorun@gmail.com

The jumping stochastic optimization procedure (SOP) in diffusion approximation scheme in Markov space with singular perturbation of regression function has following view (let $\sum_{n=0}^{-1} a_n^\varepsilon \nabla_b C(u_n^\varepsilon; x_n^\varepsilon) = 0$) [1]:

$$u^\varepsilon(t) = u + \sum_{n=0}^{\nu(t/\varepsilon^{1/\gamma})-1} a_n^\varepsilon C^\varepsilon(u_n^\varepsilon; x_n^\varepsilon), \quad u^\varepsilon(0) = u, t \geq 0, \quad (1)$$

where γ – time normalization coefficient, ν – counting process of jumping moments of Markov process (MP).

To generalization the results it was introduced the control functions $a(t) = a/t^\alpha, a > 0, b(t) = b/t^\beta, b > 0, \alpha, \beta$ satisfies convergence conditions of SOP (1) (see. [2, Theorem 1]):

$$\sum_{t=0}^{\infty} a(t) = \infty, \sum_{t=0}^{\infty} a^2(t) < \infty, \sum_{t=0}^{\infty} a(t)b(t) < \infty.$$

For the SOP (1) we have: $u_n^\varepsilon = u(\tau_n^\varepsilon), x_n^\varepsilon = x(\tau_n^\varepsilon), a_n^\varepsilon = a(\tau_n^\varepsilon), \tau_n^\varepsilon = \tau_n / \varepsilon^{1/\gamma}, n \geq 0$, where τ_n – renewal moments of equable ergodic MP $x(t), t \geq 0$ in standart phase space $(X, \mathcal{X})$.

Function $C^\varepsilon(u; x) = \nabla_b C(u; x) + \varepsilon^{-c_0} C_0(u; x), c_0 > 0, u \in \mathbb{R}, x \in X$ satisfies the conditions for the existence of a global solution of systems: $du_x(t)/dt = C^\varepsilon(u_x(t); x), x \in X$. For regression function $C(u; x)$ and its disturbance $C_0(u; x)$ exist conditions of ballance $\tilde{\Pi} C_0(0; x) = 0$ and $\tilde{\Pi} C_0'(0; x) = 0$ accrodingly, where $\tilde{\Pi}$ – projector, defined by stationary distribution of embedded Markov chain $x_n, n \geq 0$, i.e. $\tilde{\Pi} \varphi(x) = \int_X \rho(dx) \varphi(x)$.

For regression function $C(u; \cdot) \in C^4(\mathbb{R})$ we have: $\nabla_b C(u; x) = (C(u + b; x) - C(u - b; x)) / 2b, u = u(t), b = b(t)$ (the same for $C_0(u; x) \in C^4(\mathbb{R})$). Norming fluctuationsof SOP (1) are considered in view:

$$v^\varepsilon(t) = \frac{t^\gamma}{\varepsilon} \tilde{u}^\varepsilon(t), \tilde{u}^\varepsilon(t) = \frac{\varepsilon}{t^\gamma} v^\varepsilon(t), \tilde{u}^\varepsilon(t) = u_0 + \sum_{n=0}^{\nu(t/\varepsilon^{1/\gamma})-1} a_n^\varepsilon \nabla_b C(u_n^\varepsilon; x_n^\varepsilon).$$

$$\text{Let: } \rho^2 = 2 \int_X \pi(dx) q(x) C_0(x) R_0 q(x) C_0(x) - q \int_X \rho(dx) C_0^2(x);$$

$$d_1 = -q \int_X \rho(dx) C''(0; x); \quad d_2 = -q \int_X \rho(dx) C_0''(0; x); \quad k = ad_1 - \gamma.$$

Theorem. When conditions of convergence of SOP (1) and additional conditions: A1: $\rho^2 > 0$; A2: $d_1 > 0, d_2 > 0$; A3: $k > 0$ are satisfied, then it has place a double weak convergence of processes: $(v^\varepsilon(t) \Rightarrow \zeta(t), C_0^\varepsilon(t) \Rightarrow \sigma(t)w(t), \varepsilon \rightarrow 0)$, $\sigma^2(t) = (a^2 \rho^2 q^2)/t^2$ in every finite interval $0 < t_0 < t < T < \infty$. Doublecomponent boundary process $(\zeta(t), \sigma(t)w(t), t > 0)$ is heterogeneous in time diffusion process.

References

1. Gorun P.P. Generator of jumping stochastic optimization procedure in Markov space / Gorun P.P., Chabanyuk Ya.M., Kukurba V.R. //XVI Inter-national Conference "Problems of decision making under uncertainties" (PDMU-2010, October 4-8, 2010). Kyiv: Osvita Ukrainy. – P. 54.
2. Chabanyuk Ya.M. Convergence of discrete stochastic optimization procedure in diffusion approximation scheme / Ya.M. Chabanyuk, P.P. Gorun //Collected works of Institute of Cybernetics of Glushkov V.M. NSA of Ukraine and Kamyanets-Podilskij national university of I.Ogijenka. Phys.-math. sciences, 2012. – №6. – P.234–248.
3. Korolyuk V. Stochastic Systems in Merging Phase Space /Korolyuk V., Limnios N. – World Scientific Publishing, 2005. – 330 p.

NONLINEAR DYNAMIC SYSTEM KERNEL BASED RECONSTRUCTION FROM TIME SERIES DATA

Grinberg G.L., Lyubchyk L.M.

National Technical University “Kharkiv Polytechnic Institute”, Ukraine
glnginbergd@gmail.com

One of the main problems in the decision-making theory is a ranking of the objects described by the vector whose components are the result of the measurement of some performance indices. An effective approach to its solution is based on the concept of the integral index or indicator - scalar, mapped to each object [1]. A common algorithm for the

construction of integral indicators for the objects described in linear scales is usually a linear combination of the weighted indices values.

There are two main approaches to solving this problem. In the first one weight appointed by experts or calculated based on the method of paired comparisons. If both the expert assessment of the quality of objects and the importance of partial indices, the problem of optimal matching of the integral indicator ratings and weights of indices is arises (expert assessment concordance) [2].

The second approach is based on the calculation of the weights based on the dispersion criterion informative description using principal component analysis. The weights of partial indices match with elements of the first principal component and the integral indicator is calculated as the projection of the object on the first principal component or on the first right singular vector.

References

1. Aivasian S. A, Mkhitarian V. S. Applied statistics and essential econometrics. Moscow, UNITI, 1998.
2. Strijov V., Shakin V. Index construction: the expert-statistical method, Proc. Conference on Sustainability Indicators and Intelligent Decisions, 2003. - P. 56-57.

ON THE PROBLEM OF FINDING A PATH WITH OPTIMAL DIFFICULTY

Grynenko O., Semenov V.

Taras Shevchenko National University of Kyiv, Ukraine
ollyajoke@gmail.com, semenov.volodya@gmail.com

The problem of finding an optimal path on various surface is well known and many approaches to solving this problem already exist. However, very few of them take into account the difficulty of the path, where, for instance, climbing the hill usually takes much more of traveler's effort than going downhill.

The approach to handle this kind of problem, discussed in the work, proposes to use a modification of Weiszfeld's iterative algorithm for the Fermat-Weber location problem. Even though there are some open questions concerning this algorithm, it remains one of the most reliable approaches [1].

It is assumed by authors, that with given starting and ending positions on a particular surface, each interim position could be found as

a point that minimizes the sum of weighted distances from the two points with regards to the difficulty of the resulting segments of the path. This operation is repeated on each of the resulting segments, until the optimal path with desired difficulty connecting starting and ending point is found. Metrics modification is based on the gradient of the surface at any particular point.

Moreover, several cases of Fermat-Weber location problem with modifications of Weiszfeld's algorithm were reviewed in the work as well, in particular: location problem involving sets [2], location problem on a sphere [3], location problem with attraction and repulsion [4].

References

1. Brimberg J., The Fermat-Weber location problem revisited – Ontario: Mathematical Programming, 1995.– P. 71-76.
2. Nguyen Mau Nam, Applications of Convex Analysis to the Smallest Intersection Ball Problem – Online source: arxiv.org, 2011 – 22 p.
3. Stefan Nickel, Weber's problem with Attraction and Repulsion under Polyhedral Gauges – Netherlands: Kluwer Academic Publishers, 1997. – P. 409-432.
4. Xue G.-L., A Globally Convergent Algorithm for Facility Location on a Sphere – Great Britain: Computers Math.Applic., 1994 – P.37-50.

INTERDISCIPLINARY COMMUNICATION AND ELECTRONIC MANUALS

Gela Gvinepadze, Zurab Tielidze

Georgian Technical University

gvinepadzegela@gmail.com, ztielidze@mod.gov.ge

Transition of the post-soviet countries, from one economic formation to qualitatively new, sharply raises the question for manufacturers, about competitiveness of their products on the world market. Same situation is in post-soviet Georgia. While solving this problem, of course, a major role must be played by improving the quality of studies and achieving its qualitatively new stage. By this reason, during students education process, primarily, we should pay more attention to development and implementation of new approaches, which will be based on the latest achievements, from different areas of science and will use the latest tools developed in them.

Today, specialist has to navigate in the sea of information. Accordingly, to achieve a specific goal, the issue of allocation and

formation of “Extract” in the right form, gets particular importance. which requires a number of procedures : intelligent search, analysis of information. as well as giving the appropriate shape of content: its dosage, control and survey of the acquired knowledge, provide students opportunities not only to acquire knowledge in a passive form, but also to think actively, to seek new ways of solving problems.

It is worth to mention, that, in recent years this trend is becoming increasingly popular - identification of interdisciplinary connections between the different areas of knowledge and providing them to students, as survey of organic unity “anything and everything”. Here the effect of the following factors is also important – very often breakthroughs in human perception of the world are committed in the fields of intersection areas of different sciences. Elaboration of disciplines, such as mathematical linguistics, molecular biology, physical chemistry, fundamentals of creative thinking and finally the science of science, Was conditioned by this factors.

In our opinion, a valuable example of the effectiveness of this approach are works of Georgian scientist Guram Chachanidze. Which resulted creation of the original textbooks on algebra and geometry. In the textbooks author has elaborated mathematical problems, to make (force) students to familiarize with many interesting facts from the history of their country, its geography, art, from different areas of the economy, even - from national cuisine (including technology and recipes of well-known “churchkhela”). By the way, this idea was approved and annexed outside the Georgia. In particular in Bulgaria, the Baltic States, of course, with the difference that all the specifics of each country was taken into account. In this example it can be clearly seen, how small the world has become in the present conditions. But only in the finest sense of this word - in meaning that today scientists willing to use achievements not only from the related sciences. But they also transfer approaches and tools from very distant “scientific lands”, to their field of activity. So, it is said “The chemist, who knows only chemistry, hardly knows it”.

We can say even more: It was noticed long time ago, that in finding solutions of complex problems they are found by non-specialists, amateurs. As proof of this, we can cite many examples. In our opinion, we are dealing with such case with a famous person in Georgia (but famous as an actor) Zurab Kapianidze. Who saw a sheet, for entering letters of ancient Georgian writing ASOMTAVRULI, on a picture

which was designed, for a simple (It means archaic!) Children's games called "BIKILA".

When we say amateur, It is not necessary to provide an uneducated person. Most likely, he is an expert but in his domain. Who is looking for ways to use his accumulated knowledge in another field of science, in which he is interested or in "worst case" self-taught, who accumulated a certain store of knowledge in this area, and has a fresh look at not very familiar to him subjects (it's said that this lack of information helps amateurs).

Proceeding from this situation, the question is how to facilitate the creation, advancement and implementation of good ideas?

Here is what the philosopher, naukovedov A. Sukhotin writes about it: "Today, the traditional scientists when they worked each by itself, alone, gradually receded into the past. The winners are collective principles. Usually, research are conducted in groups, which include scientists of different profiles, along with specialists, in this case, We can see amateurs. This team is considered to be more productive in advancing of new ideas, than when only some specialists are united".

In determination of an effective organizational forms of modern science, the leading role was assigned to philosophy (which it is hardly worth arguing). However, to obtain a final result as a rule, procedures of communication between specialists from different fields of human activity, speaking different languages. It will be very hard to help them without resorting to the computer world. And also we must afford much greater role to electronic textbooks. To achieve this goal specialists must develop and agree certain rules, with each other and with programmers.

In the report we will discuss some of the approaches to the formation of e-books, which facilitates the perception of the students about interdisciplinary connections.

ON FRACTIONALLY INTEGRATED INVERSE STABLE SUBORDINATORS

Alexander Iksanov

Taras Shevchenko National University of Kyiv, Ukraine

iksan@univ.kiev.ua

For $\alpha \in (0,1)$, let $(D_\alpha(t))_{t \geq 0}$ denote an α -stable subordinator, i.e., an increasing Levy process, with $-\log E \exp(-sD_\alpha(1)) = \Gamma(1-\alpha)s^\alpha$ for $s \geq 0$, where $\Gamma(\cdot)$ is Euler's gamma function. Its generalized inverse $W_\alpha := (W_\alpha(u))_{u \geq 0}$ defined by

$$W_\alpha(u) := \inf\{t \geq 0 : D_\alpha(t) > u\} \text{ for } u > 0$$

and $W_\alpha(u) := 0$ for $u \leq 0$, is called an *inverse α -stable subordinator*. Obviously, W_α has a.s. continuous and nondecreasing sample paths.

For $\beta \in \mathbb{R}$, set

$$Y_{\alpha,\beta}(0) := 0, \quad Y_{\alpha,\beta}(u) := \int_{[0,u]} (u-y)^\beta dW_\alpha(y) \text{ for } u > 0.$$

Since the integrator has nondecreasing paths, the integral exists as a pathwise Lebesgue-Stieltjes integral. We call $(Y_{\alpha,\beta}(u))_{u \geq 0}$ a *fractionally integrated inverse α -stable subordinator*.

It will be explained that the fractionally integrated inverse stable subordinator is a scaling limit in the Skorokhod space of a renewal shot noise process with heavy-tailed, infinite mean 'inter-shot' distribution and regularly varying response function. Further, we shall discuss local Holder continuity of these processes and a law of iterated logarithm for both small and large times. The talk is based on recent paper [1].

References

1. Iksanov A. Fractionally integrated inverse stable subordinators/ A. Iksanov, Z. Kabluchko, A. Marynych, G. Shevchenko -2016. Preprint available at <http://arxiv.org/abs/1602.07485>

OPTIMAL CONTROL PROBLEM FOR A NONLINEAR SCHRÖDINGER EQUATION WITH A SPECIAL GRADIENT TERMS

A.D. Iskenderov¹, G. Yagub², M.Zengin²

¹Lankaran State University, Azerbaijan

²Kafkas University, Turkey

office@lsu.edu.az, gabilya@mail.ru, merveezengin14@gmail.com

We consider the problem of finding the minimum of functional

$$J_{\alpha}(v) = \|\psi(., T) - y\|_{L_2(\Omega)}^2 + \alpha \|v - \omega\|_{L_2(D)}^2 \quad (1)$$

on the set of admissible controls

$$V = \{v = v(x) : v \in L_2(D), \|v\| \leq b_0\}$$

under conditions:

$$i \frac{\partial \psi}{\partial t} + a_0 \Delta \psi + ia_1(x) \nabla \psi - a(x) \psi + v(x) \psi + a_2 |\psi|^2 \psi = f(x, t), \quad (x, t) \in \Omega, \quad (2)$$

$$\psi(x, 0) = \varphi(x), \quad x \in D, \psi|_S = 0, \quad (3)$$

where $i = \sqrt{-1}$ imaginary unit, $T > 0$, $b_0 > 0$, $a_0 > 0$, $\alpha \geq 0$ are given numbers, $D \in R^2$ is a convex bounded domain, $x \in D$, $0 \leq t \leq T$, $\Omega_t = D \times (0, t)$, $\Omega = \Omega_T$, $\psi = \psi(x, t)$ are wave function,

$$a_2 = \operatorname{Re} a_2 + i \operatorname{Im} a_2, \operatorname{Re} a_2 < 0, \operatorname{Im} a_2 > 0; \operatorname{Im} a_2 \geq |\operatorname{Re} a_2|; \quad (4)$$

$a(x)$ and $a_1(x)$ are measurable bounded real-valued functions that satisfy the conditions:

$$0 \leq a(x) \leq \mu_0, \quad \overset{o}{\forall} x \in D, \quad \mu_0 = \operatorname{const} > 0 \quad (5)$$

$$|a_1(x)| \leq \mu_1, \quad \left| \frac{da_1(x)}{dx} \right| \leq \mu_2, \quad \overset{o}{\forall} x \in D, \quad \mu_1, \mu_2 = \operatorname{const} > 0, \quad (6)$$

$\varphi(x)$ and $f(x, t)$ for $k=1, 2$ are given complex-valued functions satisfying the conditions:

$$\varphi \in W_2^0(D), \quad f \in W_2^{0,1}(\Omega); \quad (7)$$

$\omega \in L_2(D)$ is a given element and the symbol $\overset{o}{\forall}$ means “for almost everywhere”.

In this paper, the existence and uniqueness of solution of considered optimal control problem is investigated and a necessary optimality condition in variational inequality form for its solution is obtained [1,2].

References

1. Yagubov G., Toyoğlu F., Subaşı M. An optimal control problem for two- dimensional Schrödinger equation // Applied Mathematics and Computation. – 2012. - Vol. 218, iss.11. - P.6177-6187.
2. Iskenderov A.D., Yagub G., Ibrahimov N.S., Yıldırım Aksoy N. An Identification problem observed overall region for linear nonstationary quasioptics equation // XXI International Conference “Problems of Decision Making Under Uncertainties” (PDMU-2013), Skhidnytsia, Ukraine, May 13-17, 2013. - P. 38-41.

SYSTEMS OF COMMON REPRESENTATIVES APPLICATION IN CLINICAL TRIALS

Ivanchuk M.A.¹, Ivanchuk P.R.¹, Malyk I.V.²

¹Bucovinian State Medical University, Chernivtsi, Ukraine,

²Yuriy Fedkovych Chernivtsi National University, Ukraine

mgracia@ukr.net

Systems of common representatives [1] and ε -nets [1,2] as there application are commonly used in economic and political researches [1,3]. We proposed to use the ε -nets theory in clinical trials.

During clinical research doctors select patients according to the predetermined criteria (clinical characteristics) and compile information about their health. Later researchers send compiled information into the data-processing center for analyzing and statistics [4]. It is very important to select patients to represent all possible clinical symptoms of researched disease.

Consider a range space (X, R) , where X is the whole of population, R is the possible symptoms. Denote $A \subset X$ is the set of all persons with researched disease, $|A| = n_A$. An ε -net N of the set A represents the patients with all clinical characteristics which are present in nothing less than εn_A patients. According to the Welzl-Haussler theorem [2] there exists an ε -net N such that $|N| \leq (8d / \varepsilon) \log_2 (8d / \varepsilon)$.

So, using ε -nets in clinical trials makes possible to planning research in the best way to select patients with the most common clinical characteristics of the researched disease.

References

1. Raigorodskiy A.M. Systems of common representatives in combinatorics and their application in geometry// Moscow, 2009. - 136 p.
2. Haussler D., Welzl E. Epsilon-nets and simplex range queries// Discrete Comput. Geom., 1987, №2, P.127–151.
3. Gärtner B., Michael Hoffmann M. Computational Geometry // <http://www.ti.inf.ethz.ch/ew/lehre/CG12/lecture/CG%20lecture%20notes.pdf>
4. Melihov O.G. Clinical trials// Moscow, 2003. - 200 p.

MARKETING DECISIONS RESEARCH OF THE EDUCATION SERVICE MARKET

Giorgi Janelidze

Telavi Iakob Gogebashvili State University, Georgia

vip.janela@gmail.com

Nowadays the education system of the developed countries plays the role of the main dominant in the process of the changes from the knowledge economic side to the innovation side. The supporter of these changes is the “knowledge triangle”: education, scientific explore and innovation-business. The effective connection of these three features which are provided by the education service of the marketing sector play the role of the guarantee for the growing innovative economic development.

It should be mentioned that the educational activities belong to the service sector. Education is a same service like any other kind of service and therefore, should be run through the market requirements and the pricing system.

The modern education process is fully associated with the business, in the form of education issuer and the education receiver. If to consider these cases as an education receiver, it might be presented as a personal investment, which has a long lasting result.

The last few decades the businessmen started investing in education in order to create the long term goals for prospective profit. In this case, such approach will contribute to the high level of education achievement, and on the other hand it predicts a brilliant education service market of future for the effective marketing products circulation.

Talking about the marketing product, the human resources and intellectual potential are on the first place, which they are the sources of the society's creativity. Such products are obtained as the result of the effective educational system functioning. The human resources as the human capital, is orientated to the labor market. The process, which is based on the supply and demand standards requires the marketing engagement. This by itself implies the labor market research.

By the main function of marketing we understand a high quality labor market, and we recommend to accomplish a research within the educational service market. The research of the market concurrence will give us an opportunity to identify the educational requirements, prospects, the quality service, the marketing decision of the effective directions.

In the following report such aspects are represented:

Education marketing aspects, including elements and whole analyses complex (labor market subjective and its functions; education marketing working areas and objectives). This analyses will give us an opportunity to get effective decisions.

To determine the main education service requirements for the graduates professional and career perspectives.

To determine the graduates' future employment and favorable work conditions.

ONE APPROACH TO JOIN SEQUENCE OPTIMIZATION FOR DISTRIBUTED QUERY PROCESSING

Iuza Jgenti, Badri Meparishvili, Gulnara Janelidze

Georgian Technical University, Georgia

iuzazhgenti@yahoo.com

Query processing is an important concern in the field of distributed databases. The main problem is: if a query can be decomposed into subqueries that require operations at geographically separated databases, determine the sequence and the sites for performing this set of operations such that the operating cost (communication cost and processing cost) for processing this query is minimized. Distributed query processing is an important factor in the overall performance of a distributed database system [1]. Query optimization is a difficult task in a distributed client/server environment as data location becomes a major factor. In this paper, we describe the distributed query optimization problem in detail. The input is a query on distributed data expressed in

relational calculus. Four main layers are involved to map the distributed query into an optimized sequence of local operations, each acting on a local database. These layers perform the functions of query decomposition, data localization, global query optimization, and local query optimization. Query decomposition and data localization correspond to query rewriting. The first three layers are performed by a central site and use global information. Local optimization is done by the local sites. One of the major distributed query optimization problems is *Join sequence optimization* [2]: Using the join sequence method for distributed query processing, some joins are performed locally first, and the resulting relations are then sent to the assembly site.

This paper discusses the importance of join sequence optimization which can be formulated as a graph problem [3]. In the process of implementation every possible plan of binary tree makes the so-called situation space that is determined by dimension appropriate to $n!$ Factorial in case of n number of table. Contemporary database management systems, for instance SQL Server may be consisted of about 32 tables in one query. In this case the variation if the query are equal of about $2.6 * 10^{35}$ plans and selecting the optimal one causes time problem, even with superfast computers. The major function of the Query Optimizer existing in the database management system is searching the best plan that is a quit difficult task proceeded from the above-mentioned dimension. Thus, the needed to develop new and more effective methods for the join sequence optimization becomes evident. The paper proposes one new approach to Genetic Programming technique [5], which carries out the selection of a combination of Relational Algebra operations and finds the optimal solutions very fast.

References

1. M. Tamer Özsu, Patrick Valduriez, "Principles of Distributed Database Systems," Springer New York Dordrecht Heidelberg London, ISBN 978-1-4419-8833-1, 2011.
2. M. S. Chen and P. S. Yu, "A Graph Theoretical Approach to Determine a Join Reducer Sequences in Distributed Query Processing," IEEE Trans. Of Knowledge & Data Engineering, 1994, vol. 6:1. - P. 152-165.
3. K. T. Huang, "Query Optimization in Distributed Databases," in Laboratory for Information and Decision Systems: MIT, 1982.
4. Koza, J. Genetic programming: On the programming of computers by means of natural selection, The MIT Press, USA, 1992.

5. Lela Tsitashvili, Badri Meparishvili and Gulnara Janelidze. Database Query Optimization: New Approach to Genetic Programming, Georgian Technical University, Transactions, Automated Control Systems ISSN 1512-3979, 2015, № 2(20).

ENTERPRISE RISK MANAGEMENT BY COSO'S PROCEDURE

Tina Kaadze

University of Tuscia, Viterbo, Italy

tinakaadze@gmail.com

Managerial activities within enterprises are, of course, subject to many risks of different nature, which should always be considered, evaluated and should provide accordingly planning measures to countervail negative outcomes.

Dealing with the major managerial activities in running business, one particular emphasis should be placed on self questioning on the reliability of the budget items, which should be examined for the likelihood of their outcome in economic dimensions and undergo a critical approach.

This is why, COSO (Committee of Sponsoring Organization), relating to ERM (Enterprise Risk Management), has been devised in USA, since 1985, in order to teach the leadership of executive management and governance institutions on critical aspects of Governance, Ethics, Control, Enterprise Risk Management and Financial Reporting.

Since then, a large literature has followed and this paper will take care of the specific issues relating to risk factors, types, assessment, response, their management process, and communication.

This paper will summarize the many facets relating to Enterprise Risk and will report on its Assessment and Response in order to comply with the COSO suggested procedure and open discussion on its feasibility and reliability.

SYSTEMIC MODELING CONTRIBUTING TO THE DECISION-MAKING

Giorgi Kakashvili

Georgian Technical University

giorgikakashvili1@gmail.com

It is known that the formalization and modeling of any real natural phenomenon helps us to perceive, to define its possible results and analyze it. The reason is that the model is an analogous depiction or copy,

which is presented in a formalized way. Nowadays, the modeling theory has been greatly advanced, and its quality has been improved, which is oriented on the creation of process intellectual analogues. Those models can perform the mini-function reflected on the current processes, as there are realized the complex interconnected computer technologies, which are based on the mathematical logic device. We can say that this model is oriented on the specific object and gives the possibility to make the right conclusion on the possible results of the current processes, where the object is impacted by the management process. These models distinguish from the old models with its systematic character, and they practically present the systematic models.

Thus, the systematic modeling is the new method of analysis and system modeling, which does not have any analogue. Three strong fields are united in the systematic modeling, such as systematic phenomenology, inventive problem-solving theories and neuro-linguistic programming. Therefore, the object-oriented systematic models contribute to the optimal decision-making during the current process management.

The systematic modeling is characterized with the universality (it can adapt to any system), and it can help us to do the analysis of objects' properties.

In the report, we highlight these characteristics and present the object-oriented web-page projecting conception of creating the systematic modeling.

Based on the systematic analysis methodology, we can consider the object-oriented web-page projecting as the united complete process of achieving the specific goal.

Here are given the following successive stages of the above-mentioned process:

- Defining the goal of web-page projecting;
- Task formalization;
- Selecting and working on the decision;
- Decision implementation;
- Evaluating the quality (readability, perceptibility, coincidence with the issue, functionality, etc.) and making corrections;

Displaying the web-page in the network.

USE OF DECISION SUPPORT SYSTEM IN AIRLINE DEVELOPMENT

Irakli Karkashadze

Georgian Technical University

i.karkashadze@aviationcg.com

Making decisions based on full and objective analysis is one of the important conditions for business development. Factors that inhibit work with information delay the process. Use of *Decision Support System (DSS)* is useful for solving the problem and making a decision [1,2]. In the business of airline development we offer realization of manufactured decisions through automated systems of database management.

In the systems we use different methods: Information search, intellectual data analysis, precedents examination, database inspection, imitational and cognitive modeling, and situational analysis.

For example: opening new destinations for an airline depends on various important factors, and so, use of database by analytical automated system achieves: analysis of problematic situation, identification and determination of goals, finding information, formulation of criteria for evaluating decision multiplicity, realization of chosen decisions and determination, execution and evaluation of indicators of monitoring estimation. For a specific airline, analyzing problem is done by using rationalized stages accordingly.

For example in aviation there is lots of factors to pay attention before making decision of opening new flights between two cities. for checking all this factors in aviations filed there is used different programs, which helps collecting data about passenger flow, airline capacity, airport slots and economic stability in counters and some other factors. unity of this factors gives the result of making final decision and consider the risks in new decision.

References

1. Holsapple C. ,Whinston A. Decision Support systems. - West Pub. Co., 1996.
2. Shibl R., Lawley, M. and Debusse, J. Factors influencing decision support system acceptance. *Decision Support Systems*, 2013, 54(2). - P.953-961.

NEW METHODS OF OPERATING SOCIAL STRUCTURE BY THE MEANS OF INFORMATION TECHNOLOGIES

Manana Karkashadze

Akaki Tsereteli State University, Georgia

manana.qarqashadze@gmail.com

To operate any kind social structure, is accompanied by operating agency and exchanging information between social groups entering in structure membership. Development of information technology created possibility of usage intellectual and technical potential for organizing operating process. Operating is not so technical process, as social. In any field successful implementation in operating new technologies depends on, how professional is management and how are the participants ready to use newest technologies. New technologies effect on image of society as well as on operating system. Particularly, systemic connection with society that enters in structure, which means feedback to operating agency and operated subject, enables their self-organization and development. Mentioned process is vital for educational institutes. Operating is real by the means of information technologies, if society has proper culture and intelligence. Information technology, in our particular case, is the powerful resource for private school to operate perfectly. Two problems come out: first, high professional competence and required abilities while using information technologies; second, providing high quality hardware based and software based support of operating technologies. Their agreement enables for functioning educational structure to solve social, juridical and educational issues, those are mainly based on development and usage of information technologies. On the one hand at school methodological planning is determined as much as it is possible. Particularly, to analyze activity, aims, planning, determination of necessary information, decision forming, results monitoring and estimation, registration and usage of changes and on the other hand providing support of automated computer system. Electronic access of organization documents, necessary documents ad assignment is progressive product, that increase structure functioning and is based on using information technologies.

STREAM OF INFORMATION DELIVERED BY INFORMATION TECHNOLOGIES AND ABILITY OF PERCEIVING

Manana Karkashadze

Akaki Tsereteli State University, Georgia

manana.qarqashadze@gmail.com

According to research that shows human's ability of perceiving and remembering information, process of mastering and its mechanism, we conclude that person's ability of perceiving and receiving information is limitless. The speed of these processes has not undergone great changes over the centuries. Particular cases may be admitted, however expansion of this factor, is not available for everything. Modern researchers in such issues changes earlier conservative evaluations. For instance, according to American scientists in Neurology Terry Sejnowski and Kristian Harris, unlike this viewpoint memory size in human is 10 times more and equals about Pbps [1]. I consider that, technical information is meant here, however in this case this number is impressive. The more is stream of information, the more increases volume of analyzing information by person, and the more increases this one, the more increases stream of information and velocity of growth. If person manages to receive knowledge by the reason of information, no time and area is left for him to use it, whereas more and more new functions are used by information technologies concerning to supply stream of information. When person's brain is not able to adopt exceeded information, problem of information overloading arises, that covers different issues. Resistance arises between stream of information and the user. [2] Information is useful, when human controls it. Characteristics, which are connected with overloaded information differs in specific sphere. I consider that, concomitant of information technologies should be connected with limited usage of aspect of psycho-physiological influence on information and uncontrolled impact, because developing of its positive aspects are accompanied by negative results, which will concern each member of society.

References:

1. Kristen M Harris, Terrence J. Sejnowski . Noconnectomic upper bound on the variability of synaptic plasticity, 2015.
2. Eliakov A. Information overload of people. – Camara, 2005.-125 p.

SYSTEMS OF LOGICAL REASONING IN LOGICS OF PARTIAL PREDICATES

Kasianiuk V.S., Malutenko L.M., Shkilniak O.S.

Taras Shevchenko National University of Kyiv, Ukraine

malutenko@gmail.com

The apparatus of mathematical logic gives an efficient way of solving of variety of problems in informatics and programming. While classical predicate logic is the most common basis for logical formalisms, it has some fundamental restrictions not allowing to deal sufficiently with structuredness, incompleteness and partiality of information. Thus it becomes important to introduce new program-oriented logical formalisms. One of them is composition-nominative logics of partial quasiary predicates [1–3] based on wide classes of partial mappings over nominative data.

Effective reasoning may be a key part of many information systems. Sequent calculus is an efficient Gentzen-style deduction system. Sequent calculi are a formalization of logical consequence which is one of the central concepts of logic. A refinement of this concept as logical consequence relations for logics of partial predicates was introduced in [1]. Properties of logical consequence relations for sets of formulas are a semantic basis for calculi of sequent type.

In this paper we propose sequent systems for logical reasoning for pure first-order composition-nominative logics of partial quasiary predicates. The systems are constructed for various logical consequence relations for logics of partial single-valued and multi-valued predicates. For the constructed calculi the soundness and completeness theorems are proved. Proofs of the soundness theorems are based on the theorems about counter-models for sets of formulas of an unclosed path in a sequent tree. We prove the latter theorems using model (or Hintikka) sets.

References

1. Nikitchenko M., Shkilniak S. Applied Logic. Kyiv: Publishing house Kyivskiyi Universytet, 2013. - 278 p. (in ukr.).
2. Nikitchenko M., Shkilniak O., Shkilniak S. First-order composition-nominative logics with generalized renominations. In Problems in Programming. – 2014. - № 2–3. – P. 17–28 (in ukr.).
3. Nikitchenko M., Shkilniak S. Semantic Properties of Logics of Quasiary Predicates.// Proceedings FOI-2015. Chisinau, Moldova. – 2015.- P.198–211.

BIG DATA ANALYTICAL TECHNOLOGY TO IDENTIFY THE DISEASES

Davit Kharaishvili, Badri Meparishvili, Gulnara Janelidze

Georgian Technical University, Georgia

davit.kharaishvili@gmail.com

New medical analytics platform unlocks the wealth of knowledge from patient electronic health records and provides actionable solutions to help clinicians be more effective and improve patient outcomes. The big data analytics concept plays a pivotal role in the evolution of Health care practices and research. It has provided tools to accumulate, manage, analyze and assimilate large volumes of disparate, structured and unstructured data produced by current healthcare systems [1]. Big data analytics has been recently applied towards aiding the process of care delivery and disease exploration. However, the adoption rate and research development in this space is still hindered by some fundamental problems inherent within the big data paradigm. In this paper, we discuss some of these major challenges with a focus on three upcoming and promising areas of medical research, where the concepts of big-data analytics are currently being applied.

1) Image processing. Medical image data (computed tomography, magnetic resonance imaging, X-ray, molecular imaging, ultrasound, photoacoustic imaging, fluoroscopy, positron emission tomography computed tomography, mammography) can range anywhere from a few megabytes for a single study (e.g. an histology image) to hundreds of megabytes per study. Such data requires large storage capacities, fast and accurate algorithms if any decision assist automation were to be performed using the data. In addition, prognosis and treatment processes, then the problem of providing cohesive storage and developing efficient methods capable of encapsulating the broad range of data becomes a challenge.

2) Signal processing. Medical signals also pose volume and velocity obstacles especially during continuous, high-resolution acquisition and storage from a multitude of monitors connected to each patient. However, physiological signals also pose complexity of a space-time nature. Analysis of physiological signals is often more meaningful when presented along with situational context awareness which needs to be embedded into the development of continuous monitoring and predictive systems to ensure its effectiveness and robustness. Currently healthcare systems use numerous disparate and continuous monitoring

devices that utilize singular physiological waveform data or discretized vital information to provide alert mechanisms in case of overt events.

3) Genomics. The cost to sequence the human genome is rapidly decreasing with the development of high-throughput sequencing technology [2,3]. With implications for current public health policies and delivery of care [4,5], analyzing genome-scale data for developing actionable recommendations in a timely manner is a significant challenge to the field of computational biology.

Health care decision makers need easy access to trend data, in real-time, to make quicker decisions that optimize resources and patient care. Everyone agrees that the future of medicine is personalized. The scientists are building a scalable genomics platform to embark on the era of truly personalized medicine.

Using big data analytical technology it has discovered a way to identify the diseases earlier than physicians currently do. The solution requires looking at the human body's data the same way you would collect sensor data from a missile traveling at mach speed – as continuously changing signals.

All the three areas of interest: medical image analysis, physiological signal processing and integration of physiological data with genomic data come to conception of DNA Microarray sequencing analysis as the human genome image recognition problem. DNA microarray technology allows rapid identification of the level of expression of thousands of genes in a tissue or organism, all on a single slide.

In this paper, a particular scanned images of DNA microarrays analysis problem, is investigated using this Bayesian approach [6]. We have proposed a Bayesian base calling solution to the hidden Markov model of microarray slides. We have developed an algorithm to estimate the sequence of bases in the presence of unknown system parameters. The proposed method reduces the training overhead, using the Markov model. Further possible performance improvements can be achieved by appropriately redesigning the Markov model to incorporate the anomalies that arise in microarray slide data.

References

1. Ashwin Belle, Raghuram Thiagarajan, S.M.Reza Soroushmehry, Fatemeh Navidi, Daniel A. Beard and Kayvan Najarian, Big Data Analytics in Healthcare. ARTICLE in BIOMED RESEARCH INTERNATIONAL, JANUARY 2015, <https://www.researchgate.net/publication/279198958>.

2. Eric S. Lander, Lauren M. Linton, Bruce Birren, et al. Initial sequencing and analysis of the human genome. Nature, 409(6822):860_921, Feb 15 2001. Date revised 2013-05-01; Last updated 2013-09-25.
3. Radoje Drmanac, Andrew B. Sparks, Matthew J. Callow, et al. Human genome sequencing using unchained base reads on self-assembling dna nanoarrays. Science, 327(5961):78-81, 2010.
4. Timothy Caulfield, Jim Evans, Amy McGuire, et al. Reflections on the cost of "low-cost" whole genome sequencing: Framing the health policy debate. PLoS Biol, 11(11):e1001699, 11, 2013.
5. Dewey FE, Grove ME, Pan C, et al. Clinical interpretation and implications of whole-genome sequencing. JAMA, 311(10):1035-1045, 2014.
6. Karl Fraser, Zidong Wang, Xiaohui Liu, Microarray Image Analysis: An Algorithmic Approach, by Taylor and Francis Group, LLC Chapman & Hall/CRC is an imprint of Taylor & Francis Group, ISBN 978 1 4200 9153 3, 2010.

LIMITED GENERATOR OF RANDOM EVOLUTION IN THE ASYMPTOTIC SMALL DIFFUSION SCHEME

¹Khimka U.T., ²Chabanyuk Ya.M., ¹Swez O.I.

¹National University "Lviv Polytechnic", Ukraine

²Lublin University of Technology, Poland

yaroslav.chab@gmail.com

Consider random evolution with diffusion perturbation defined by stochastic differential equation[1,2]

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

Limited evolution has a representation

$$du(t) = C(u(t))dt + \sqrt{\delta}\sigma(u(t))dw(t), \quad \text{where } C(u) = \int_X C(u, x)\pi(dx) \quad \text{and}$$

$$B = 2 \int_X C_0(x)R_0C_0(x)\pi(x), \quad B = \sigma^* \sigma.$$

Balance condition holds $\int_X C_0(x)\pi(dx) \equiv 0$.

The random evolution (1) is defined by the generator

$$L^{\varepsilon, \delta}\varphi(u, x) = [\varepsilon^{-3}Q + (\varepsilon^{-1} + \delta^{-1})C_0(x) + C(x)]\varphi(u, x).$$

Lema. Solution of singular perturbation problem [2] for generator $L^{\varepsilon, \delta}$ on perturbed test-function

$$\varphi^{\varepsilon, \delta}(u, x) = \varphi(u) + (\varepsilon + \delta)\varphi_1(u, x) + \varepsilon^3\varphi_2(u, x),$$

where $e/d \rightarrow 1$, has form $L^{\varepsilon, \delta} \varphi^{\varepsilon, \delta}(u, x) = L^{\delta} \varphi(u) + \theta_L^{\varepsilon}(x) \varphi(u)$, where limited generator L^{δ} is determined from relation

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

and residual term $\theta_L^{\varepsilon}(x)$ is defined by the ratio

$$\sup_{x \in X} \theta_L^{\varepsilon}(x) \varphi(u) \rightarrow 0, \varepsilon \rightarrow 0.$$

References

1. O.I.Kiykovska. Random evolution in a scheme of asymptotically small diffusion with markov switchings / O.I.Kiykovska, Ya.M.Chabanyuk // Cybernetics and Systems Analysis. – 2013. – Том 49, №2. – P. 303-308.
2. V. Koroliuk and N. Limnios. Stochastic Systems in Merging Phase Space. World Scientific Publishing, 2005.

ASYMPTOTIC DISSIPATIVITY CONDITIONS OF THE GENERALIZED LORENZ SYSTEM

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

¹National University "Lviv Polytechnic", Ukraine

²Lublin University of Technology, Poland

anastasiakinash@gmail.com

Considering the model of city system, which is described by the generalized Lorenz model with diffusion term and Markov switching[1]

$$\begin{aligned} dX / dx &= a_1(a_2Y - a_3X), dY / dx = b_1(b_2X - b_3Y) - b_4XZ, \\ dZ / dx &= c_1XY - (c_2 + x(t)c_2)Z + \sigma(X, Y, Z)dw(t), \end{aligned} \quad (1)$$

where X - the volume of products manufactured by the city system; Y - the number of indigenous people; Z - land rent, $x(t), t \geq 0$ - Markov process[2], $\sigma(X, Y, Z)$ - diffusion, $w(t)$ - Wiener process.

The asymptotic system for (1) has form

$$\begin{aligned} dX / dx &= a_1(a_2Y - a_3X), dY / dx = b_1(b_2X - b_3Y) - b_4XZ, \\ dZ / dx &= c_1XY - c_2Z \end{aligned} \quad (2)$$

which is dissipative.

Lyapunov function for the system (2) is taken in the form

$$V(X, Y, Z) = X^2 + Y^2 + Z^2.$$

The asymptotic dissipativity conditions have representation

$$\begin{cases} A_1 < 2a_1a_3, \\ A_1 \leq a_1a_3 + b_1b_3 - \sqrt{(a_1a_3 - b_1b_3)^2 + (a_1a_2 + b_1b_2)^2}, \\ b_4 \geq c_1, \\ A_1 \leq 2c_2, \end{cases}$$

where $A_1 > 0$ - const.

References

1. Beliauskii S.S. Generalized model of city system (generalized Lorenz system). / S.S. Beliauskii, T.A. Orlianin // 3rd international scientific conference “Mathematical modeling and differential equations”: articles collection of 3rd international scientific conference. Brest, September, 17–22, 2012. – Minsk: BHU, 2012. – P. 70-78.
2. Korolyuk V.S. Stochastic Systems in Merging Phase Space/ Korolyuk V.S., Limnios N. – :World Scientific Publishing, 2005. – 330 p.

METHODS FOR OPTIMAL CONTROL OF DISTRIBUTED PARAMETER SYSTEMS AND APPLICATION TO TRANSIENT THERMOELECTRIC COOLING

¹Kotsur M., ²Nakonechniy O.

¹Yuriy Fedkovych Chernivtsi National University, Ukraine

²Taras Shevchenko National University of Kyiv, Ukraine

mpcc@chnu.cv.ua

A large variety of optimization problems is related to distributed parameter systems (DPSs), whose behavior is described by partial differential equations. Many distributed objects, phenomena and processes in physics and engineering can be simulated as DPSs. An efficient operation of such systems is provided by solving optimal control problems, whose results are optimal control functions.

Solving optimal control problems for DPSs is a nontrivial task, which essentially depends on the type of partial differential equations, the boundary conditions for these equations, the cost functional, and control inputs. The boundary conditions for practical applicable DPSs often have nontrivial form. They may contain partial derivatives, control functions, etc. The complexity of DPS optimization problems does not allow one to develop a unified approach to solve them. The individual methods should be used.

An example of DPS is a process of transient thermoelectric cooling described by the parabolic equations with the boundary conditions specified by the physical model of the thermoelectric

converter and the mode of its operation. Two methods to solve the optimal control problems of transient mode of the thermoelectric cooler are described in [1,2]. The first one is the variational method [1] which gives the necessary conditions of optimality. The second method consists in sampling the object and moving to the lumped parameters system, which is used to optimize the Pontryagin maximum principle [2].

Examples of computer modeling of optimal control functions for transient thermoelectric cooling process are given in [1,2]. These functions can be used in the construction and auto-calibration PI and PID controllers for the automatic process control of transient cooling in the thermoelectric devices for different purposes.

References

1. Kotsur M. Mathematical modeling and optimization of transient thermoelectric cooling process // Optimal Control of Distributed Parameter Systems with Application to Transient Thermoelectric Cooling Advances in Electrical and Computer Engineering, 2015. - V.15, N2. - P.117-122.
2. Kotsur M.P. Mathematical modeling and optimization of transient thermoelectric cooling process //Technology Audit and Production Reserves. – 2016. - V.1/2(27). - P.29-34.

STOP LOSS AND STOP BUY CALCULATION BASED ON STOCKS DATA

Kotsiuba I., Yeleyko Y.

Ivan Franko National University of Lviv, Ukraine

kotsiuba@hotmail.com

Many investors struggle with the task of determining where to set their stop loss levels. Investors don't want to set their stop loss levels too far away and lose too much money if the stock moves in the wrong direction. On the other hand, investors don't want to set their stop loss levels too close and lose money by being taken out of their trades too early.

Rather than continuously monitor the price of stocks or other securities, investors can place a limit order or a stop order with their broker. These orders are instructions to execute trades when a stock price hits a certain level. A limit order is used to try to take advantage of a certain target price and can be used for both buy and sell orders. A limit order instructs the broker to trade a certain number of shares at a specific price or better [1, 2].

Stop loss and stop buy levels are very important for traders and we should be able to distinguish where to set them. A too tight or too wide stop loss or stop buy can be easily triggered even when we choose the right direction. Therefore, we propose the strategy how correctly to choose stop loss and stop buy levels based on historical data.

References

1. <http://www.fxkeys.com/interpreting-trend-lines-in-forex-trading>
2. <http://www.learningmarkets.com/how-to-determine-where-to-set-a-stop-loss>

SCIENTIFIC AND APPLIED PRINCIPLES OF CREATING UNITED NATIONAL SYNCHROINFORMATION SYSTEM

¹Koval V.V., ²Velichko O.N., ²Golovnia M.V., ¹Dorogobed V.V.,
¹Kalian D.O., ³Shkliarevskyi I.Y.

¹National University of Life and Environmental Sciences of Ukraine

²SE "Ukrmetrteststandard", Ukraine

³VAT "Information service technologies", Ukraine

v.koval@nubip.edu.ua, ermatec@ukrcsm.kiev.ua, ish@ist.net.ua

Rapid development of national science and technology, considering world economy globalization, is characterized by intensive use of reference values of timeline and frequency that serve as the basis to synchronous functioning of high technology systems and hubs.

Information and telecommunication systems, that use digital technologies, are based on precise measuring and synchronizing of time intervals. Quality of service of modern information services strictly relies on parameters and characteristics of synchronization. Ability to scale, collaborate and integrate in to other countries and continents systems also depends on it [1].

Here is list of national objects that demands synchroinformation: power supply systems, telecommunications, metrology, digital TV, billing, aviation and railway, oil and gas pipelines, agriculture, environmental protection and other industries. In addition, importance of receiving exact time reference signals for services and networks of special purpose, which solve national security problems, should be mentioned. Existence of own system for providing high precision time and clock signals and systems for distributing synchroinformation is a measure of high technological development of the state.

Synchronization quality depends on synchroinformation transportation inside the country that is provided under uncertainty.

Time signal transportation with precision from nanosecond fractions to several microseconds can be made digital telecommunications can be done by using telecommunication networks using clock signals, for instance, of 2,048 MHz frequency.

Distributing synchroinformation signals in new but already occupying leading positions batch transportation environments (Ethernet, IP/MPLS), it makes sense to implement both transferring reference timescale of national standards (primary and secondary) and frequency to consumers. Today, the most widely used way to solve mentioned problem is transferring timescale via packet-switched networks basing on precision time protocol PTP that was developed according to international IEEE-1588 standard.

Transferring synchroinformation using that approach also allows to implement clock-phase synchronization in digital telecommunication networks and becomes basis for creating national network that provide synchroinformation services, for instance, electronic signature validation service, controlling remote frequency standards that require no periodic calibration so on.

Effective way to solve the problem on national level can be creating United national synchroinformation system of Ukraine (UNSS) [2]. For practical implementation and achieving the goal modernization of system for transferring timescale according to PTP protocol (IEEE-1588) was done [2]. Implementation and deployment of group standard of time and frequency units are planned for SE "Ukrmetrteststandard" company with reserving operating frequency (to achieve reliability, stability and continuity of time and frequency signals). In addition, modernization of system for external verification using the extended range of satellite navigation systems (GPS, GLONAS, GALILEO, SAVAS(EGNOS)) is supposed. Preparing proposals to current legislation on time and frequency provisioning, synchronization signals usage, national exact timescale and united Kyiv accounting and reporting time are done inside Ukrainian borders.

References.

1. Borsch V.I., Karlash S.D., Koval V.V., Korshun E.I., Kostik B.I., Tumanov I.G. Problems of creating united national synchronization network // Communication. – 2004. – № 6(50). – P. 15-19.

2. Koval V.V., Kostik B.I., Sukach G.O. Conceptual basis for constructing united national synchroinformation network of Ukraine / Scientific notes of URIO. – 2010. – №1 (13). – P.5-13.

3. Shkliarevskyi Igor, Golovnya Milentiy. “IEEE 1588 Protocol based National Time-scale Transfer Application in Ukraine”, International IEEE Symposium on Precision Clock Synchronization for Measurement Control and Communication (ISPCS), September 22-27, 2013. - P.120.

THREE STEP METHOD WITH MEMORY BASED ON METHOD CHORD FOR SOLVING SYSTEM OF NONLINEAR EQUATIONS

Kovalchuk O.

Ivan Franko National University of Lviv, Ukraine

olyak2005@gmail.com

Consider the system of nonlinear equations

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

For solving system (1) we can use method chord

$$x_{k+1} = x_k - P(x_k, x_{k-1})^{-1} P(x_k), \quad (2)$$

where $P(x_k, x_{k-1})$ is divided difference.

We propose next three-step method with memory based on method (2)

$$x_1 = x_0 - P(x_0, x_{-1})^{-1} P(x_0)$$

$$u_k = x_k - P(x_k, x_{k-1})^{-1} P(x_k), \quad (3)$$

$$v_k = x_k - \beta_k P(x_{k-1}, x_{k-2})^{-1} P(x_k),$$

$$x_{k+1} = \arg \min_{\lambda} \|P(u_k + \lambda(v_k - u_k))\|,$$

where β_k such as $\|P(v_k)\| < \|P(x_k)\|$.

We prove convergence of method (3). Using proposed method helps us reduce the calculating time for finding the solution of the system comparing with method (2). In many problems, we have done numerical research of proposed method and method chord, and comparison of results was made. From numerical experiments, we show that three-step method is very efficient when Jacobian is a singular and large dimension. Using method (3) allows minimizing computing for solving systems of nonlinear equations.

INTELLIGENT DECISION SUPPORT SYSTEM FOR PRODUCTION SCHEDULING IN PAPER INDUSTRY

Kozlov P.V.

National Technical University of Ukraine “Kyiv Polytechnic Institute”

kozlov.pavlo@gmail.com

In the paper industry may increase profits by reducing the amount of waste paper or cardboard, and by optimum planning of production orders and storage.

The main stages for optimization are production planning and machines scheduling.

When planning the cutting of the paper reel to the rolls of finished product planner works with a lot of background information about the order - the width, diameter, weight, grade, density, type of packaging etc.

The use of intelligent decision support systems for planning production and cutting rolls allow a person to handle the large amount of background information and to make an optimal production plan for different types of machines.

This will be possible if the system allows for periodic characteristic of paper production and storage costs of products in stock.

Therefore, the mathematical model and objective function for intelligent decision support system for the production of paper, should allow for options such as the execution of the order and number of products made out of order:

$$\begin{aligned}y_1 &= f(u_1, u_2) \rightarrow \min \\y_2 &= f(u_1) \rightarrow \min\end{aligned}\tag{1}$$

Where u_1 - number of rolls taken to cutting; u_2 - the number of knives changes.

The objective function for scheduling cutting will be:

$$J = a_1 u_1 + a_2 u_2 + c_1 y_1 + c_2 y_2 + d_1 (y_1 - y_1^t)^2 + d_2 (y_2 - y_2^t)^2\tag{2}$$

where a_1 - the cost of a roll; a_2 - the cost of simple machines; c_1 - the cost of all the order; c_2 - the cost of unordered rolls; d_1 - losses from failure of the order; d_2 - the cost of warehousing;

The proposed objective function considers orders production and storage costs of goods in the warehouse. Optimizing this function allows to create a plan with maximum output capacity utilization and reduce storage costs of finished goods in stock.

SYSTEM FOR AUTOMATED OF SIGN LANGUAGE TRANSLATION

Krak Iu., Kasianiuk V.

Taras Shevchenko National University of Kyiv, Ukraine

krak@unicyb.kiev.ua

Humanization of social processes makes actual the problem of creation of automation and more flexible algorithms that would help to create new computer systems for the deaf people training and communication. The solution is based on the concept of the deaf non-verbal communication information technology. The aim of this work is to create automated translation system from Ukrainian natural language to the language of signs. Implementation of automated translation involves the creation of set-theoretic model of Ukrainian language [1] using it as opportunity for modeling relevant related usual and sign languages. The system is based on a grammatical structure of simple sentences which are to be grouped appropriately by topics that arise in everyday life. The sentences in the statistical database are integrated into the structures obtained by synthesis. The structures of sentences contain rather than words sequences of them, each of which can be used constructing the sentences. The sequences can contain separate words and various sets of words. For example, the sentence "he goes", "she goes", "time goes" are united in one structure "{he, she, time, ...} goes". Such sequences can be changed and supplemented during translation. Similar structures are built for the sign sentences. To build grammar structures authors have taken the set of sentences from the program of Ukrainian sign language specialized schools. The results obtained have covered the possible sentences on topics and words-signs vocabulary for the full-scale school program. The system contains around 3000 sentences (on 20 topics) and covers school program vocabulary. About 300 general structures are obtained. Subsequent studies are intended to complement the system with more sentences (from everyday life for different age and professional groups), which will provide synthesis of model clauses set enough for everyday communication.

References

1. Krak Iu.V., Barmak O.V., Romanyshyn S.O. The method of generalized grammar structures for text to gestures computer-aided translation // Cybernetics and Systems Analysis. – 2014. - Vol. 50, Is. 1. - P.116-123.

SUCCESS OF CHINESE ECONOMICAL REFORMS

Natalia Kvachadze

Georgian Technical University, Georgia

natalie.Kv@gmail.com

Before the Chinese government introduced economic growth reforms led by Deng Xiaoping, in 1979, the average annual real gross domestic product (GDP) growth rate in China was estimated at 5.3% (from 1960 to 1978). Since China has shifted from a centrally planned to a market-based economy, country has experienced rapid economic and social development. GDP growth has averaged nearly 10 percent a year, the fastest sustained expansion by a major economy in history. China has lifted more than 800 million people out of poverty and recently became the second largest economy and is increasingly playing an important and influential role in the global economy. Asian leaders view China's economic growth as an "engine of growth for all Asia".

The success of China's economic policies and their implementation has resulted in immense changes in Chinese society, it minimized poverty and the living standards for everyone in China has drastically increased in comparison to the pre-reform era, while incomes and income inequality have increased, which is attributed to the disappearance of the welfare state and differences between coastal and interior provinces. The Chinese government faces numerous economic challenges, including: reducing its high domestic savings rate and correspondingly low domestic demand; sustaining adequate job growth for tens of millions of migrants and new entrants to the work force; reducing corruption and other economic crimes; containing environmental damage and social strife related to the economy's rapid transformation.

Thanks to years of rapid development, China has laid a solid material foundation, and its economy is hugely resilient and has enormous potential and ample room for growth. The set of policies already adopted, emphasized the need for continued economic reforms and the need to increase domestic consumption in order to make the economy less dependent on exports in the future. This year government will carry out policies to ensure that the economy performs within an appropriate range. Including more tax cuts, incentives for specific industries, regulatory reforms and more aid to lift people out of poverty. The government will continue supply-side reform to streamline the government's administrative power over business and to provide policy-

level convenience for private entrepreneurs. By unifying the pension, social security and housing systems, people will no longer be discriminated against because of their job or their origins. Reform of the residence system allows migrants to apply for residence permits if they fulfill some reasonable conditions, giving them equal access to education, employment services and healthcare, wherever they choose to live. As an important developing country, China has long been committed to pushing forward the global climate talks and has kept its promises to emission reduction, playing a key role in fighting global warming. China's economy will still grow, it has entered a “new normal” of slower, but more stable and sustainable, economic growth shifting from fast quantitative expansion to a stage of pursuing higher quality and efficiency, maintain medium-to-high growth rate of between 6.5% and 7%.

Countries around the world are looking forward to a much stronger relationship with China to share more dividends from the Asian giant's reform and development.

References

1. China's Economic Rise: History, Trends, Challenges, and Implications for the United States . Wayne M. Morrison .Specialist in Asian Trade and Finance October 21, 2015.
2. Report on the Work of the Government. <http://news.xinhuanet.com>.
3. The Chinese Path and The Chinese Dream. By Li Junru.
4. Economic Structure of China.
5. http://www.economywatch.com/world_economy/china/structure-of-economy.html

ESSENCE AND TASKS OF DECISION-MAKING IN THE REGIONAL ECONOMIC SYSTEMS' MANAGEMENT

Alexander Kviralashvili

Georgian Technical University

aleksandre_ake@mail.ru

The regional economy management is a social-economic, process-oriented and coordinated impact, which provides the normal conditions and vital functions for the region and population. The region's function and development management means the coordinated action for decision-making and its complex implementation.

The main point of our report is about the decision-making based on the use of the region's all potential possibilities, such as human and

natural-unnatural resources, industrial, agricultural and other scientific-technical potential.

The research object was the Region of Kakheti. The goal of the research was to define the region's peculiarities, functional and development necessities, the society's complex interests, management tasks and their priorities, decision-making formation and implementation ways and methods.

We have conducted the analysis of the potential of the Region of Kakheti. We have worked out the region's development strategic plan and the conception of its implementation. The conception includes the complex programs, region's development and function budget and its realization methods.

According to the current management principles and criteria, we review the different directions of the regional economy management and decision-making, such as democratic management (transferring the most of the management's state function from center to the regions); authoritarian management (authorities, responsibilities and control are mainly oriented on the center); coordinated management; subordinated management (strict administration subordination)' functional management (management with the branch bodies); administrative management (management by senior managers to control the subordinates; based on the relationship between the government and subordinates).

In the condition of the management functions democratization, the mechanisms of ratio motivation of decision-making and economic-administrative management methods are changed.

In the regional economy, the administrative methods have the peculiarities; they are based on the specific-addressed tasks, and are depicted with the direct impact on the managed objects. The main responsibility of the decision-making is on the management body.

All the above-mentioned directions have the trivial character and presents the main direction of our research.

In the report, we have focused on the decision-making points, which are connected with the strategic, tactical and operative management. Therefore, we have defined the strategic objectives of the management and decision-making, targeted orients and region's economic tasks, internal and external management factors influencing on the regional economy for the tactical management, decision-making methods of the operative management for the realization of current issues.

In our work, we have reviewed the main methodological principles of the regional economic system management, such as a systematic character – all the elements of the economic system should function and be developed as an organically united system; complexity – complex development of the region; proportionality – the proportional development of region's economy by the regional management system. The implementation of this principle means to define the priority and main parts of the regional economy, which has impact on the whole region. Providing the priorities consider the appropriate and relevant development of all the rest directions of the region's economy, among them is providing the necessary proportion.

INNOVATIVE METHODS IN BINARY DIGIT SYSTEM OF COUNTING

Tamaz Lachashvili

Iakob Gogebashvili Telavi State University

Tamazi.L@rambler.ru

In computer systems any kind of text and graphic, audio and video files represent the most complex combinations of numbers one and zero shifting in specific order, which are written in appropriate register. There are a number of “traditional” methods of changing from counting Binary digit system into decimal system or vice versa, which are quite difficult and ineffective in terms of time. Below I will represent an innovative method with the help of which during the oral calculations the above mentioned operations can be done in seconds.

In order to change decimal up to ≈ 300 numbers (which are nine category numbers in binary system) into binary system, it is necessary to know by heart the relevant meanings of numbers in decimal system up to and including 18 and products of 16 including 18 in decimal system, after which we will be able to calculate orally.

The rule is as follows: we divide the number which should be transferred by 16 and we write the complete meaning of decimal number in binary system, then we write relevant binary meaning of the decimal remainder, considering four categories (e.g. remainder 3 in binary 11, will be written 0011), or we can subtract the product of less number and 16 from the number which should be changed, that we should know beforehand.

9 × 16 = 144	14 × 16 = 224
10 × 16 = 160	15 × 16 = 240
11 × 16 = 176	16 × 16 = 256
12 × 16 = 192	17 × 16 = 272
13 × 16 = 208	18 × 16 = 288

0 - 0	7 - 111	14 - 1110
1 - 1	8 - 1000	15 - 1111
2 - 10	9 - 1001	16 - 10000
3 - 11 B	10 - 1010	17 - 10001
4 - 100	11 - 1011	18 - 10010
5 - 101	12 - 1100	
6 - 110	13 - 1101	

For example, let's change the number 299 into binary system, we will have: 299-288=11, so we write the number relevant to 18 in binary 10010 and we write relevant to remainder 11 in binary system 1011. We will have 100101011.

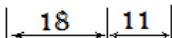
Let's change 182, we will have: 182-176=6, so we write relevant to 11 in binary 1011 and write 110 relevant to 6 considering four categories 0110, we will have 10110110.

We can change from binary system to decimal system in reversal method. To do this we should divide the number into categories, the formula will look like this:

$$(X)_2 = (A)_2 * 2^n + (B)_2$$

Where X- represents the number which should be changed into decimal system, A is the binary number according to the primary marked category, n- is the number of remaining categories after the primary marking, B- relevant number in binary system according to the marked n category

$$(100101011)_2 = (10010)_2 * (2^4) + (1011)_2 = 18 * 16 + 11 = 288 + 11 = 299$$

100010 1011


Where A=18, n=4, B=11

(the method of the above mentioned oral calculation is shown)

DIFFUSION AND GAUSSIAN PROPERTIES OF THE MULTI-CHANNEL STOCHASTIC NETWORKS

Lebedev Eugen, Chechelnitski Alexander, Livinska Hanna

Taras Shevchenko National University of Kyiv

leb@unicyb.kiev.ua, alex_che@voliacable.com

livinskaav@gmail.com

The object of our interest is a service process in multi-channel stochastic networks. It is a vector of large dimension with complex systems of stochastic relations determining the process. In previous works, as a rule, input flows were independent. Thus, interdependence of service process components was caused by trajectory intersections for information packets before their outputs from the network. In the paper we omit this restriction and the process of information treatment became more complicated.

That is why the method of functional limit theorems is especially efficient for the analysis of service process in stochastic networks under consideration. The method gives the possibility to find the principles which form the foundation of a functioning process for the network of the given type, to construct an approximative process and to calculate the distribution of functionals in order to obtain integral characteristics for the service process.

The service process in multi-channel stochastic networks with interdependent input flows are considered. In heavy traffic conditions functional limit theorems of diffusion approximation types are proved. Local characteristics of the diffusion are represented via network parameters.

References

1. Anisimov, V.V., Lebedev, E.A. Stochastic service networks. Markov models. - K.: Lybid, 1992. - 208 p.
2. Livinska A.V., Lebedev. E.A. A Limit Theorem for Multi-channel Networks in Heavy Traffic. // Cybernetics and Systems Analysis, 2012, No. 6. - P. 106-113.
3. Livinska H.V., Lebedev E.O., Conditions of Gaussian non-Markov approximation for multi-channel networks // Proceedings of the 29-th European Conference on Modelling and Simulation ECMS-2015. – Albena (Varna), Bulgaria, May 26-th – May 29-th. ISBN: 978-0-9932440-0-1 – 2015. – P. 642-649.

CONTROL SYSTEMS WITH NEURO-INFORMATION SUBSYSTEM OF DECISION MAKING

Lysenko V., Dudnyk A., Komarchuk D.

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

Biotechnological objects primarily include poultry farms and greenhouses. Both areas except technology and process equipment (technical facility) have biological filling (chicken, plants). Each of these biotechnical objects characterized by a significant energy consumption. So for poultry in the cost structure of production, the share of energy is up to 20 %, and for greenhouse plants - up to 70 %.

With rampant increasing of energy prices is important to use control algorithms of electrotechnical complexes which accompany appropriate technology, taking into account the biological filling state and maximize production profit primarily by reducing energy costs. The intelligent control systems of electrotechnical objects are able to form such algorithms, which use the theories of stochastic processes, neural networks, game theory and statistical decisions, etc.

These circumstances are explained by the fact that the management policy of electrotechnical complexes implement stabilization modes designed to maximize performance.

Taking the observations by the external temperature during 2010, dividing them quarterly, a package of applied mathematics program "Statistica" synthesized and configured Kohonen neural network with the mean error of 0,13 °C. Sample of energy efficient control system of electrotechnical complex in greenhouses for production testing is implemented on the basis of natural disturbances forecasting using stochastic processes and neural networks [1].

For example, the control system of growing vegetables in greenhouses allows to provide the highest profit from the sale of products and to minimize energy costs by implementing additional unit for neural network prediction of external disturbances and determine the control actions using generalized optimality criterion.

References

1. Lysenko V. Greenhouse Environment Control System With Neural Network Predictions of External Disturbances / V.Lysenko, V.Reshetyuk, V.Shtepa, A.Dudnyk // XXII International students scientific conference "Contemporary aspects of production engineering", 22 may 2013. Warsaw, Poland. – P. 40-52.

ON ONE HYBRID MODEL OF A SCHEDULE THEORY PROBLEM

Makhno M., Apanasenko D.

Taras Shevchenko National University of Kyiv, Ukraine

mikhail@makhno.kiev.ua, diminio7@gmail.com

The paper considers one scheduling theory problem that might be solved by the methods of mathematical programming. This problem may lead under additional conditions to the need of the parameter's dynamics consideration in order to find out the optimal solutions.

A temporal nature of the schedule theory problems refers them to a special class, which differs significantly from the volumetric economical problems. Unlike the economical problems, where an answer of the question about numbers or volume of production is needed, the problems of scheduling theory should determine the order of works execution in view of their importance or complexity [1].

It should be noted that the presence of additional parameterized conditions, which may have dynamic character, affects on the final result of the schedule evaluating. It leads to the need of the hybrid models development for the schedule theory problems and researching their possible solutions.

Let us consider the problem of organizing n jobs for 1 machine. The methods of mathematical programming may be used to solve this problem. Additional conditions may lead to a need of taking into consideration the problem parameters dynamics during the search of optimal solutions. Those parameters may have time limit or jobs order.

The presented problem thus may be represented as a two-criterion optimization problem with antagonistic criteria that can be solved by using various mathematical programming techniques or game theory methods.

A further consideration and formalization of jobs ordering process on the example of testing problem allows to get a hybrid model, which consists of an scheduling theory optimization problem and differential equation describing the changing dynamics of one of the optimization problem's parameter. The value of time remaining at the end of all test tasks resolving is considered as a criterion. The results of numerical experiment are presented.

References

1. Жданова Е.Г. Теория расписаний. – Москва, 2000. - 136 с.

MULTI-CRITERIA CAPASITY EXPANSION PROBLEM FOR ALTERNATIVE ENERGY SOURCES

Manovytska D.O., Halytsya Y. I.

Taras Shevchenko National University of Kyiv, Ukraine

galinadolenko2006@yandex.ru

A perspective direction for creating a reliable power supply, significantly improving the living conditions for people, environmental preservation by reducing the amount of harmful emissions, is the widespread use of alternative energy sources. Among these sources wind, solar and biomass power are primarily considered. The work presents multi-criteria model for structure choice of wind, solar and biomass capacity in the year t . We consider the following criteria: total generation:

$$u_w N_w(t) + u_s N_s(t) + u_b N_b(t) \rightarrow \max,$$

total investment cost for installed capacities of renewable power:

$$C_w(t)N_w(t) + C_s(t)N_s(t) + C_b(t)N_b(t) \rightarrow \min,$$

$$CO_2 \quad \text{emissions:} \quad e_w N_w(t) + e_s N_s(t) + e_b N_b(t) \rightarrow \min,$$

where: u_w, u_s, u_b – the annual utilizable hours per unit capacity, e_w, e_s, e_b – amount of CO_2 emissions per unit energy produced, $C_w(t), C_s(t), C_b(t)$ – unit investment cost in year t , $N_w(t), N_s(t), N_b(t)$ – cumulative installed capacity in year t .

The set of constraints from Renewable Power Optimization Model [1] is used to form the decision space. To solve the formulated multi-criteria optimization problem restriction method [2] is suggested.

References

1. Cong R.-G., Shen S. How to Develop Renewable Power in China? A Cost-Effective Perspective/R.-G.Cong, S. Shen //The Scientific World Journal Volume 2014, Article ID 946932. - 7 p.
2. Dolenko G.O. System optimization. Applied problems/G.O. Dolenko // Kiev, 2014. - 67 p. (in ukrainian)

THE SINGLE-PERIOD INVENTORY MODEL FOR VERTICALLY INTEGRATED FIRM

Manzhos T., Kulyk A.

Vadym Hetman Kyiv National Economic University, Ukraine

tmanzhos@kneu.edu.ua, ankulyk@kneu.edu.ua

Vertical integration can help companies to reduce inventory costs and improve efficiency by decreasing safety stock and transportation expenses, reducing turnaround time, among other advantages.

We consider a single-period inventory problem for vertically integrated firm which consists of two stages of production. Let Q is production capacity of the first stage (A) in a given period; p is the fraction of Q which is used as an input to a production process for the second stage of production (B). The amount $(1-p)Q$ of goods can be sold for a profit. Demand for the product at the first stage is a random variable with cumulative distribution function $F_2(x)$. The output pQ of production A are raw materials for the second stage of production process (B). Let pQk is production capacity of the stage B where k is considered a parameter defined by analysis of production technology. Demand for the product at the second stage is a random variable with cumulative distribution function $F_1(x)$. Let h_2 , d_2 and h_1 , d_1 are the unit holding costs and the unit shortage costs for stages A and B, respectively. We suppose these parameters are not dependent on time. The cost functions $u_2(\cdot)$ and $u_1(\cdot)$ (see, for example, [1]) of productions A, B, respectively, have been used for a model. The problem is to find the best production quantity Q and fraction p in terms of the cost minimization.

It is proved that the optimal strategy (Q^*, p^*) for the given inventory problem is a solution of the system of equations:

$$\begin{cases} F_2((1-p)Q) = \frac{d_2 - u'_2(Q)}{h_2 + d_2}, \\ F_1(pQk) = \frac{d_1 - u'_1(pQk) - u'_2(Q)/k}{h_1 + d_1}. \end{cases}$$

In case of some general conditions this solution exists and is unique.

References

1. Varian H. R. Intermediate Microeconomics: A Modern Approach (8th edition). – New York: W. W. Norton & Company, 2009. – 739 p.

COPING WITH UNCERTAINTY IN MEDICAL RESEARCH WITH HELP OF DECISION SUPPORT SYSTEM

¹Martsenyuk V.P., ²Andrushchak I.Ye.

¹University of Bielsko-Biala, Poland,

²Lutsk National Technical University, Ukraine

Medical system research require information support system implementing data mining algorithms resulting in decision trees or IF-THEN rules. Besides that such a 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 are used for qualitative analysis of diseases mathematical models. Algorithms such as decision tree induction and sequential covering algorithm are applied for data mining from learning data set.

Even without considering probabilistic nature of the most of quantities and parameters of information models we saw the complex qualitative behavior of diseases models depending on parameters and controllers

Here we would like to present our results in field of application of system analysis methods to problem of clinical medicine. We emphasize effects of uncertainty that should be taken into account in such complex systems. It will be shown that even considering deterministic models of such nonlinear systems we see different qualitative behavior closely dealt with parameters values. Nowadays there are obtained a lot of models describing physiological indices of human body at different diseases and treatment schemes. Primarily they are based on regression analysis. More complex ones use neural networks and evolutionary programming. The most significant attempts to construct mathematical models at different levels of hierarchy of human organism were made in [Murray, 1989], [Keener and Sneyd, 1998], [Marchuk, 1983]. Mackey and Glass investigated nonlinear phenomena applying dynamic systems and introduced notion of dynamic diseases. Without considering uncertainty all these models can be applied for patients from determined groups (primarily for given age and a lot of another restrictions).

Naturally there arises a problem to develop a general model for disease. It is incorrect to state that we managed offering unique universal algorithm to construct disease general model at whole. More correct is to say this approach can be used for diseases of different

nature. We believe this approach can be extended to processes in sociology and demography as well as for economy and finance branches tasks. A lot of them have the same nature as human diseases. Let's pay attention on special medical terminology necessary (as small as possible). First of all, the most recognized definition of disease states that disease is a set of pathologic processes weakening vitality and activity of a human organism. Here pathologic process is a set of pathologic (that is not normal) and protectoral reactions within human organism. That is, the most significant is modeling pathologic process.

Based on this reasoning we offered general model for pathologic process including three counterparts

(i) the *reason* or cause of disease (it may be some external factor (like bacteria, chemicals) or own modified cells (tumor cells);

(ii) *immune system* supports organism with help of specific antibodies (sort of predators) and plasmatic cells (their ancastors);

(iii) *normal cells*, tissues and organs (it is necessary to consider them to satisfy to some constraints of toxicity).

For these researches we used our own software - Software Environment for Medical System Researches (SEMSR). There is developed conceptual model of software environment of system medical investigations support.

References

1. Martsenyuk V.P., Andrushchak I.Ye., Gandzyuk N.M. Constructing exponential estimates in compartmental systems with distributed delays: an approach based on the hale-lunel inequality// Cybernetics and Systems Analysis. – 2013. - 49 (3). – P.347-352.
2. Martsenyuk V.P., N.M.Gandzyuk, Stability estimation method for compartmental models with delay, Cybernetics and Systems Analysis. - 2013. - 49 (1). – P. 81-85.
3. Martsenyuk V.P., Bagriy-Zayats O.A. Construction of Estimates of Solutions in the Model of Antitumor Immunity with Impulse Disturbances//Journal of Automation and Information Sciences. - 2013. - Vol. 45/10. - P.75-82.
4. Martsenyuk V.P., Andrushchak I.Ye., Kuchvara O.M. Method of Construction and Determination of Approximate Solutions of the Model of Pharmacokinetics of Nanoparticles// Journal of Automation and Information Sciences. – 2012. – Vol. 44/8. – P.32-43.

A GENERALIZATION OF THE CONCEPT OF CORE GAMES FOR FUZZY SET OF ALLOWED COALITIONS

Mashchenko S.O., Morenets V.I.

Taras Shevchenko National University of Kyiv, Ukraine

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

Cooperative game theory solves the problem of "equitable" distribution of profits among the players in case of their cooperation. In the case where not every group of players has the opportunity to cooperate, there is a cooperative game with restricted cooperation. In some cases it is also difficult to clearly define the allowed coalitions.

In this paper we consider the core of cooperative games with fuzzy set of the allowed coalitions. If we want to generalize to this case the concept of a kernel, we obtain the "fuzzy set" of irregularities, which can be formulated in this form:

$$\sum_{i \in N} x_i = v(N) \quad (1)$$

$$\sum_{i \in S} x_i \geq v(S), \quad S \in \tilde{\Omega}, \quad (2)$$

where the (2) should be understood in this way.

Let $F_S = \{x = (x_1, \dots, x_n) \mid \sum_{i \in N} x_i = v(N), \sum_{i \in S} x_i \geq v(S)\}$ – the set of

vectors x , which satisfying the constraint (2) for the coalition $S \in \Omega$. Then the (2) means that the set of admissible solutions of the system (1), (2) must be set as $\tilde{F} = \bigcap_{S \in \tilde{\Omega}} F_S$, where according to the [1] $\bigcap_{S \in \tilde{\Omega}} F_S$ – the intersection of fuzzy sets $\tilde{M}$ clear sets F_S , which is a fuzzy set of type 2.

The report covered a two-criterion task of search of a solution to epy (1), (2) and approach to obtaining approximate solution to this problem.

References

1. Mashchenko S. The problem of the mathematical programming with the fuzzy set of indexes of constraints. // Cybernetics and systems analysis. – 2013. - 49(1). - P. 62 – 68.

THE SINGLE-PERIOD INVENTORY MODEL WITH FUZZY TRIANGULAR DEMAND

Melnyk O.

Vadym Hetman Kyiv National Economic University, Ukraine

melnyk_olya@ukr.net

A single-period inventory model attempts to solve the problem of finding the optimal order quantity that minimizes the expected inventory costs.

The mathematical model presented in the study has the following assumption:

1. A single-period inventory problem is considered.
2. The considered problem is relevant for a new product. Expected demand is forecasted on the base of the Bass model [1] with taking into consideration a judgment of experts.
3. The following notation are used: s – purchase or production cost per unit; h – holding cost per unit; p – shortage cost per unit; Q – order quantity at the start of the period.

Let the expected value of demand be a triangular fuzzy number $\tilde{\lambda}$ with membership function $\mu_{\tilde{\lambda}}$:

$$\mu_{\tilde{\lambda}}(x) = \begin{cases} L(x) = \frac{x-a}{\Delta}, & a \leq x \leq b \\ R(x) = \frac{c-x}{\Delta}, & b \leq x \leq c \\ 0, & -\infty < x < a, \quad c < x < \infty \end{cases},$$

where Δ is determined by experts judgment, $\Delta = c - b = b - a$.

Then the expected fuzzy value of inventory costs model is $\tilde{L}(Q) = sQ + p \max\{0; \tilde{\lambda} - Q\} + h \max\{0; Q - \tilde{\lambda}\}$.

For defuzzification of $\tilde{L}(Q)$ the median method is used.

The algorithm for searching of the optimal order quantity that minimizes the expected inventory costs is developed in the study.

References

1. Bass F.M. A new product growth for model consumer durables. – Management Science, 1969. – V.15(5). – P. 215 – 227.

LEFT-CENSORED SAMPLES FROM WEIBULL DISTRIBUTION – STATISTICAL INFERENCE AND APPLICATIONS

Jaroslav Michalek¹, Michal Fusek²

¹ University of Defence, Czech Republic

² Brno University of Technology, Czech Republic

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

The problem of statistical analysis of left-censored samples from a skewed distribution using the maximum likelihood method is solved only partially, see e.g. Mitra and Kundu [J. Stat. Comput. Sim. (2008)], Fusek and Michalek [J. Stat. Comput. Sim. (2015)]. On one hand, the maximum likelihood approach can certainly be used when data are not normally distributed and the obtained estimates have good asymptotic properties. On the other hand, likelihood equations can be nonlinear, rather complicated, and it is often impossible to find their analytic solution. Moreover, it is difficult to determine Fisher information matrix which is necessary for description of asymptotic variability of obtained estimates.

This contribution focuses on type I left-censored skewed samples from Weibull distribution. A computational procedure for determination of maximum likelihood estimates of parameters of Weibull distribution will be described and the analytic form of the Fisher information matrix will be presented. Bias of the ML estimates of expected value and variance considering various sample sizes and levels of censoring is examined using simulations. Simulations are focused primarily on the properties of estimators for small sample sizes. Parameters of the simulated samples are chosen with respect to real environmental data. The asymptotic Wald's test for comparison of two independent multiply left-censored Weibull samples is given and its power function considering various sample sizes is analyzed. Derived methods are used for assessing the effectiveness of the wastewater treatment plant with respect to presence of musk compounds in fish tissue samples.

INVERSE PROBLEMS FOR LINEAR VARIATIONAL EQUATIONS WITH A PARAMETER UNDER UNCERTAINTIES

Nakonechniy O.

Taras Shevchenko National University of Kyiv, Ukraine

a.nakonechniy@gmail.com

Let H_+ and H_0 be two Hilbert spaces over the set of complex numbers $\mathbf{C}$ and H_+ be a densely and continuously embedded subspace in H_0 . We assume that H_0 is identified with its dual.

Let μ be a measure defined on σ -algebra $\mathbf{B}$ of subsets of a certain set T . Denote by H'_+ the space dual of H_+ and by $L^2(T_1, H'_+, \mu)$ the space consisting of all functions g defined on $T_1 \in \mathbf{B}$ with values in H'_+ such that

$$\int_{T_1} g(t)_{H'_+}^2 \mu(dt) < \infty.$$

Suppose that for each $t \in T$ a family of continuous sesquilinear forms $a(t, \varphi, \psi)$ on H_+ is given.

Suppose also that observations y_k of the form

$$y_k = \int_{T_1} (g_k(t), \varphi(t)) \mu(dt) + v_k + \eta_k, \quad k=1, N, \quad (1)$$

are given, where $T_1 \in \mathbf{B}$, $g_k \in L^2(T_1, H'_+, \mu)$ are known functions, $\varphi \in L^2(T, H_+, \mu)$ is a solution of variational equation

$$a(t, \varphi, \psi) = (B(t)f, \psi) \quad \forall \psi \in H_+ \quad (2)$$

at a certain vector f from a Hilbert space F , $B(t) \in L(F, H'_+)$, v_k and η_k are, respectively, certain unknown numbers and realizations of random variables.

Let $f \in G$ and $v = (v_1, \dots, v_N) \in V$, where G and V are some given sets in F and $\mathbf{C}^N$, respectively, and let η_k be a sequence of random variables for which $E\eta_k = 0$ and the numbers $E\eta_k \bar{\eta}_j = r_{kj}$ are known. An expression

$$\hat{f} = \sum_{k=1}^N u_k y_k + c, \quad (3)$$

where $c, u_k \in F$, is called a linear estimate of f .

The guaranteed mean square error of estimation has the form

$$\sigma(u, c) = \left\{ \sup_{G, V} E \left\| f - \hat{f} \right\|_F^2 \right\}^{1/2}, \quad (4)$$

where $u = (u_1, \dots, u_N)$.

Under the condition of well-posedness of problem (2), we investigate problems of finding the estimates that have minimal estimation error $\sigma(u, c)$. It is shown that for certain sets G and V such estimates are expressed via solutions of some special linear equations.

References

1. Nakonechniy O. Minimax Estimation of Functionals from Solutions to Variational Equations in Hilbert Spaces, Kiev State University, 1985. – 80 p. (in russian).

ESTIMATIONS OF SOLUTIONS OF BOUNDARY VALUE PROBLEMS FOR SECOND ORDER DIFFERENTIAL EQUATIONS UNDER UNCERTAINTIES

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 vector-function $\varphi(t) = (\varphi_1(t), \dots, \varphi_n(t))^T$ is generalized solutions of the following equation:

$$-\frac{d}{dt} A \frac{d\varphi}{dt} + B\varphi = f(t), \quad 0 < t < t_1, \quad (1)$$

with boundary condition

$$1) \quad \varphi(0) = 0, \quad \varphi(t_1) = 0, \quad (2)$$

in case then A - positive-definite matrix, B - positive semi-definite matrix, and

$$2) \quad \varphi(0) = \varphi(t_1), \quad \varphi'(0) = \varphi'(t_1), \quad (3)$$

in case of A and B - positive-definite matrixes.

It is assumed, that vector stochastic process realization in the form

$$y(t) = H_1 \varphi(t) + H_2 \xi(t) + \eta(t), \quad (4)$$

is observing on the interval $(0, s), s \leq t$, H_1, H_2 are defined matrixes with dimensions $N \times n$ and $N \times m$ respectively, $\xi(t)$ and $\eta(t)$ - realizations of uncorrelated continuously differentiable and continuous

stochastic processes, with $E\xi(t)=0, E\eta(t)=0$. Sets G_1, G_2, G_3 from functional spaces $L_2(0,1)$, $L_2(0,s) \times L_2(0,s)$, are also defined, $f(t) \in G_1$, correlation functions of processes $\xi'(t)$ and $\eta(t)$ belongs to G_2 and G_3 .

Denote by φ_L and ξ_L the linear estimation of solutions of the equations (1) with mentioned boundary conditions and vector process $\xi(s)$ according to observation (4).

Guaranteed mean square error of such linear estimations is

$$\sigma(\varphi_L, \xi_L) = \left\{ \sup_{G_1, G_2, G_3} E \left(\int_0^{t_1} |\varphi(t) - \varphi_L(t)|^2 dt + |\xi(s) - \xi_L(s)|^2 \right) \right\}^{\frac{1}{2}}.$$

Let G_1, G_2, G_3 is defined like

$$G_1 = \left\{ f : \int_0^{t_1} \left(A \frac{d\varphi}{dt}, \frac{d\varphi}{dt} \right) dt + \int_0^{t_1} (B\varphi, \varphi) dt \leq \gamma_1^2 \right\},$$

$$G_2 = \left\{ \xi : \int_0^s E |\xi'(t)|^2 dt \leq \gamma_2^2 \right\}, \quad G_3 = \left\{ \eta : \int_0^s E |\eta(t)|^2 dt \leq \gamma_3^2 \right\},$$

and functions $\hat{\varphi}(t), \hat{\xi}(t)$ are solutions of following system

$$\begin{aligned} -\frac{d}{dt} A \frac{\hat{\varphi}}{dt} + B\hat{\varphi} &= H_1^T (y(t) - H_1\hat{\varphi} - H_2\hat{\xi}) \gamma_1^2 \gamma_3^{-2}, \\ \frac{d\hat{\xi}}{dt} &= \gamma_2^2 \hat{p}, \\ -\frac{d\hat{p}}{dt} &= \gamma_3^{-2} H_2^T (y(t) - H_1\hat{\varphi} - H_2\hat{\xi}), \\ \hat{p}(t_1) &= 0, \quad \hat{p}(0) = 0, \end{aligned} \tag{5}$$

with boundary conditions (2) or (3) for function $\hat{\varphi}(t)$.

It is shown, that proposed estimations $\hat{\varphi}, \hat{\xi}$ are optimal in some sense, algorithm for calculation of $\sigma(\hat{\varphi}, \hat{\xi})$. is obtained.

References

1. Nakonechniy O. To guaranteed estimations of solutions of linear algebraic equations under uncertainty / O. Nakonechniy, S. Demydenko, M. Losieva // Journal of Computational & Applied Mathematics. – 2015. – №3(120). – P. 39-49 (in ukrainian).

2. Nakonechniy O. On approximate estimation of linear functionals of solutions of variational equations in Hilbert Spaces / O. Nakonechniy, M. Losieva // Bulletin. Cybernetics. -2002. - Vol.3. - P.64-66 (in ukrainian).

GUARANTEED ESTIMATION OF SOLUTIONS TO THE NEUMANN SCREEN PROBLEMS FOR HELMHOLTZ EQUATION WITH INEXACT DATA FROM THEIR NOISY OBSERVATIONS AT CERTAIN SYSTEM OF POINTS OR SURFACES

Nakonechniy O., Podlipenko Yu.

Taras Shevchenko National University of Kyiv, Ukraine

a.nakonechniy@gmail.com, yourip@mail.ru

We study guaranteed estimation of solutions φ to the Neumann screen problems for the scalar Helmholtz equation

$$\Delta\varphi + k^2\varphi = 0 \quad \text{in } \mathbb{R}^3 \setminus \Gamma,$$

$$\frac{\partial\varphi^+}{\partial\nu} = g \quad \text{on } \Gamma,$$

$$\frac{\partial\phi}{\partial r} - ik\phi = o(r^{-1}) \quad \text{as } r := |x| \rightarrow \infty,$$

where k is wave number, $k \neq 0$, $\text{Im}k \geq 0$, Γ is a bounded, simply connected, orientable smooth, open surface in $\mathbb{R}^3$ with a smooth boundary curve which does not intersect itself, $\partial\varphi^+/\partial\nu$ denotes the normal derivative to Γ on that its side which is oriented by a continuous family of unit normals ν , $\partial\varphi^-/\partial\nu$ denotes the normal derivative to Γ on its opposite side, and g is unknown function defined on Γ . Such problems appear in scattering of acoustic fields by hard screens.

For solving the estimation problems, observations of unknown fields at certain points or surfaces located in the domain $\mathbb{R}^3 \setminus \Gamma$ are needed. We assume that these observations are perturbed by additive random noises and that g , as well as the second moments of random noises in observations are not known; the only available information is that they belong to given bounded sets in the appropriate functional spaces.

Using the above information, we find optimal estimates both for unknown solutions and for the linear functionals from them. In other words, we look for the estimates in the class of linear estimates with respect to observations, for which the maximal mean square error of estimation taken over all the realizations of perturbations from certain

given sets takes its minimal value. Such estimates are called the guaranteed or minimax mean square estimates.

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

In particular, we find the representations for the guaranteed estimates of linear functionals from unknown solutions to Helmholtz problems which are expressed via solutions of certain systems of integral equations not depending on specific form of above functionals. The latter implies that the corresponding combination of a single- and a double-layer acoustic surface potentials generated by the solutions of obtained integral equations can be taken as good estimates for unknown solutions of the Neumann screen problems.

Notice that in the papers [1] and [2] the guaranteed estimation of unknown solutions and data of Helmholtz problems in the domain $\mathbb{R}^n \setminus \overline{D}$, where D is an open bounded domain in $\mathbb{R}^n$, $n = 2, 3$, was investigated.

References

1. Nakonechny A. G. Inverse Problems for Helmholtz Equation Under Uncertainty Conditions. Proceedings of URSI International Symposium on Electromagnetic Theory (EMTS), 09/2010.
2. Podlipenko Yu., Shestopalov Yu., Prishlyak V. Estimation under uncertainties of acoustic and electromagnetic fields from noisy observations. arXiv:0910.2331 [math.AP]

OPTIMAL STRATEGY IN MODELS WITH UNCERTAINTY, DESCRIBED BY GOMPERTZIAN EQUATION

Nakonechnyi O.G., Zinko P.M.

Taras Shevchenko National University of Kyiv, Ukraine

a.nakonechniy@gmail.com, petro.zinko@gmail.com

We consider two opposing (antagonistic) coalitions of players K_1 and K_2 , dynamic of the processes are described by a system of ordinary differential Gompertzian equations [1,2]. The coalitions can choose a program strategy as well as positional strategy.

To find the optimal strategies we use the principle of guaranteed result. We search the linear positional coalition strategy K_1 on the base of matrix principle of Hamilton-Pontryagin maximum. The coalition players K_1 and K_2 choose strategies $u(t) \in U(t), v(t) \in V(t)$:

$$U(t) = \left\{ u(t) = (u_1(t), \dots, u_{m_1}(t)), t \in [0, T] \right\},$$

$$V(t) = \left\{ v(t) = (v_1(t), \dots, v_{m_2}(t)), t \in [0, T] \right\}, \text{ accordingly.}$$

We describe the dynamic of the confrontation process (including informational) by a system [3]:

$$\begin{aligned} \frac{dx_i(t)}{dt} = & \left(\sum_{j=1}^n a_{ij}(t) \ln x_j(t) + \sum_{j=1}^{m_1} b_{ij}(t) u_j(t) + \right. \\ & \left. + \sum_{j=1}^{m_2} c_{ij}(t) v_j(t) \right) x_i(t), \quad i = \overline{1, n} \end{aligned} \quad (1)$$

with the initial condition

$$x_i(0) = x_i^0, \quad i = \overline{1, n}, \quad (2)$$

accordingly, for the coalition K_1 when $i = \overline{1, s}$ and for the coalition K_2 when $i = \overline{s+1, n}$, where $s < n$, $a_{ij}(t)$, $b_{ij}(t)$, $c_{ij}(t)$ - continuous function on $[0, t_1]$; $u_j(t), v_j(t)$ - the piecewise continuous function on $[0, t_1]$. We mean the functions $x_i(t), i = \overline{1, n}$, satisfying equation (1) almost everywhere, are the solutions of the equations (1), (2). If the strategies $u(t), v(t)$ belong to a certain set of some functional spaces, we should investigate the following tasks:

$$I_k(u, v) \rightarrow \max_{u \in U}, \quad k = \overline{1, s},$$

$$I_k(u, v) \rightarrow \min_{v \in V}, \quad k = \overline{s+1, r}, \quad r \leq n,$$

where $I_k(u, v) = g_k(x_k(t_1)), k = \overline{1, r}$ - functions of coalitions' targets K_1, K_2 .

References

1. Наконечный А.Г. Задачи управления для дифференциальных уравнений динамики Гомперца / А.Г. Наконечный, В.П. Марценюк // Кибернетика и системный анализ. – 2004. - №2. – С.123 – 133.
2. Marzeniuk V.P. System analysis methods of medical and biological processes /V.P. Marzeniuk , O.G.Nakonechnyi. – Ternopil: Ukrmedknyha, 2003. – 241p.
3. Nakonechny O.G. Confrontation problems with the dynamics Gompertzian systems / Nakonechny O.G., Zinko P.M. // Journal of Computational&Applied Mathematics. – 2015 – №3 (120) - P. 50-60.

DECISION MAKING ISSUES IN THE PROCESS OF HIGHER EDUCATION REFORM

Ketevan Nanobashvili

David Aghmashenebeli University of Georgia

qeti.nanobashvili@gmail.com

Decision making problems in the process of higher education management for the first time caused the great interest in the 60s of the last century of the American scholars L. Mets and the M. Peterson. They focused their attention on the processes and phenomena, which created problems in the country's higher education system of those times. Of course, these problems were related to or caused by the ongoing structural changes in the American higher education institutions, among which one of the most visible change was related to consolidation of higher education, which was associated with the creation of the new model of financing and the changes in the number of students' contingent; establishment of the new relationship between state and higher education institutions; providing more autonomy to higher institutions which was later turned into a trend in Europe, as well as in other countries, and this trend continues even today.

Obviously, these changes have led to the relevant changes in the management of higher education, which is fueling the creation of new models of management and this innovation has become more evident with regard to the development of the modern management information technologies. Each management model is different from each other concerning the rights of decision making. In the rights we consider quality ratio between central and decentralized decision making. Decentralize decision making leads to university professors and lecturers, who are competent in the university management and from their own interests, they have the full right to take part in this process. The same can be said about Students' self-government, which has a certain degree of competence and at the same time the right to be engaged in the activities of the university regulation. Obviously, this model of decision making with positive sides has some negative ones, which is reflected in the fact that the decision making is somewhat dragged out in time and the long-term involvement of professors and students' in the process leads to their separation from the learning process. We consider that solving this problem requires finding compromise and selecting optimal variant!

The started reforms in the Georgian education system continue and at this point, it is very relevant to focus on the solution of the decision-making problems in the process of higher education reform.

In respect to this problem, the report will present the following:

- the analysis of strategic, tactical and operational forms of higher education management decision making;
- the analysis of the main models of higher education management decision making;
- information technologies supporting decision making (software and technical facilities);
- decision making at the level of dean's office.

The report will discuss information related to the technologies supporting decision making at the level of: students' contingent, examination sessions and curriculum.

At the level of students' contingent we will consider automatization of each student's registration and analysis functions, information storage and retrieval of data bases and etc.

At the level of exam sessions decision making in the process of schedule formation will be presented, as well as the progress of sessions and input of the results in the database and etc.

At the curriculum level education process planning and implementation will be discussed.

ABOUT THE APPROACHES TO MODELING DISTRIBUTION PROCESSES AND EVALUATING THE EFFECTIVENESS OF ADVERTISING

Naumenko Y., Adzhubey L.

Taras Shevchenko National University of Kyiv, Ukraine
yura.was.here@gmail.com, adzhubey@ukr.net

The main problem of determining the optimal advertising budget is to determine the budget that would receive a guaranteed return on advertising [1]. Any deviation from the optimal solution results in inefficiency.

To study and modeling the processes of extension of advertising on consumers we can use the description of the changes in the concentration of its impact over time. One approach, used to assess the effectiveness of advertising events on the outcome is modeling the process of spreading of the impact via the schemes, similar to models of diffusion.

We received and investigated mathematical models, which consider the processes of change in population among which the advertising extends. Building the model of the advertising distribution is based on the diffusion equation with diffusion coefficient given by the solution of differential equations. Using the dynamic advertised product quantities generalizes the approach based on diffusion models.

Investigation of advertising effectiveness conducted by simulating the utility functions of goods, construction of the demand functions and analyzing the impact of advertising on demand. The task of optimizing advertising policy is seen as time problem that is closely connected with the problem of price optimization.

Conclusion. The paper proposes an approach to modeling the impact of advertising on public awareness about the product that being advertised. Based on the approach by which this process is considered similar to the process of diffusion, mathematical models of hybrid type are obtained. The models that are taking into account the changing of population and into account the changes of the goods volume are considered. Numerical experiments with specific examples were conducted.

References

1. Шведун В.А. Разработка методического обеспечения формирования совокупного рекламного бюджета предприятия // Бизнес-Информ. – 2008. – № 9. – С. 60–68.

ABOUT PERMANENT CONDITIONS OF A DISCRETE PREDATOR-PREY SYSTEM

Nenya O. I.

Kyiv National Economic University, Ukraine

alexni@ukr.net

In this abstract we consider the following discrete predator–prey system

$$\begin{cases} x(n+1) = x(n) \exp \left\{ a(n) - b(n) \sum_{s=1}^{\infty} K(s)x(n-s) - c(n)g\left(\frac{x(n)}{y(n)}\right)\frac{y(n)}{x(n)} \right\}, \\ y(n+1) = y(n) \exp \left\{ -d(n) + e(n)g\left(\frac{x(n-\tau(n))}{y(n-\tau(n))}\right) \right\}, \end{cases} \quad n = 0, 1, 2, \dots, \quad (1)$$

where $x(n), y(n)$ are the densities of prey population and predator population at time $n \geq 0$, $a(n), b(n), c(n), e(n), d(n), \tau(n)$ are bounded

nonnegative sequences such that

$$0 < a^l \leq a^u, \quad 0 < b^l \leq b^u, \quad 0 < c^l \leq c^u,$$

$$0 < d^l \leq d^u, \quad 0 < e^l \leq e^u, \quad 0 < \tau^l \leq \tau^u. \quad K(s) \in [0, \infty) \text{ is bounded for}$$

$$s = 1, 2, \dots, \text{ and } \sum_{s=1}^{\infty} K(s) = 1. \text{ Here } a^u = \sup_{n \in \mathbb{N}} a(n), \quad a^l = \inf_{n \in \mathbb{N}} a(n).$$

The response monotonic function $g(u) = \beta u^{\alpha-1} / (\gamma + u^\alpha)$, $\alpha \geq 2$, satisfies:

$$(i) \quad g \in C^1([0, +\infty), \mathbb{R}), g(0) = 0, \quad \lim_{u \rightarrow +\infty} g(u) = 0.$$

$$(ii) \quad \exists \quad p > 0, \text{ that } (u - p)g'(u) < 0 \text{ for } u \neq p;$$

$$(iii) \quad h'(u) < 0 \text{ for all } u \geq 0, \text{ and } h(0) = \lim_{u \rightarrow 0} \frac{g(u)}{u}, \text{ where } h(u) = \frac{g(u)}{u}.$$

Sufficient conditions for permanence are presented.

Theorem. 1 Assume that

$$a^l - b^u M_1 - c^u h(0) > 0, \quad d^u < g(p)e^l, \quad a^u - b^l m_1 + d^u > 0,$$

$$\text{where} \quad M_1 = \exp(a^u - 1) \cdot \left(b^l \sum_{s=1}^{\infty} K(s) \exp(-sa^u) \right)^{-1},$$

$$m_1 = \frac{(a^l - c^u h(0)) \exp\{a^u - c^l h(0) - \exp\{a^u - c^l h(0) - 1\}\}}{b^u \sum_{s=1}^{\infty} K(s) \exp\{-s(a^l - b^u M_1 - c^u h(0))\}},$$

are satisfied. Then system (1) is permanent.

SOLVING LYAPUNOV-SYLVESTER OPERATOR EQUATIONS BY CONVEX PROGRAMMING METHODS

Nikitin A.V.

Taras Shevchenko National University of Kyiv, Ukraine.

nikitin2505@gmail.com

We investigate of some properties of Ito-Skorohod stochastic differential equations in Hilbert spaces. In particular, we are interested in solvability of Lyapunov-Sylvester operator equations. Existence of a solution to such an equation provides stability of certain system of Ito-Skorohod stochastic differential equation in a Hilbert space.

Let X be a separable Hilbert space with the inner product (x, y) and the norm $|x|$. We investigate the stochastic differential equation

$$dX_t = X_t A dt + \sum_{k=1}^{\infty} (X_t B_k dW_k(t) + \int_U C_k(u) X_t \tilde{v}_k(dt, du)), \quad (1)$$

defined on a fixed filtered probability space. Here A , B_k and $C_k(u)$ are some unbounded linear operators defined on a dense set $D \in X$.

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 such that, for $x \in D$ $X_t x$ has a stochastic differential obtained by the application of the right-hand side of (1) to x .

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

$$A^* H + H A + \sum_{k=1}^{\infty} (B_k^* H B_k + \int_U C_k^*(u) H C_k(u) \Pi_k(du)) = -G \quad (2)$$

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.

Define the objective function

$$\phi_0(H) \equiv -\lambda_{\min}(-A^* H - H A - \sum_{k=1}^{\infty} (B_k^* H B_k + \int_U C_k^*(u) H C_k(u) \Pi_k(du))), \quad H \in \bar{L} \quad (3)$$

$$\bar{L} = \{H : \lambda_{\min}(H) \geq 0, \lambda_{\max}(H) \geq 1\} \quad (4)$$

where $\lambda_{\min}(\cdot)$ and $\lambda_{\max}(\cdot)$ are lower and upper bound of the operator spectrum respectively.

Now we consider the optimization problem

$$H^* = \arg \min_{H \in \bar{L}} \phi_0(H) \quad (5)$$

and we can reformulate a criterion of asymptotic stability in the mean square.

Theorem 1. *System (1) is asymptotically stable in the mean square if, and only if, there exists operator H_0 which is a solution to problem (5) for $\phi_0(H_0) < 0$.*

References

1. Skorohod A.V. Asymptotic methods in the theory of stochastic differential equations. – AMS (Translation of mathematical monographs). – 2008. – Vol.78. – 343 p.

REQUIREMENTS IN TEST DESIGN
S. Okhanashvili, M. Okhanashvili, Ia Okhanashvili
Iakob Gogebashvili Telavi State University, Georgia
ok-svi@tesau.edu.ge

Nowadays testing is one of the methods of checking and assessing the knowledge, which can identify how well a student (or a group of students) has learnt the specific subject or topic. Also testing provides us with systematic, complete, exact, and fast information about teaching process.

While designing the test it is important to take into account the following features, such as: reliability, validity, flexibility, simplicity, fairness, objectivity, and impartiality.

The aim of testing is to identify the problems in teaching, in students' knowledge as well as to detect the so called "white spots" in test design, which will support the eradication of pedagogical "errors" and searching for new methods of teaching.

Testing-knowledge can be assessed both in writing and orally by giving practical tasks, using the computer and other means. While designing the test mainly two types of questions are used: open ended and closed ended. The examples of open ended questions are: describe the method, experiment, write your opinion, compare the results, evaluate the given opinion, and etc.

The examples of close ended questions are: True/False sentences, complete the gaps, group the data, complete the chart, put the events in the right order chronologically, and etc.

Different types of questions are used in the test, that is why it should be designed so that the questions will vary from open ended to close ended ones.

In addition, we should remember that tasks in the test differ in logical structure: factual question (what, where, who, when?), functional question (why, for what?), structural question (what is it made from? What parts does it consist of?), concept questions (define the concept), concept-association questions (fill in the gaps), continue the sequence, concept-semantic task (which of these expresses the similar idea?) and problem questions.

It is also necessary to consider the analyses of test design and evaluation. Nowadays there are several methods, but giving the grade or point to a specific question is the most common one.

Today testing is the most convenient with the help of computer, since giving the share point to each question and then calculating the results is much easier than by using written and oral tasks. While analyzing the test it is possible to:

Compare test results with the average “number”.

Prepare in advance the criterion which is based on learnt material or topic and aims to assess some specific knowledge.

In this case the first one is called “norm oriented test”, while the second one is called “Criterion oriented test”

Designing the online version of a test (On-Line, Offline) is widely demanded process nowadays and its main goal is:

- To be measurable;
- To be valid and reliable;
- To use open and close ended questions;
- To be time oriented;
- To be transparent.

MODELLING AND MITIGATION OF PUBLIC RESPONSE TO CATASTROPHES AND ACCIDENTS IN CONDITIONS OF UNCERTAINTIES AND MULTI-FACTOR RISKS

Pankratova N.D.

Institute for Applied System Analysis NTUU«KPI», Ukraine
natalidmp@gmail.com

The methodology for scenario analysis regarding the field of public response to catastrophes and accidents is applied. During social disasters, certain events can happen that significantly change the attitudes and sentiments of the involved sides of conflict, causing the usual forecasts to be incorrect or inaccurate. Moreover, social disasters can lead to other accidents and catastrophes, e.g. explosions leading to oil spills and contamination of soils and water. To analyze these cases in situations of uncertainty and multi-factor risks a methodology called foresight is developed. In such cases it is advisable to apply modified qualitative methods of the foresight methodology (Delphi method, morphological analysis method, analytical hierarchy method and others) to develop models suitable for description of the social disasters [1]. These models will then be used to construct scenarios for the social disaster, allowing to assess the mitigation methods and provide decision-making support regarding the best actions to reduce the negative consequences of a social disaster in the context of sustainable development.

The proposed approaches and methods can be effectively applied for modelling and evaluation of measures to prevent and control potential disasters and provide decision-making support for disaster situations. Developed approaches are very flexible to use in systems of various nature, such as technical, environmental, social, human, economic and others

The application of the proposed above methodologies and techniques to solve problems associated with environmental, technical and social disasters as a software tool is developed. On the basis of system methodology using the foresight methods the projects in direction of environmental and technical disasters were realized. Developed tools allow reduce the time, financial and human resources for recovering from the effects of disasters in conditions inaccuracy, incompleteness, fuzziness, untimeliness, noncredibility, and contradictoriness of information.

References

1. Gorelova G.V., Pankratova N.D. Innovative development of socio-economic systems based on the methodologies of foresight and cognitive modelling. – Kiev: Naukova dumka, 2015. – 464 p.

ANALYSIS METHODS STATISTICAL 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. Atmospheric turbulence is a three-dimensional Gaussian random field $W_t(\vec{x}) = \{\xi_1(\vec{x}), \xi_2(\vec{x}), \xi_3(\vec{x})\}$, $\vec{x} \in R^3$ with matrix correlation function $R_t(\vec{x}) = \sigma^2 \exp\{-|\vec{x}|L^{-1}\}$ [1]. In the case of homogeneous isotropic turbulence correlation, function $R_t(\vec{x})$ is corresponding to the spectral density matrix

$$\{S_{k,l}(\vec{\lambda})\} = 2\sigma^2 |\vec{\lambda}|^2 \left(\delta_{k,l} - \frac{\lambda_k \lambda_l}{|\vec{\lambda}|^2} \right) \left[L\pi^2 \left(|\vec{\lambda}|^2 + L^{-2} \right)^3 \right]^{-1}.$$

When the components $W_t(\vec{x})$ are independent random fields, we use for their simulation algorithms described in [2]. Let $A = \{\vec{\lambda} : |\vec{\lambda}| \leq \Lambda\}$,

$R = \{d_i, i = 0, 1, \dots, M\}$ - breaking some areas A , $\vec{\lambda}_i \in d_i$. The model based on the following formula:

$$\xi_k(\vec{x}) = \sum_{i=0}^M \left(\cos(\vec{x}, \vec{\lambda}_i) \xi_{1i} + \sin(\vec{x}, \vec{\lambda}_i) \xi_{2i} \right),$$

where $\{\xi_{1i}, \xi_{2i}\}$ - strictly sub-Gaussian independent random variables,

$$E\xi_{1i} = E\xi_{2i} = 0, \quad E\xi_{1i}^2 = E\xi_{2i}^2 = \nu_k(d_i), \quad \nu_k(d_i) = \iint_{d_i} S_k(\vec{\lambda}) d\vec{\lambda}.$$

Here we provide a comparison with existing methods of statistical simulation of atmospheric turbulence.

Reference

1. Shalygin A.S. Applied methods of statistical simulation / A.S. Shalygin, Yu.I. Palagin. - SPb, 1986. - 320 p. (in russian).
2. Pashko A.O. Numerical simulation of Gaussian homogeneous random fields / A.O. Pashko // Scientific Bulletin of the Uzhgorod University. Series: Mathematics and Computer Science. – 2013. - Vol. 24, №1. – P. 116-120 (in ukrainian).

USING SIMULATION OF RANDOM PROCESSES AND FIELDS IN SOLVING HEAT CONDUCTION PROBLEMS

¹Pashko A.A., ²Terenchuk S.A.

¹Taras Shevchenko National University of Kyiv, Ukraine

²Kyiv National University of Construction and Architecture, Ukraine

aap2011@ukr.net, terenchuksa@ukr.net

A large number of applications describes as boundary problems. Modeling the heat transfer in houses and other various purpose buildings involves solving the problem of heat conduction.

Let D be an arbitrary domain environment that is limited with smooth border ∂D . In the process of monitoring the distribution of heat value $u(x, t)$ at each point of the medium x at the initial moment t_0 and at every point x_0 of the border ∂D environment on some t let sets period $t_0 < t < T$ of initial conditions $u(x, t_0) = \xi(x)$, $x \in D$, and boundary conditions $u(x_0, t) = \eta(t)$, $x_0 \in \partial D$, $t \in (t_0, T)$ [1]. There are possible cases of absence or presence of a heat source in the area D ,

$$\frac{\partial}{\partial x} \left(k \frac{\partial u(x,t)}{\partial x} \right) = C\rho \frac{\partial u(x,t)}{\partial t}, \text{ or } \frac{\partial}{\partial x} \left(k \frac{\partial u(x,t)}{\partial x} \right) + \zeta(x,t) = C\rho \frac{\partial u(x,t)}{\partial t}$$

where $\zeta(x,t)$ - density heat sources at a point in time.

We study the case when $\zeta(x,t)$, $\xi(x)$ and $\eta(t)$ are random processes and fields of typical spectral density.

A Gaussian random fields is usually considered in this case.

However, the real simulation using by precision calculations, derives strictly sub-Gaussian random processes and fields. To construct realizations of random processes and fields used their spectral representation in the form of stochastic integrals [2].

Reference

1. Sabelfeld K.K. Monte Carlo methods in boundary value problems. / K.K. Sabelfeld. - Novosibirsk: Nauka, 1989. - 280 p.
2. Pashko A.O. Numerical simulation of Gaussian homogeneous random fields./A.O.Pashko // Scientific Bulletin of the Uzhgorod University. Series: Mathematics and Computer Science. - 2013. - Vol. 24, №1. - P.116-120.

THE CONCEPTION OF MAKING MARKETING DECISION BASED ON KNOWLEDGE ECONOMICS IN THE AREA OF MASS SERVICE

Rusudan Piranishvili

Iakob Gogebashvili Telavi State University, Georgia

rusudan-piranishvili@mail.ru

Transferring the country to marketing economics has drastically increased the demand in the area of mass service the demand vector of which is aimed at business. The major problem in this process is the service of clients, that is, fully meeting the clients' demand. This subject is discussed in terms of marketing, which encompasses co acting of materialistic environment, staff, processes of business functions and modern elements.

This marketing complex includes planning business programs and methods of their implementation that requires diagnostic analyses, expert evaluation, factual registration, economic calculations and making decisions while using modern technology in managing other current processes. Obviously, it is necessary to work out the means for

optimal facilitation of these processes, which will focus on modern information and computer technology.

It is quite difficult to work out facilitating means of making decisions in managing mass service business entities, because it belongs to the group of hard-to-formalize systems. To function successfully it is important to use the knowledge, which can be called **knowledge economics**.

Knowledge economics consists of education and research analyses, information economics and theory of making a choice and decision in variety of alternatives, which can create the stable atmosphere in the field of mass service. Moreover, scientists describe modern global economics as transition to the knowledge economics, as an extension of information society, which is also known as knowledge society. It is true since modern society rapidly gains, creates, spreads and uses knowledge for successful economic and social development by using all kinds of educational means, mostly electrical communication ones.

Importance of using knowledge economics in marketing is an inevitable process. Knowledge economics focuses on production of knowledge technology-knowledge engineering and knowledge management, which is equipped with the intellectual (human) knowledge capital gathered in business economics; with the economic-mathematical methods and models of management, modern information-computer technology. Knowledge economics has huge potential in the field of mass service and social development. It offers the society effective ways of service, producing high quality consumer products with less expenditure.

Building the system of knowledge economics in mass service marketing is a systematic process and its main goals are as follows:

- ❖ Scientific research of system of creating and gaining the mass service marketing knowledge;
- ❖ Study of consumer market;
- ❖ Forecasting mass demand for service;
- ❖ Building the dynamic model of marketing technology.

In the following report we are discussing modern approaches of achieving these goals; designing mathematical models, planning data base and conceptual algorithms of optimal decisions.

GROWTH OF ANALYTIC IN THE CIRCLE CHARACTERISTIC FUNCTIONS

Platsydem M.

Ivan Franko National University of Lviv, Ukraine

marta.platsydem@gmail.com

Let F - probability law. The function $\varphi(z)$, defined for real z is a characteristic function of this law. If φ has the analytic continuation on the disk $D_R = \{z: |z| < R\}$, $0 < R \leq +\infty$, then we name φ by analytic in D_R . It is known that φ is analytic in D_R characteristic function if and only if for every $r \in [0, R)$

$$W_F(x) = 1 - F(x) + F(-x) = O(e^{-rx}), x \rightarrow +\infty.$$

Let L be a class of continuous increasing functions α such that $\alpha(x) \equiv \alpha(x_0) > 0$, as $x \leq x_0$ and $\alpha(x)$ increase to $+\infty$ as $x \leq x_0 \rightarrow +\infty$. We say that $\alpha \in L_{si}$ if $\alpha \in L$ and $\alpha(cx) = (1 + o(1))\alpha(x)$ as $x \rightarrow +\infty$ for any $c \in (0, +\infty)$, that is α is slowly increasing function.

Theorem Let function $\alpha \in L_{si}$ and $\beta \in L_{si}$ such as

$$\frac{\beta^{-1}(c\alpha(x))}{x} \rightarrow 0 \quad \text{and} \quad \alpha\left(\frac{x}{\beta^{-1}(c\alpha(x))}\right) = (1 + o(1))\alpha(x) \quad \text{as}$$

$x \rightarrow +\infty$ for ever $c \in (0, +\infty)$, and φ be an analytic in D_R , $0 < R < \infty$, characteristic function of the probability law F , which satisfies the condition $\overline{\lim}_{r \uparrow R} W_F(x)e^{Rx} = +\infty$. Then

$$\rho_{\alpha\beta}^*[\varphi] = \overline{\lim}_{x \rightarrow +\infty} \frac{\alpha(x)}{\beta\left(\frac{x}{\ln^+ (W_F(x)e^{Rx})}\right)}.$$

References

1. Kinash O.M., Parolya M.I. About growth of characteristic functions of probability laws. – Visn. Lviv. Univ. Ser. Mech.-Math.- 2012. - Issue. 77. - P. 109-129.

ON RETRIAL QUEUES WITH CONSTANT STATE DEPENDENT RETRIAL RATE

Vadym Ponomarov

Taras Shevchenko National University of Kyiv, Ukraine

vponomarov@gmail.com

The paper deals with a research of bivariate Markov process $\{X(t), t \geq 0\}$ whose state space is a lattice semistrip $S(X) = \{0, 1, \dots, c\} \times \mathbb{Z}_+$. The process $\{X(t), t \geq 0\}$ describes the service policy of a multi-server retrial queue in which the rate of repeated flow changes according to threshold control policy but remains constant when the number of repeated calls lies between threshold values. In this class of 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 and to propose the closed formulas of its main performance measures. The investigative techniques use an approximation of the initial model by means of the truncated one and the direct passage to the limit.

Due to the assumption of a constant retrial rate, a model under investigation fits into the well studied class of QBD processes, analyzed by many authors (see [1], for example). Now such models are typically solved by using numerical schemes for solving a system of non-linear matrix equations, leading to the so-called rate matrix R . These schemes would apply to the $M/M/c/c$ retrial queue with constant retrial rate, but will produce a computational algorithm rather than an explicit analytical solution.

The main purpose of this paper is to obtain analytical representation of probabilistic characteristics of the $M/M/c/c$ queue in the steady state through its parameters for all $c=1, 2, \dots$. The implementation of the results is demonstrated on the numeric examples in which the behavior of main integral characteristics of the queues is shown.

References

1. Artalejo J.R., Gomez-Corral A., Neuts M.F. Analysis of multiserver queues with constant retrial rate. - European Journal of Operational Research 135, 2001. - P. 569–581.
2. V. Ponomarov, E. Lebedev. Finitesource retrial queues with state-dependent service rate. BWWQT 2013, CCIS 356, 2013. - P. 140–146.

THE USE OF PIECEWISE LINEAR REGRESSION IN FORECASTING PROBLEMS.

Polaychenko A.I., Galkin O. V., Veres M.M.

Taras Shevchenko National University of Kyiv, Ukraine

apolyachenko@mail.ru, galkin@unicyb.kiev.ua,

veres@unicyb.kiev.ua

Regression analysis techniques are commonly used to solve the huge range of different tasks. Regression analysis allows us to build an approximation of unknown function which is depend on the selected parameters (factors) in the form of some mathematical model using observations data. Traditionally linear and nonlinear regression analysis are distinguished. The linear regression has well-elaborated theoretical basis and there are no any difficult to build the linear models and they are rather simple for analysis. The most of the real processes and dependencies have nonlinear nature. Therefore, the description of these processes by using linear models lead to the significant errors. The nonlinear models are more powerful in sense of correctness of reproduction the behavior of unknown function. But these models are studied not enough and there are any difficulties to construction such models. In order to keep the benefits of the linear models and adequately describe the behavior nonlinear dependencies the piecewise linear regression model can be used.

We discuss the algorithm for finding the linear models, which are included in a piecewise linear model its application for solving the problem of approximation. First step we use the elementary linear model to rank the input data in ascending values of the factors, taking into account their impact on the value of the objective function, which also helps to smooth changes in the values of the dependent variable. The next step is the construction and analysis of implicit models which are aggregated by the piecewise linear regression model. Each of these implicit models are built for separate of the observation period for which the standardized coefficient of determination is verified. Therefore, each implicit model is bounded to the considered interval. This approach allows to build the correct implicit models, thereby ensuring the correctness of the resulting aggregated model. The result of the algorithm is aggregated piecewise linear partially defined regression model. At the end we discuss the application the aggregating model for calculating the predicted value of the desired function. As an example of

the approach depending on the performance of mobile devices on the technical characteristics of its components is considered

References

1. Eliseeva, I.I. The Economy. - Moscow: Finance and Statistics, 2007.
2. Ivakhnenko A.G. Modeling of complex systems. – Kyiv: Vishcha School, 1987.
3. Ascenso J., Lombardi M. et al. The extinction law from photometric data: linear regression methods.//arXiv:1203.5257

OPTIMIZATION OF RETRIAL QUEUE WITH LIMITED NUMBER OF RETRIALS

Pryshchepa O.V.

National University of Water and Environmental Engineering,
Rivne, Ukraine

o.v.pryshchepa@nuwm.edu.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 one attempt and which a rate of primary customer flow depends on the number of customers in the orbit. A rate of the input flow is controlled by hysteresis strategy. Such strategy is built by means of two thresholds H_1 and H_2 , $H_1 \leq H_2$. If in some moment of time the number of customers in the orbit does not exceed H_1 then the system operates in the first mode with the rate of input flow h_1 . If time the number of customers in the orbit exceed H_2 then the system operates in the second mode with the rate of input flow h_2 . If the number of customers in the orbit is in the interval $(H_1; H_2]$ then the system has such mode in which it was at the previous moment of time.

The system state at time t can be described by means of a process $Q(t, H_1, H_2) = (Q_1(t, H_1, H_2), Q_2(t, H_1, H_2), R(t, H_1, H_2))$, where $Q_1(t, H_1, H_2)$ is the number of busy servers at time t , $Q_2(t, H_1, H_2)$ is the number of customers in the orbit at time t , $R(t, H_1, H_2)$ is the system operating

mode. The process $Q(t, H_1, H_2)$ is a continuous time Markov chain with the state set $S(Q) = S^1(Q) \cup S^2(Q)$, where

$$S^1(Q) = \{(i, j, 1) : i = 0, 1, \dots, c; j = 0, \dots, H_2\}, \quad S^2(Q) = \{(i, j, 2) : i = 0, 1, \dots, c; j = H_1 + 1, \dots\},$$

$$S^1(Q) \cap S^2(Q) = \emptyset.$$

An algorithm which finds stationary probabilities for the system with control of this type has been proposed.

In this work we also consider optimization problem for finding optimal strategy of control:

$$S_i(H_1, H_2) \rightarrow \max, \quad i = 1, 2; \quad S_i(H_1, H_2) \rightarrow \min, \quad i = 3, 4$$

$$H_1, H_2 \in \{0, 1, \dots\}, \quad H_1 \leq H_2,$$

where $S_1(t, H_1, H_2)$ – the number of customers that were served before time t in the first mode; $S_2(t, H_1, H_2)$ – the number of customers that were served before time t in the second mode; $S_3(t, H_1, H_2)$ – the number of customers that become sources of repeated attempts; $S_4(t, H_1, H_2)$ – the number of switching rate of the input flow.

Functions $S_i(H_1, H_2) = \lim_{t \rightarrow \infty}^{-1} S_i(t, H_1, H_2)$, $i = \overline{1, 4}$ can be submitted via the stationary probabilities in an explicit form. They give the algorithm for finding of Pareto optimal solutions of this optimization problem.

The similar optimization problem for retrial queues has been considered in [3].

References

1. Artalejo J.R., Gómez-Corral A. Retrial Queueing Systems. A Computational Approach. - Springer, 2008. – 318 p.
2. Falin G. I. and Templeton J. G. C. Retrial queues. – London: Chapman & Hall, 1997. – 328 p.
3. Lebedev E.A., Usar I.Ya. On queues with retrial calls and controlled input flow / E.A., Lebedev, I.Ya. Usar // Report of NAS of Ukraine. – 2009. –N5.- P.52-59.

DECISION MAKING METHOD BASED ON WEIGHTS VARYING IN COGNITIVE MAPS IMPULSE PROCESS MODELS

Romanenko V.D., Milyavsky Y.L.

Educational-scientific complex “Institute for Applied Systems Analysis”
National Technical University of Ukraine “KPI”, Ukraine
ipsa@kpi.ua, yuriy.milyavsky@gmail.com

Impulse process dynamic in cognitive maps (CM) of complex systems is formulated as difference equations in increments of CM coordinates:

$$\Delta Y_i(k+1) = \sum_{j=1}^n a_{ij} \Delta Y_j(k), \quad (1)$$

where $\Delta Y_i(k) = Y_i(k) - Y_i(k-1)$, $i=1,2,...,n$; a_{ij} – weight of edge connecting j -th and i -th CM vertices.

To automate cognitive control (decision making) dynamic model (1) is augmented by external control inputs which are implemented based on varying the values of CM weights a_{ij} . Varying weight of a coefficient is possible when we can change sensitivity of influence of one CM vertex on another. While controlling impulse process (1) by weights a_{ij} varying degree of influence of coordinate Y_j on coordinate Y_i changes.

The forced motion equation of impulse process (1) in vector-matrix form with full coordinate values is the following:

$$\bar{Y}(k+1) = (I + A - Aq^{-1})\bar{Y}(k) + B(k)\Delta\bar{a}(k) + \bar{\xi}(k), \quad (2)$$

where $\Delta\bar{a}(k) = \bar{a}(k) - \bar{a}(k-1)$ is an increments vector of matrix A coefficients (one in each matrix row), q^{-1} is reverse time shift operator, $B(k)$ consists of corresponding coordinates Y_j that influence other coordinates Y_i via edges with varying weights a_{ij} , $\bar{\xi}(k)$ is random noise.

To find optimal controls Δa_{ij} quadratic optimality criterion is proposed:

$$J(k+1) = E[\bar{Y}(k+1) - \bar{G}]^T [\bar{Y}(k+1) - \bar{G}] + \Delta\bar{a}^T(k) R \Delta\bar{a}(k)], \quad (3)$$

where $\bar{G}$ is the reference vector, R is the given diagonal positive definite matrix. Having minimized (3) with respect to vector $\Delta\bar{a}(k)$ we obtain the control law for decision making:

$$\Delta\bar{a}(k) = -[B^T(k)B(k) + R]^{-1}B^T(k)[(I + A - Aq^{-1})\bar{Y}(k) - \bar{G}].$$

RATE FUNCTIONAL IN A LARGE DEVIATIONS PROBLEM FOR DISCRETE-TIME RANDOM EVOLUTIONS

Samoilenko I.V.

Taras Shevchenko National University of Kyiv. Ukraine

isamoil@i.ua

The problem of large deviations is solved in four stages [1], Ch.2):

- 1) Verification of convergence of the exponential (nonlinear) generator $\mathbf{H}^e$, to the limit exponential (nonlinear) generator $\mathbf{H}$;
- 2) Verification of exponential tightness of the pre-limit Markov processes. Convergence of the semigroups, corresponding to $\mathbf{H}^e$, and exponential tightness of the pre-limit Markov processes give the large deviations principle in $\mathbf{D}_E[0, \infty)$;
- 3) Verification of the comparison principle for the limit exponential generator, showing that the semigroups, corresponding to $\mathbf{H}^e$ really converge to the unique semigroup, corresponding to $\mathbf{H}$;
- 4) Construction of a variational representation for the limit exponential generator that gives the rate functional.

The limit theorems for the discrete-time Markov processes (MP)

$$\eta(t) = \sum_{k=0}^{\lfloor t/s \rfloor} \xi_k$$

are based on a martingale characterization of MP $\eta(t)$, $t \geq 0$ with the generator $\mathbf{L}$ of MP $\eta(t)$.

By analogy, the LDP for the Markov processes (MP) is based on the exponential martingale characterization of MP $\eta(t)$, $t \geq 0$ with the exponential generator (EG)

$$\mathbf{H}\varphi(u) := \ln(e^{-\varphi(u)} \mathbf{L} e^{\varphi(u)} + 1).$$

We analyze the construction of the rate functional and its connection with the martingale control problem [2].

References

1. Feng J., Kurtz T.G. Large Deviation for Stochastic Processes. – 131, AMS, RI, 2006. – 410 p.

2. Kurtz T.G. Martingale problems for controlled processes . – Lecture notes in control and information sciences. – Berlin:Springer, 1987. – Vol. 91. – P. 75-90.

A STRONGLY CONVERGENT METHOD FOR VARIATIONAL INEQUALITIES OVER THE SET OF SOLUTIONS THE EQUILIBRIUM PROBLEMS

Semenov V.V.

Taras Shevchenko National University of Kyiv

semenov.volodya@gmail.com

Let H be a real Hilbert space with inner product $(\cdot, \cdot)$. For operator $A: H \rightarrow H$, subset $M \subseteq H$, and bifunction $F: H \times H \rightarrow \mathbb{R} \cup \{+\infty\}$ we denote by $VI(A, M)$ and $EP(F, M)$ sets $\{x \in M : (Ax, y - x) \geq 0 \ \forall y \in M\}$ and $\{x \in M : F(x, y) \geq 0 \ \forall y \in M\}$, respectively. We are interested in the approximate solvability of problems

$$\text{find } x \in VI(A, EP(F, C)), \quad (1)$$

and,

$$\text{find } x \in VI(A, EP(F_1, C_1) \cap EP(F_2, C_2)). \quad (2)$$

Problems of form (1) or (2) are referred as variational inequality over the set of solutions the equilibrium problem or over the set of solutions the system of equilibrium problems. This problems have found applications in a wide array of disciplines, including mechanics, economics, partial differential equations, information theory, approximation theory, signal and image processing, game theory, optimal transport theory, probability and statistics, and machine learning. Motivated by the idea of Korpelevich's extragradient method and Antipin's recent extensions the extragradient method to equilibrium problem, we'll introduce a new and maybe efficient method for solving problem (2). This method use the Moreau's proximity operator. Principal difference here, at each iteration, we solve strongly convex programming problems only instead of a auxiliary equilibrium programming problems. We'll prove the strong convergence of these methods under mild conditions.

APPLICATION OF LEXICOGRAPHY TO SOLVING OF VECTOR PROBLEMS WITH LINEAR-FRACTIONAL FUNCTIONS OF CRITERIA

¹Semenova N., ²Lomaha M., ²Samus Y.

¹Glushkov Institute of Cybernetics of NAS of Ukraine

²Uzhhorod National University, Ukraine

nvsemenova@meta.ua, lomagamarija@yandex.ua

Theoretical and practical importance of lexicographical optimization is displayed by its possible applying to solving problems of multicriterion optimization in any subordination given on the set of criteria. The property of lexicographical order completeness enables to use it for different purposes.

We regard the optimization problem $P(F, X): \max^P F(x) | x \in X$, where $F = (f_1, f_2, \dots, f_l)$, $f_i = f_i^1 / f_i^2$, $f_i^1 = \langle c^i, x \rangle$, $f_i^2 = \langle d^i, x \rangle$, $c^i, d^i \in R^n$, $i = 1, \dots, l$, $X = \{x \in R^n | Ax \leq b, x \geq 0\}$, $A \in R^{m \times n}$, $b \in R^m$.

Let's regard the problem $L(F, X): \max^L F(x) | x \in X$. Let $\tilde{X}^P$ i $\tilde{X}^L$ be sets of optimal solutions of the problems $P(F, X)$ i $L(F, X)$ respectively. It is known that $\tilde{X}^L \subset \tilde{X}^P$. Thus lexicographical optimization makes it possible to reveal some Pareto optimal solutions of the problem $P(F, X)$, in which the number of different optimal estimations is generally equal to the number of different subordinations of criteria ranging. To solve the problem $L(F, X)$ we may use methods of multicriterion optimization [1, 2], when the searching of its optimum is reduced to solving the sequence of one-criterion problems according to the scalarization scheme. In the case of a one-stage solving you may use the results of the work [3].

References

1. Семенова Н.В. Векторні задачі дискретної оптимізації на комбінаторних множинах: методи дослідження та розв'язання / Н.В. Семенова, Л.М. Колечкіна. – Київ: Наук. думка, 2009. – 266 с.
2. Червак Ю.Ю. Оптимізація. Непокращуваний вибір / Ю.Ю. Червак. – Ужгород: Ужгородський національний університет, 2002. – 312 с.
3. Ломага М.М. Квадратичні задачі лексикографічної оптимізації: властивості та розв'язання / М.М. Ломага, В.В. Семенов // Комп'ютерна математика. – 2013. – № 2. – С. 134-143.

INFINITESIMAL GENERATOR FOR THE CONTINUOUS HIDDEN MARKOV MODEL

Semenyuk S.A.¹, Chabanyuk Ya.M.², Budz I.S.³

¹Institute of information technologies “Intellias”

²Ivan Franko National University of Lviv

³Lviv Polytechnic National University

semenyuk@gmail.com

An obvious extension to the basic hidden Markov model (HMM) model is to allow continuous observation space instead of a finite number of discrete symbols.

Let's consider such HMM as a two-component process $z(t) = (x(t), y(t))$. Where the HMM state process $x(t), t \geq 0$ is an uniformly ergodic Markov process in the standard phase space $(X, \mathbb{S})$ with a generator [1]:

$$\mathcal{Q}\varphi(x) = q(x) \int_x P(x, dy) [\varphi(y) - \varphi(x)], \quad \varphi \in \mathbf{B}(X).$$

Let process $x(t)$ have stationary distribution $\pi(B), B \in \mathbb{S}$.

And the HMM observation process $y(t)$ is defined by the conditional distributions:

$$b(x, y) = p(y(t) = y \mid x(t) = x), y \in Y$$

The conditional distributions $b(x, y)$ can in principle be arbitrary but usually they are restricted to be finite mixtures of simple parametric distributions, like Gaussian [2]

It can be shown that the process $z(t)$ is Markovian, moreover, it is ergodic and stationary if $x(t)$ is ergodic and stationary [3].

Obtained result allows to consider and study complex stochastic systems that depends on hidden Markov models [1].

References

1. Koroliuk V. S., Limnios N. Stochastic Systems in Merging Phase Space. - World Scientific, 2005.
2. Lawrence R. Rabiner. A tutorial on hidden Markov models and selected applications in speech recognition // Proceedings of the IEEE. - 1989. -77(2). – P. 257-286.
3. Leroux, B.G. Maximum-likelihood estimation for hidden Markov models// Stochastic Processes and their Applications. – 1992. – 40. – P.127-143.

ON TWO-STEP GAUSS-NEWTON TYPE METHODS FOR SOLVING THE NONLINEAR LEAST SQUARES PROBLEM

¹Shakhno S., ²Iakymchuk R., ¹Yarmola H.

¹Ivan Franko National University of Lviv, Ukraine

²KTH Royal Institute of Technology, Sweden

¹s_shakhno@lnu.edu.ua, ²riakymch@kth.se

Let us consider the nonlinear least squares problem

$$\min f(x) := \frac{1}{2} F(x)^T F(x), \quad (1)$$

where $F: R^n \rightarrow R^m$ is a Fréchet-differentiable operator, $m \geq n$.

For solving the problem (1) we apply two-step iterative methods [1] that are based on the Gauss-Newton method [2]. On each iteration, these methods require to compute the derivative only once, as the Gauss-Newton method, and to solve two systems of linear equations but with the same symmetric matrix $F'(z_k)^T F'(z_k)$. The latter induces a small increase in the number of floating-point operations ($O(n^2)$), which is negligible compared to the Gauss-Newton method. However, the order of convergence of these methods is higher than of the Gauss-Newton method and it is in range from $1 + \sqrt{2}$ to 3.

In this talk, we will present the local convergence of the considered methods, the uniqueness ball of the solution, and the results of numerical experiments.

References

1. Iakymchuk R., Shakhno S. On the Convergence Analysis of a Two-Step Modification of the Gauss-Newton Method // PAMM – Proc. Appl. Math. Mech. – 2014. – Vol.14. – Issue 1. – P. 813-814.
2. Dennis J. E., Jr., Schnabel R.B. Numerical Methods for Unconstrained Optimization and Nonlinear Equations, SIAM, 1996, 378 p.

SECURITY SYSTEM ELEMENTS OF ASDE OMEGA

Sharapov M., Kucherenko O., Lukovych O.

Taras Shevchenko National University of Kyiv, Ukraine

boxus@ukr.net

While developing the alternative system of distant education (ASDE)Omega we paid attention to its security system elements. The formal (visual) side of security system first appears during registration of new user in Omega. One can access Omega's distant courses only

after registration that includes filling of the appropriate online form. The submitted information is stored to a separate file at the server while the administrator of the project is informed about new user via e-mail. Later on administrator checks all submitted information and makes decision on transferring these data to a database. It precludes the use of sql-injections of all kinds and other harmful scripts. It increases safety of the registration process and makes it impossible to penetrate to the system without legal authorization. In addition to the data provided by the user during registration, administrator obtains additional technical information about the user and stores it to the database. Administrator can also change some data (e.g. login, password) and inform user about it via e-mail. It could happen when database already contains entered login and/or password. Some sites prefer to warn their users about such coincidences during registration but this policy weakens the security while giving the user additional information on database. Sometimes users submit strong (long) passwords that oddly enough could be easily brute forced, so administrator can change these passwords too.

Every user belongs to one of main groups with corresponding rights. Within certain group, each user has got an access to a specific number of e-learning courses; other courses are not available for him or his access/rights/permissions are limited there. These rights determine, for example, whether he can pass tests and write control papers. If user enters the system with teacher's rights then he can view students' tests, check up their control papers and so on. It is possible to prevent an unauthorized access even if intruder (hacker) knows both valid login and password.

**ABOUT RADON-NIKODYM DENSITIES, USED FOR THE
MEASURES, GENERATED BY STATIONARY GAUSSIAN
PROCESSES IN HILBERT SPACE, UNDER THEIR
NONLINEAR EVOLUTIONARY TRANSFORMATIONS**

Shataashvili A.D., Fomina T.A.

Batumi Shota Rustaveli State University

Donetsk National University of Economics and Trade
named after M. Tugan-Baranovsky

shatal@bk.ru

One of the main problems in the theory of random processes is the establishment of equivalence conditions or the absolute continuity of the two probability measures, generated by some random processes in

certain function spaces or in an abstract Hilbert space, or, generally speaking, interconnected linear or nonlinear transformations and in an obvious finding type of respective Radon-Nikodim densities, which practically represent the main instrument for solving many problems of a practical nature in statistics of random processes, such as the establishment of optimal assessment in the extrapolation tasks, filtering of random processes, their optimal management, and in the tasks, dealing with information transfer and establishment of their entropy degree, and many others - their list is huge. Therefore, it becomes clear how important is any new result in the investigated area, which at least to a small degree promotes this science further.

In our early works we analyzed two pairs of random processes $(y(t), \xi(t))$ and $(x(t), \xi(t))$, $(0 \leq t \leq a)$ in Hilbert space H with a scalar product $(\cdot, \cdot)$ and a norm $|\cdot|$ and interconnected nonlinear and linear evolutionary differential operators as follows:

$$\frac{dy(t)}{dt} - A(t)y(t) + A_1(t)y(t) + \alpha f(t)y(t) = \xi(t), \quad (1)$$

$$\frac{dx(t)}{dt} - A(t)y(t) + A_1(t)x(t) = \xi(t), \quad (2)$$

$$(0 \leq t \leq a), y(0) = x(0) = \xi(0) = 0$$

Where α is a parameter, $A(t)$ and $A_1(t)$ – are the families of linear, generally said, unrestricted operators, but such ones generate the families of evolutionary restricted operators - $V(t, s)$ and $V_1(t, s) = V(t, s)A_1(s)$ according to Hilbert-Schmidt norm in H ; $f(t, y(t))$ is a – nonlinear function, defined in $\{[0, a] \times H\}$ area and taking their values from H and its trajectory belongs to $L\{[0, a] \times (-1)\}$ function space, $\xi(t)$ is a Gaussian random process with the values from H , $M\xi(t) = 0$ by correlative operator function $R(t, s) (0 \leq t, s \leq a)$, which is also restricted according to Hilbert-Schmidt norm in H space.

There has been established a unique solution of equations (1) and (2) $y(t)$ and $x(t)$, the equivalence of $\mu_{yy}X(\mu_y \sim \mu_x)$ measures, generated by these solutions (incidentally, $x(t)$ - is a Gaussian process, because (2) is a linear equation); there has been found a general type of Radon-Nikodym density.

STUDENT-LIKE MODELS FOR RISKY ASSET AND CONCEPT OF FRACTAL MARKET

Shchestyuk N.

National University “Kyiv-Mohyla Academy”, Ukraine

Natalyshch@gmail.com

A generation ago, the Efficient Market Hypothesis (EMH) was widely accepted by academic financial economists and still resides at the forefront of modern financial theory; for example, see Eugene Fama’s (Nobel Prize in 2013) influential survey article, “Efficient Capital Markets” (1970). The EMH states that asset prices fully reflect all available information, requires that agents have rational expectation and investors’ reactions be random and follow a normal distribution so that the net effect on market prices can not be reliably exploited to make abnormal profit. A direct implication is that it is impossible to "beat the market" consistently on a risk-adjusted basis. Thus there is a very close link between EMH and the random walk hypothesis (Louis Bachelier, 1900). Later financial economists began making heavy use of probability theory and statistics to model asset prices. In the Black-Scholes model (Nobel Prize in 1997) the instantaneous log return of stock price P_t is an infinitesimal random walk with drift μ ; more precisely, it is a geometrical Brownian motion.

In the wake of the 2008 financial crisis, many have challenged the dominant economic theories and perspectives on markets. The EMH in particular has fallen short in explaining the crisis. Then alternative theories that provide a more accurate representation of markets have emerged. Fractal Market Hypothesis (FMH), for instance, focuses on the investment horizons and liquidity of markets and investors – factors limited in the framework of EMH. The theoretical framework of fractal markets can clearly explain investor behavior during periods of crisis and stability. Edgar Peters formalized FMH in 1991 within the framework of chaos theory in 1991 to explain the heterogeneity of investors with respect to their investment horizons. The concept of fractals comes from mathematics (B. Mandelbrott) and refers to a fragmented geometric shape that can be broken into smaller parts that fully or nearly replicate the whole.

In this paper we present alternative to GBM that incorporates the Student-like distribution of the returns. This model gives asset prices as GBM but is driven by some nondecreasing stochastic "activity time" (or "fractal time") process.

We consider a model for stock price $\{P_t, t \geq 0\}$ driven by standard Brownian motion B , which has a “fractal clock” rather than a calendar clock:

$$\log P_t = \log P_0 + \mu t + \theta T_t + \sigma B(T_t), \quad (1)$$

where $\mu \in R$, $\sigma > 0$ reflect drift and diffusion, $\theta \in R$ determined skewness, $\{T_t, t \geq 0\}$ is positive process, nondecreasing with stationary but not independent increments $\tau_t = T_t - T_{t-1}$. When random activity time process $T_t = t$, then equation (1) is Black-Sholes formula and $\log P_t$ is normal for any t . In this paper we construct the activity time

$T_t^m = \sum_{i=1}^t \tau_i^m$, where τ_i has reciprocal (inverse) Gamma distribution

$R\Gamma(\alpha, \beta)$. For this model we present distribution theory, find option price and consider delta-hedging problem.

References

1. Giron F.J., Castillo C. A note on the convolution of inverted-gamma distributions with applications to the B-Fisher distribution, - Statistic and Operations Research. - 2001. - 95(1). - P.39-44.
2. Heyde C.C., Leonenko N.N. Student Processes.// Applied Probability. - 2005. - 37. - P. 342-365.

NON-STATIONARY MODELS OF POPULATION DYNAMICS IN INFORMATION CONFRONTATION

Shevchuk Y. M.

Taras Shevchenko National University of Kyiv, Ukraine

nysya@hotmail.com

In this work non-stationary model of information confrontation is offered. Non-stationary model represented as a system non-linear differential equations. The innovation of this model is non-stationarity.

Let us denote by $L_k(t), k = \overline{1, N}$ the solution of equations

$$\frac{dL_k(t)}{dt} = (a_k(t) + b_k(t)L_k(t)) \left(L_0 - \sum_{k=1}^N L_k(t) \right), \quad L_k(0) = L_{0k},$$

with $L_{0k} > 0, a_k(t), b_k(t)$ – functions continuous on the random interval $[0, T]$.

The detailed analysis of this mathematical model is leading us to the necessary condition for the existence of positive bounded solutions and interval which it belongs to. If we are adding the control component to the system, then we get the problem of controllability for non-stationary models of information confrontation.

Let us denote by $L_k(t), k = \overline{1, N}$ the solution of equations

$$\frac{dL_k(t)}{dt} = (a_k(t)u(t) + b_k(t)L_k(t))(L_0 - L_k(t)), \quad L_k(0) = L_{0k},$$

$a_k(t), b_k(t)$ - functions continuous on the random interval $[0, T]$.

Problem transforms to find the continuous function $u(t)$, which $\tilde{L}_k(T) = L_{k3}, k = \overline{1, N}$, where $\tilde{L}_k(T) = L_0 - L_k(T)$.

References

1. Nakonechny O.G. Best-mean estimates in models of information confrontation// XXIV International Conference “Problem of desigion making under uncertainties”. - Cesky Rudolec, Czech Republic. September 1-5, 2014. - P.114-115.
2. Nakonechny O.G. Confrontation problems with the dynamics Gompertzian systems/ Nakonechny O.G. and Zinko P.M.// Journal of Computational&Applied Mathematics. – 2015 – №3 (120) - P. 50-60.

MODAL TRANSITIONAL LOGICS OF PARTIAL QUASIARY PREDICATES WITHOUT MONOTONICITY RESTRICTION

Shkilniak O.

Taras Shevchenko National University of Kyiv, Ukraine

me.oksana@gmail.com

In this paper we study new classes of program-oriented logical formalisms – modal transitional logics of partial non-monotone predicates.

Modal logics have many applications in various fields including theoretical and applied computer science, philosophy and linguistics. They are usually based on classical predicate logic which, however, has some fundamental restrictions which don't allow taking into account sufficiently incompleteness and partiality of information. Composition-nominative modal logics of partial predicates [1] is a program-oriented logical formalism based on wide classes of partial mappings over

nominative data combined with modal logics. Modal transitional logics (MTL) of partial quasiary predicates [1, 2] are its important variant.

In this paper we consider MTL of partial quasiary predicates without monotonicity restriction. We define languages and semantic models of pure first-order MTL. Depending on restrictions on the transition relation, a number of different classes of MTL can be distinguished. Significant difference between MTL of monotone and non-monotone predicates is demonstrated using the converse Barcan formula as an example. We describe semantic properties of pure first-order MTL of non-monotone predicates. Various logical consequence relations ($\models_{IR}$, $\models_T$, $\models_F$, $\models_{TF}$) for sets of formulas specified with states are defined and their properties are described. Then, basing on these properties, we construct corresponding sequent calculi. We define various classes of sequent calculi of pure first-order MTL of non-monotone predicates. For these calculi we specify conditions for a closure of a sequent and reproduce corresponding sequent forms. The soundness and completeness theorems are proved for the introduced calculi.

References

1. Nikitchenko M., Shkilniak S.. Applied Logic. - Kyiv: Publishing house Kyivskyi Universytet, 2013. - 278 p. (in ukr).
2. Shkilniak O. Modal Logics of Partial Predicates without Monotonicity Restriction. In Proceedings FOI-2015. Chisinau, Moldova, 2015. - P. 198–211.
3. Shkilniak O. Modal logics of non-monotone partial predicates// Bulletin of Taras Shevchenko National University of Kyiv. Series: Physics & Mathematics. – 2015. – 3. - P. 141–147 (in ukr).

QUANTIFIER-FREE FUNCTIONAL AND RENOMINATIVE LOGICS OF PARTIAL PREDICATES

Shkilniak S.S., Volkovyskyi D.B.

Taras Shevchenko National University of Kyiv, Ukraine

ttp@unicyb.kiev.ua

In this paper we study new classes of program-oriented logical formalisms: quantifier-free composition-nominative logics of partial quasiary predicates. Those logics occupy intermediate position between propositional logic and first-order logics. Quantifier-free logics don't contain quantification composition specific to first-order logics.

Let's distinguish the following levels of quantifier-free logics of quasiary predicates:

- renominative logic (RNL);
- renominative logic with predicates of weak equality (RNLE);
- renominative logic with predicates of strong equality (RNLSE);
- quantifier-free functional logic (FQFL);
- quantifier-free functional logic with composition of weak equality (FQFLE);
- quantifier-free functional logic with composition of strong equality (FQFLSE).

Renominative logic is disclosed in [1]. Renominative logic with equality and quantifier-free functional logic are studied in [2,3], quantifier-free functional logic with equality are described in this article.

At quantifier-free levels functions and predicates are set on name-sets. V - A -name set is the function like $d: V \rightarrow A$, where V – set of object names (variables), A – the set of base values. Let's name the set of all V - A -name set as ${}^V A$.

Functions of the form ${}^V A \rightarrow A$ call V - A -quasiary functions; denote the class of such functions as Fn^A . Functions of the form ${}^V A \rightarrow \{T, F\}$ call V - A -quasiary predicates; denote the class of such predicates as Pr^A .

It's possible to rename basic value input predicates on the RNL level. This allow us to enter the renominative composition $R_{\bar{x}}^{\bar{v}}$; base compositions RNL: logical connections $\neg, \vee$ and $R_{\bar{x}}^{\bar{v}}$.

On RNLS and RNLSE levels in addition it's possible to distinguish variables using special 0-ares compositions – equality predicates. We introduce predicates weak (up to a certainty) equality $=_{xy}$ and strict (exact) equality $\equiv_{xy}$. Basic compositions RNLS: $\neg, \vee, R_{\bar{x}}^{\bar{v}}, =_{xy}$.

Basic compositions RNLSE: $\neg, \vee, R_{\bar{x}}^{\bar{v}}, \equiv_{xy}$.

At quantifier free functional levels one's can create new baselines for input data of functions and predicates. This allows to enter the composition of superposition $S^{\bar{x}}$. We should enter special 0-arna compositions – functions denomination (dereferencing) ' $\bar{x}$ ', where $x \in V$ to work with the individual data components. Basic composition FQFL: $\neg, \vee, S^{\bar{x}}, 'x$.

At quantifier free and functional levels with equality additionally introduce a special composition of equality $Fn^A \times Fn^A \rightarrow Pr^A$. We consider two kinds of this composition: weak (up to a certainty) equality $=$ and strict (exact) equality $\equiv$.

Basic composition FQFLE: $\neg, \vee, S^{\bar{x}}, 'x, =$.

Basic composition FQFLES: $\neg, \vee, S^{\bar{x}}, 'x, \equiv$.

There was a description of the semantic models and language of classes RNL, RNLE, RNLSE, FQFL, FQFLE, FQFLSE. For them explored the relation of logical consequence $\models_{IR}, \models_T, \models_F, \models_{TF}$ and the logical equivalence $\sim_{IR}, \sim_T, \sim_F, \sim_{TF}$.

Proposed classically-identical normal forms of formulas when renominative characters (superposition) applied only to the characters basic predicates (basic functions and predicates).

Theorem 1. For each Φ formula of languages RNL, RNLE, RNLSE, FQFL, FQFLE, FQFLSE is possible to build the appropriate normal formula Ψ such that $\Phi \sim_{TF} \Psi$.

Theorem 2. In the case of FQFLE for $\models_{IR}$ we have transitivity composition $=$, but for $\models_T, \models_F, \models_{TF}$ transitivity $=$ is broken.

This means that for FQFLE there is only appropriate attitude $\models_{IR}$.

Theorem 3. In the case of FQFLSE we have transitivity composition $\equiv$ for each of the ratios $\models_{TF}, \models_T, \models_F, \models_{IR}$.

Based on the properties of the logical ratio consequence for sets of formulas we build relevant sequent calculus. Shows properties of decomposition formula (they induce the corresponding sequential form – sequent calculus rules) and properties of availability of logical consequence (they induce the corresponding of closure sequence, locked sequence is sequential calculus axioms).

References

1. Nikitchenko M., Shkilniak S. Mathematical logic and theory of algorithms. - Kyiv: Publ. center Kyivskyi Universitytet, 2008. - 528 p. (in ukr).
2. Shkilniak S., Volkovytskyi D. Renominative composition-nominative logics with predicates of equality// Bulletin of Taras Shevchenko National University of Kyiv. Series: Physics & Mathematics. – 2014. – 3. - P. 198–205 (in ukr).
3. Shkilniak S., Volkovytskyi D. Quantifier-free functional logics of partial quasi-ary predicates.// Bulletin of Taras Shevchenko National University of Kyiv. Series: Physics & Mathematics. – 2015. – 3. - P. 148–154 (in ukr).

PETUNIN ELLIPSOID ROBUSTNESS

Shlykov M.

Taras Shevchenko National University of Kyiv, Ukraine

maksym_shlykov@ukr.net

Ellipsoids are widely used in decision making theory. They can give data description, estimate mean, mode, median and quantiles, determine data-ranking, classify data. The most common ellipsoidal estimators are minimum volume ellipsoid and minimum covariance determinant estimator. In [1] author uses them to estimate the mean of data set.

One of the ellipsoids that may be used to estimate is Petunin ellipsoid. Its main capability is known confidence level that equals to

$\frac{n}{n+1}$. Here n is the size of data set. The original algorithm proposed by author is inconvenient for spaces with dimension higher than three. We have modified the original algorithm by reformulating it in terms of affine subspaces. The new algorithm allows building Petunin ellipsoid in any finite-dimensional spaces even for cases when dataset is degenerate. The complexity of modified algorithm is the same as the original one's. It equals $O(n \lg n)$ for one- and two-dimensional spaces and $O(n^2)$ for higher dimensions.

Another important issue about ellipsoidal estimators is their robustness to outliers. One of the robustness characteristics that may be considered is so-called breakdown point (see [1]). It appears that Petunin ellipsoid estimator for mean has the same breakdown point as minimum volume ellipsoid and minimum covariance determinant estimator i.e. can be treated as high-breakdown estimator.

Further research will be concerned with asymptotical properties of Petunin ellipsoid matrix and center. In particular it is interesting if Mahalanobis distance determined by ellipsoid will converge to Hotelling distribution.

References

1. Rousseeuw P.J. Multivariate estimation with high breakdown point. In Mathematical Statistics and Applications Vol. B - Dordrecht, 1985. – P. 283-297.

SOLUTIONS OPTIMIZATION OF LINEAR DIFFERENCE EQUATIONS SYSTEM WITH RANDOM COEFFICIENTS

Shusharin Yu.

Kyiv National Economic University named after Vadym Hetman,
Ukraine

shusharin@meta.ua

Considering system of linear difference equations with random coefficients

$$X_{n+1} = A(\xi_{n+1}, \xi) X_n + B(\xi_{n+1}, \xi) U_n \quad (n=0,1,2,\dots), \quad (1)$$

where ξ_n – Markov process, which is determined by the difference equations system

$$p_k(n+1) = \sum_{s=1}^q \pi_{ks} p_s(n), \quad p_k(n) \equiv P\{\xi_n = \theta_k\} \quad (2)$$
$$(k=1,\dots,q) \quad (n=0,1,2,\dots)$$

Control vector U_n is searched from condition of the quadratic functional minimum

$$v = \left\langle \sum_{n=0}^{\infty} X_n^* Q(\xi_n) X_n + U_n^* L(\xi_n) U_n \right\rangle. \quad (3)$$

We will find the optimal control in the form

$$U_n = S(\xi_n) X_n \quad (n=0,1,2,\dots). \quad (4)$$

Let us reduce the system of linear difference equations (1) to the system of difference equations.

Necessary conditions of solutions optimality of the difference equations system (1) are defined.

References

1. Валеев К.Г., Карелова О.Л., Торелов В.И. Оптимизация линейных систем со случайными коэффициентами. - М., издательство РУДН, 1996. - 258 с.
2. Пашко А.О., Шушарін Ю.В. Розв'язування лінійних стохастичних рівнянь із випадковими коефіцієнтами методами Монте-Карло. Науковий вісник Чернівецького національного університету імені Юрія Федьковича. Серія: Комп'ютерні системи та компоненти. – 2014. – Вип.№2. – Том 5. – С. 21-27.

GROUPING INFORMATION PROBLEM: LINEAR DISCRIMINATION OF MATRIX 'FEATURE VECTORS'

Skotarenko F.

Taras Shevchenko National University of Kyiv, Ukraine

fred.unicyb@gmail.com

The problem of a linear discrimination as a variant of the problem of grouping information (GIP). In general GIP which is an important component of applied research, appears in one of the manifestations: a problem of recovery function, presented his observations or - in the form of classification, clustering, pattern recognition. Linear discrimination of two classes is an important representative of the latest version of GIP. Linear discrimination inserted and considered for elements of Euclidean space matrices of a fixed dimension. The importance of clustering or classification tasks defined by the recognition that in many important applied problems of representative natural objects are grouped perform matrix. Matrix, in particular, presented image. Just - spectrogram in processing audio signals, too, is the image matrix. Formulation and solution of linear discrimination based on the use of a special class of linear operators introduced by the authors in [4] - cortege operators. The work the proposed are necessary facts from the theory cortege operators.

References.

1. Donchenko V.S. Kirichenko M.F., Serbaev D.P. Recursive regression transformation and dynamical systems// Proc. of the Seventh International Conference "Computer Data analysis and Modeling: robustness and computer intensive methods". – V.1. – September 6-10, 2004. – Minsk. – P. 147-151.
2. Donchenko V. Kirichenko M., Krivonos Yu. Generalizing of neural nets: Functional nets of special type// International Journal Information Models and Analysis. – N 3. –V.14. – 2007. Kyiv, Ukraine -Sofia, Bulgaria. – P. 259-266.
3. Donchenko V. Krak Ju., Krivonos Yu. Recurrent procedure in solving the Grouping Information Problem in Applied Mathematics//ITHEA: International Journal Information Theories and Applications. – V.1.– N 1. Kyiv, Ukraine -Sofia, Bulgaria. – 2012. – P. 62 -77.
4. Donchenko V., Zinko T., Skotarenko F. "Feature Vectors" in Grouping Information Problem in Applied Mathematics: Vectors and Matrixes. – V.Velichko, A.Voloshin, K. Markov(ed.)- Problems of Computer Intellectualization.- Institute of Cybernetics NASU, ITHEA.-Kyiv, Ukraine -Sofia, Bulgaria.- 2012.- P. 111-124.

ON-LINE PARAMETER ESTIMATION WITH LEAST DEVIATION NORM FROM ‘ATTRACTION’ POINTS FOR LINEAR OBJECTS UNDER UNCERTAINTIES

Slabospitsky A.S.

Taras Shevchenko National University of Kyiv, Ukraine

sl@univ.kiev.ua

The on-line estimation problem of non-stationary parameter matrix A is considered for linear object 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 investigated in non-classical case when this one may be not unique for linear discrete dynamic system:

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

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

Under these assumptions the set of above-mentioned estimate of slowly time-varying parameter matrix A is defined as

$$\text{Arg min}_A Q(A, N),$$

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

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

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

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

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

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

AIR DRAG FUNCTIONS INTERPOLATION USING PARABOLIC SPLINE

Stelia O., Sirenko I., Potapenko L.

Taras Shevchenko National University of Kyiv, Ukraine

oleg.stelia@gmail.com

One of the main factors that affect the characteristics of the projectile trajectory is air resistance. Last years the dependence of projectile air resistance on its speed was determined by a ground fire. For computer calculating of projectiles trajectories a system of nonlinear differential equations of external ballistics was solved. Air resistance function is the right side of these equations. In the process of solving these equations must have a drag function approximation. For many applications, such as solving inverse problems of ballistics, it is important to approximate function that are not just continuous, but also has a continuous derivative.

In this paper interpolation of table air resistance function was proposed by using parabolic spline. Methods of spline interpolation functions make it possible to build piecewise polynomial function of low degree which is continuous with its derivatives. Presentation of air resistance function as spline allows its further effective use in numerical algorithms of differential equations solution that describe the motion of projectiles.

In this work parabolic splines for interpolation Siachi air resistance law and 1943 year air drag law was built. Graphic comparison of the constructed spline with the approximations of laws air used by other authors was done.

This graphs of splines exhibit high precision and show that the spline function saves the behavior of resistance and can be used in models of external ballistics.

MONOTONIC DIFFERENCE SCHEME FOR THE UNSTEADY CONVECTION-DIFFUSION EQUATION

Stelia O., Sirenko I., Potapenko L., Stelia I.

Taras Shevchenko National University of Kyiv, Ukraine

oleg.stelia@gmail.com

Numerous applications, particularly in ballistics, simulation environment, medicine, etc. are based on boundary value problems for the of convection-diffusion-reaction equation. Such wide using of this equation makes it necessary to create the new highly efficient numerical

methods for solving it, especially for significant dominance of convection diffusion. In this paper a monotonic difference scheme for of unsteady convection-diffusion-reaction equations.

We consider the boundary problem

$$\begin{aligned} \frac{\partial u(x,t)}{\partial t} &= D(x,t) \frac{\partial^2 u(x,t)}{\partial x^2} - V(x,t) \frac{\partial u(x,t)}{\partial x} + \\ &+ A(x,t)u(x,t) + f(x,t), x \in (0, L), t > 0, \\ u(0,t) &= U_0(t), \quad u(L,t) = U_L(t), \\ V(x,t) &\neq 0, \quad 0 < D(x,t) < 1, \end{aligned}$$

To construct the difference scheme we used parabolic splines. The monotonicity of obtained difference scheme was shown.

Using developed software the numerical calculation in case of dominance member of convective diffusion was carried out. The numerical solution of the problem can be reproduced as a parabolic spline on the interval of integration for selected discrete points in time. The results of numerical experiments show that proposed monotonic difference scheme for the convection-diffusion-reaction equation allows solving boundary value problems for a wide range of coefficients values.

RESEARCH, EVALUATION AND IMPROVEMENT OF MANAGEMENT METHODS OF EDUCATIONAL PROCESS IN HIGHER EDUCATIONAL INSTITUTIONS

Tevdoradze M., Lolashvili N., Bajiashvili A.,

Saltkhutsishvili M., Rukhadze T.

Georgian Technical University

medeat@gtu.ge

The education sphere is characterized by specific management tasks, for solution of which there are no ready means. This situation in the sphere of educational process management of higher educational institutions is caused by the weak structuring and complexity of the formalization of management problems, the complexity of the structure and organization of management of modern higher educational institutions. At the same time, practically, there are not exist problem-oriented decision support systems in this area. In addition, also should

be noted a relatively low degree of independence of decision-making process in higher educational institutions, which is limited by a variety of regulations and administrative documents.

Taking into account the above mentioned, in the world there is a practice where management of higher educational institution is considered as management of business-processes [1]. Accordingly, it becomes possible to apply the approaches, methods and means for design and improvement/optimization of business-processes. This, eventually, increases the efficiency of the higher education institution. The research of organization's business-processes makes it possible to study and improve the performance of departments, to optimize their interactions, to reduce costs and identify those processes that affect on the effectiveness indicators.

Next, we propose the method of research, evaluation and increase of the efficiency of management methods of educational process from the point of view of business-processes theory.

To study and evaluate the effectiveness of the educational process, first must be developed a system of criteria, parameters and indicators for evaluation the effectiveness of the educational process, which should be focused on evaluation system of higher education institutions and represent the strategic goals of a higher education institution [2]. Then must be identified the business-processes that take place in the learning process and build their valuation models. In the activity of any organization it can be identified at least several dozens of business-processes. For identification of the business-processes and their structuring there may be carried out the following classification of business-processes: basic, accompanying, supporting, providing, managing and development processes.

After identification of the business-processes, there must be developed models of their evaluation and improvement/optimization in order to obtain further recommendations. This work should include several steps:

1. The construction of the initial model - "As is". At this stage, there are revealed the business-process boundaries, identified its key elements, is collected information about its work. This model does not fully reflect the work process;

2. The revision of the initial model, analysis and clarification. Here are revealed contradictions and duplication of actions, are defined limitations, relations of process, and is received the final model - "As is";

3. The development of the model "To be" - after analyzing the current situation must be determined the desired state of the process. This kind of model shows how the process should be in the result of all the improvements;

4. Testing and application of the model "To be". Testing is connected with the checking of the developed model and, if necessary, with its modification. Then implementation begins. After application of the final model - "To be", the effectiveness of the educational institution is verified, by means of organizational diagnostics, and also by monitoring the performance indicators of business-processes.

References

1. Tevdoradze M., Bajiashvili A., Lolashvili N., Chigladze T., Ioseliani G.. Process-oriented management of modern organizational institution. "Intellect", N3(50), 2014. – P.14-17.
2. Tevdoradze M., Bajiashvili A., Lolashvili N., Bagishvili G., Saltkhutsishvili M. Computer modeling of business-processes. Inter.Scientific conf., dedicated to the 85th anniversary of Academician I.Prangishvili "Information and computer technologies, modeling and management." Works. GTU. 3-5 Nov.,Tbilisi, Georgia, 2015. – P.176-181.

INTELLECTUALIZATION PROBLEMS OF VIRTUAL ENTERPRISES

Timashova L.

Taras Shevchenko National University of Kiev, Ukraine

alex_timashov@mail.ru

New approaches for creation of virtual enterprises are considered. Also new methods are proposed to intellectualize the processes of management. Basic concepts and information tools are suggested to realize systems of such class.

In a contemporary information society, the traditional concept of an enterprise is gradually losing its isolation and spatial territorial localization features. Traditionally an enterprise is defined as an industrial and technological organization merging means of production and labor force for goods and services production. Network- and virtual organizations (enterprises) have developed ultimately. In these organizations boundaries between their members, resources and units are not clearly determined. From our point of view, virtual organizations are more productive since conventional enterprises with persistent

hierarchical logistic structure are not capable of prompt changes in business.

Software tool's family for group activity is used to solve problems of functioning: message systems; computer conferencing; electronic meeting rooms; co-authoring systems; and argumentation systems[1].

By current moment the problem of virtual enterprise creation has been solved successfully. System of virtual enterprise organizing as an information system of partners-participants in the distributed infrastructure was developed. It includes an optimization engine for complex search for partners. Balance models were built to plan processes of resources integration. Business processes were classified as a base for new systems engineering. Integrated set of models was developed for decision making system in the field of finances, logistics, and production. Economic and mathematical apparatus and crisis-proof management technologies were developed. They are necessary tools for modeling of virtual enterprise's trends

References

1. Davidow W., Malone M. The virtual corporation: structuring and revitalizing the corporation for the 21st century. - N.Y., Harper Collins, 1992.

FINITE AND INFINITE COMBINATORIAL SETS

Timofeeva N.K.

International Scientific and Training Center for Information
Technologies and Systems, Ukraine
tymnad@gmail.com

Typically, the problems of combinatorial optimization are solved on a finite set of combinatorial nature. The argument of objective function of them is the combinatorial configuration of different types [1, 2]. These are the permutation, the sample of different types, the partitioning of the natural number, graphs and more. But if you examine them in detail, we can see that their set can be both finite and infinite. Consider the partitioning n -element set into subsets. This combinatorial configuration is argument of objective function in different problems of partitioning, including such as classification, clustering, the problem of coating etc. In solving the problem of clustering number of clusters and their characteristics are unknown, but asked the set of elements that need to be distributed in clusters. Therefore, the argument of the

objective function it is the partitioning n -element set into subsets without repetition, formed of n -element of a finite basic set $A = \{a_1, \dots, a_n\}$. Suitably their set is finite. In the classification characteristic classes are generally known, but an unknown number of elements subject to classification. Moreover, the same object may belong to different classes. Therefore, the argument of objective function in this problem formed of an infinite base set. Suitably their set is infinite. It contains a partitioning n -element set into subsets with repetition. By partitioning problems ascribe and the problems of coating of objects cover a given surface. Modeled it in the theory of combinatorial optimization can be seen that the argument of the objective function in there is a partition n -element set of the subset both repetition and without repetition.

References

1. Сергиенко И.В. Модели и методы решения на ЭВМ комбинаторных задач оптимизации /И. В. Сергиенко, М. Ф. Каспшицкая. – К. : Наук. думка, 1981.– 281 с.
2. Тимофієва Н.К. Теоретико-числові методи розв'язання задач комбінаторної оптимізації. Автореф. дис... докт. техн. наук / – Ін-т кібернетики ім. В.М. Глушкова НАН України, Київ. – 2007. – 32 с.

AUTOMATIC SUPPORT SYSTEMS FOR ANESTHESIA PRACTITIONERS

Turkia Ekaterine¹, Mgeladze Jumber², Jibuti David¹
¹Georgian Technical University, Georgia
²Caraps Medline Clinic, Georgia
e.turkia@gtu.ge; jmgeladze@gmail.com

Decision making and expert analysis systems are becoming more important in the medical area. In order to effectively operate, these systems must contain complete knowledge base of related field, which is usually challenging in terms of data gathering [1].

As of today the practice to keep single medical history on a patient with available access by several health / diagnostic centers is not established in Georgia. Patient data including examination results, prescription history are especially important for anesthesiology. Two cases require special attention:

Very often patients don't remember about prescription medication taken or treatments performed that can have some impact on the

anesthesia procedure. For example, some patients don't mention anticoagulants or even hide the fact of taking antidepressants.

In critical cases, when patient requires immediate operation or when he or she is unconscious or incommunicable. Besides unknown medication the patient's illnesses like Parkinson's, epilepsy, allergy, and others can affect anesthesia procedure.

Lack of information about patient's medical history puts his vital systems – like cardiovascular, pulmonary, and nervous – under high risk, which can lead to worsening of patient's condition up to fatality in extreme cases.

Our goal is to create centralized system to store patient data, which is required for anesthesia procedure. This system will integrate diagnostic results, sickness / treatment history, specialist notes (prescriptions, advice, results), which will be processed using formal methods of automatic expert analysis. Implementation of these machine learning systems based on both current and historical data will aid anesthesiologist to come to the right decision.

Figure 1 shows fragment of BPMN (Business Process Modelling Language) model, which describes interaction of stakeholders in centralized system of patient data store.

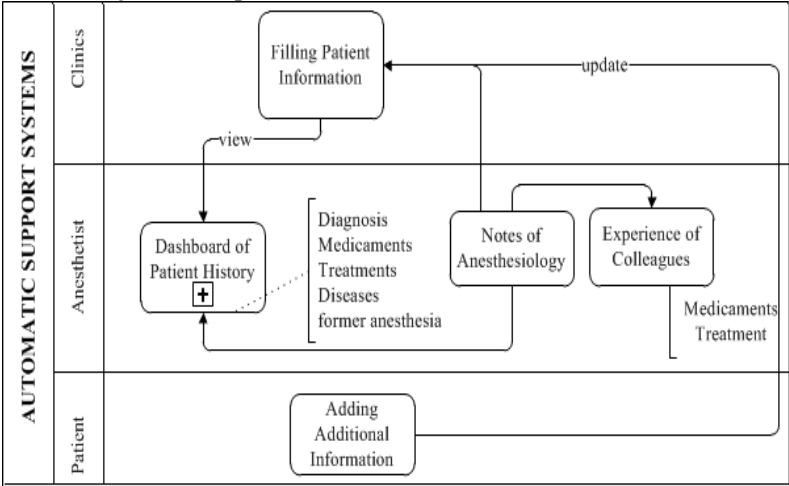


Fig.1. Fragment of BPMN model - interaction of stakeholders in centralized system

On the IT side, described model will be designed as an administrative support system, which is used for proactive decision

making in management. As a rule, these systems are user friendly, based on database and knowledge base systems [2,3].

It can generate analytic information including dashboards, includes search-engine instruments, incorporates tools for decision making and expert analysis.

References

1. Rahimi B, Vimarlund V, Timpka T. Health information system implementation: a qualitative meta-analysis, J Med Syst. - 2009. - 33(5). -P.359-68.
2. Kaniclidis A., Kimble C. A Development Framework for Executive Information Systems, Proceedings of GRONICS '95, 1995. Groningen, The Netherlands. - P.47 - 52.
3. Surguladze G., Turkia E. Software Management Basics, GTU, Tbilisi, 2016 (in georgian).

HIL TEST STANDS AND TESTING OF TRACKED VEHICLES

Tymashov O.

Glushkov Institute of Cybernetics NAS of Ukraine

alex_timashov@mail.ru

Hardware-In-the-Loop (HIL) is a form of real-time simulation. HIL differs from real-time simulation by the addition of a real component in the loop. This component may be an Electronic Control Unit (ECU).

HIL simulation is a technique that is used in the development and test of complex process systems. HIL simulation provides an effective platform by adding the complexity of the plant under control to the test platform. The complexity of the plant under control is included in test and development by adding a mathematical representation of all related dynamic systems. These mathematical representations are referred to as the "plant simulation." The plant is simulated and the ECU is real. The purpose of a Hardware-In-the-Loop system is to provide all of the electrical stimuli needed to fully exercise the ECU. In this way you "fool" the ECU into thinking that it is indeed connected to a real plant. The HIL simulation includes a mathematical model of the process and a hardware device/ECU you want to test. The hardware device is normally an embedded system. The most effective way to develop an embedded system is to connect the embedded system to the real plant, if such a plant exists. Increasingly however, HIL simulation is more efficient and or required. The main purpose with the HIL Simulation is to test the

hardware device on a simulator before we implement it on the real process.

You may want to test the different part of the of tracked vehicles individually to make sure it works as planned and HIL simulation is important in design and testing of the different subsystems.

As the complexity of the hardware being controlled increases, so too does the complexity of the embedded system that is designed to control the hardware. HIL simulation is a technique that is used increasingly in the development and test of complex real-time embedded systems.

Another benefit of Hardware-In-the-Loop is that testing can be done without damaging equipment.

SYSTEM PROBLEMS OF ECOLOGICAL SAFETY OF NANOTECHNOLOGIES ARE IN FOODS

Unrod V.I.

Cherkasy State Technological University, Ukraine

unrod@mail.ru

Modern nanotechnologies refers to materials, structures, and engineering systems in sizes ranging from 1–100 nm. These methods have rapidly developed in many different areas of science and technology and have created new multidisciplinary fields like nanobiotechnology, nanochemistry, nanoinformation technology. New nanomaterials make them more suitable for different applications in different industries. However, these materials may create threats of environment pollution or even harmful effects on human health. Our knowledge regarding the safety of used nanomaterials in food and nutrition industries is low. The main concern regarding human exposure to nanoparticles is that there are different entry routes such as digestion, inhalation, or skin absorption. After absorption, nanoparticles may enter the bloodstream and settle in different tissues such as the brain or trigger immune responses.

Some authors have studied genetic alteration as a potential consequence of nanoparticles in food or nanoengineering of food. Some social and non-government organizations like Action Group on Erosion, Technology and Concentration (ETC Group) have called for a moratorium on the release of nanotechnology products until their safety has been demonstrated. Despite all of these debates, nanotechnology has already entered into food packaging, agriculture technologies, and food processing, as well as the nature of food, so the public is seeking safety

assurances from governments and food producers.

There are system problems of ecological safety in the surfaces of nanostructures that could affect their cytotoxicity. Hydrophobicity, charge, roughness, and, most importantly, surface chemistry are factors that could change the toxicological effects of absorbed nanoparticles in the human body.

Reference

1. Moraru CI, Panchapakesan CP, Huang Q, Takhistov P, SEAN L, Kokini JL. Nanotechnology: a new frontier in food science. Food Technol-Chicago. 2003; 57(12):24–9.
2. Унрод В.И. Введение в науку о наноматериалах и нанотехнологиях: учебное пособие. – Черкассы: Издатель Чабаненко Ю.А., 2013. – 262 с.

ABOUT THE PROPERTIES AND APPLICATION OF THE SPECIAL PRIME NUMBERS SEQUENCES

Vadnyov D., Ivohin E.

Taras Shevchenko National University of Kyiv, Ukraine

dima@sybianwave.com, ivohin@univ.kiev.ua

This paper discusses the specific sequence of prime numbers, their properties, enters operations on these sequences, obtains estimates for intervals accommodation for prime numbers closest to the specified number. An algorithm to approximate an arbitrary rational number using elements introduced sequences of primes is proposed. It is proved statements accommodation for estimates intervals of prime numbers closest to the specified integer number. These results allow to prove the method of constructing triangular fuzzy numbers in interval form, the boundaries of which are elected by using the elements specific sequences of prime numbers [1].

The report contains analysis of special sequences of prime numbers and their properties and definitions of operations on defined sequences. An algorithm to approximate an arbitrary rational number with usage of elements from given prime number sequence is proposed. Set of non-negative rational numbers represented as two elements from given sequences ratio is reviewed. Lower and upper coupled sets are obtained, statements regarding estimations of placement intervals of prime numbers nearest to given integer are proven. Representation method for fuzzy integers and real numbers revealed. A method of formalization of the process of fuzzy discrete system states membership functions dynamics is developed. A fuzzy approach based modification of

Merkle-Hellman's messages encryption algorithm is offered. This modification improves algorithm's crypto stability level. Concept of fuzzy databases for processing weakly formalized information is generalized on the basis of fuzzy concepts formation and formalization of fuzzy select operations for quantitative terms.

Obtained results used to improve filtering results. There is proposed to use aperture size as interval based triangular integer fuzzy numbers. Increased computation time compensated by increased filtering results quality. Calculated results proof method's efficiency and constructivity.

References

1.Івохін Є.В. Про застосування спеціальних множин простих чисел для визначення міри належності нечітких множин// Журнал обчислювальної та прикл. математики. – 2013. – №4. – С.1-8.

TEAM BUILDING WITHIN ORGANIZATION AND THE BEST ALTERNATIVE CHOOSING PROBLEMS

Varshanidze T.

Batumi Shota Rustaveli State University, Georgia

tako.varshanidze@mail.ru

“People believe gladly what they want to believe”
(Caesar, Gaius Julius, 100-400 BC, roman general and statesman)

The present paper outlines within organizations, people are the most important production factor. It is people who determine the degree of success an organization is able to achieve. Within organizations, people have to cooperate to achieve goals. This article will focus attention not only on humans as individuals, but also as part of a group. The paper underlines, that people in organizations can be considered from various perspectives. Organizations prefer to attract employees. Motivated people are good at their job and therefore add extra value to the organization. But what is motivation? The word “motivation” comes from the Latin word “mover”, meaning “moving”. Motivation is what gets us moving. Motivation can be described as the inner readiness of a person to perform certain actions.

The paper emphasizes, that an important aspect of decision-making is that choices have to be made. In most cases, alternative will be available and the best one should be chose. In order to select the best option, relevant information is needed. It follows that the decision-making process is closely related to data collection and data assimilation processes. Decision often have to be made in situations where there is a

lack of information, resulting in a certain degree of uncertainty. Decision-making is a human activity, so cooperation and creativity play an important role. A number of techniques and tools can be used to help make effective decisions.

The paper concludes, that decisions made within organization are about issues or problems of a varied nature, derive from a variety of situations and need to be worked on by various people or groups. If there is a significant discrepancy between what should be happening and that is actually happening, there is problem.

References

1. Robbins, S. & Coulter, M., Management, New England, "Prentice Hall", 2003 (In English).
2. Tjepkema, S., Werken, Leren en Leven Met Groepen, Cambridge, "Cambridge University Press", 2003 (In English).
3. Rampersad, H., Effectief Teamwork, Gebaseerd op Total Performance Scorecard, Scriptum Management, October, London, Publisher "Perseus Books Group", 2002 (In English).
4. Alblas, G. and Wijsman, E., Gedrag in Organisaties, Wolters-Noordhoff, Groningen, Vaughan, "Woodbridge Press", 2001 (In English).

CONSTRUCTION OF ADAPTIVE GROWING CROPS AGROTECHNOLOGIES

Vergunova I.

Taras Shevchenko National University of Kyiv, Ukraine

vergunova@bigmir.net

The impossibility of accurately predict long-term weather and phytosanitary conditions of crops is the reason for obtaining the growing crops models for average forecast and standard level of processes in the field. But these models differ much from the models that will be received by the current data. The proposed approach considers the model of agricultural technology as a series of models of technological operations. Model data views in the initial time using N basic indicators for the average forecast for a given climatic region and standard technology and based on the use of the set of productive rules. For the next moments being built the concretization based on the weather conditions, the state of the field and the main economic indicators. Since the technology includes K agricultural actions, then the correction carried out in the moments related with their start.

From the large numbers of active factors are not for everyone occur the changes that lead to the need of corrections. Not all parameters

clearly define the results of the next technological operation. This allows to include in the current rules only the parameters change of which has a significant impacts on the results operation. With the transition to the next operations derived the structure indicated in Fig. 1. The use of organization the data similar to the MIVAR in the matrix of knowledge base enables to introduce evolutionary factor to the production rules and get adaptive network of rules. This approach allows the build the sequence of operations of technology that take into account the impacts as the route of inference.

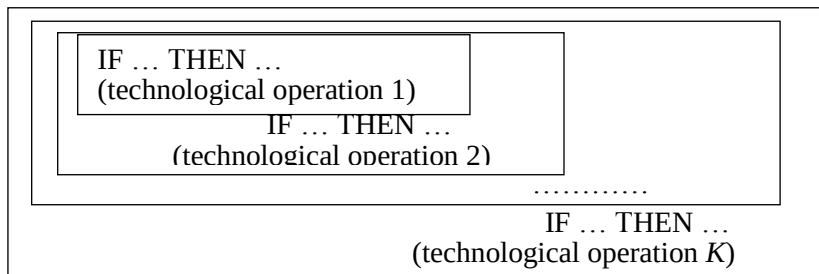


Fig. 1. The general structure of productional rules

MATHEMATICAL MODELLING OF SALT TRANSFER IN SATURATED-NON-SATURATED SOIL MASS IN CASE OF NON-STATIONARY MOISTENING CONDITION

¹Vlasyuk A.P., ²Tsvetkova T.P.

¹International university of Economics and Humanities named after Academician Stepan Demianchuk, ²National University of Water Management and Nature Resources Use, Ukraine

A.P.Vlasyuk.rv@gmail.com, Tsvetkova@ukr.net

The mathematical modelling had been carried out of salt transfer process in saturated-non-saturated soil mass under its moistening and under the admission of salt solutions via inflow plots. The mathematical model of this problem in generally adopted specifications may be described by the following boundary problem:

$$\frac{\partial \left(D_1(c_1) \frac{\partial c_1}{\partial x} \right)}{\partial x} + \frac{\partial \left(D_1(c_1) \frac{\partial c_1}{\partial y} \right)}{\partial y} - \nu'_x(c_1) \frac{\partial c_1}{\partial x} - \nu'_y(c_1) \frac{\partial c_1}{\partial y} - \gamma_1(c_1 - C^*) = \sigma_1 \frac{\partial c_1}{\partial t}, \quad (1)$$

$$\frac{\partial}{\partial x} \left(k_1(c_1) \frac{\partial h_1}{\partial x} \right) + \frac{\partial}{\partial y} \left(k_1(c_1) \frac{\partial h_1}{\partial y} \right) - \frac{\partial}{\partial x} \left(\nu(c_1) \frac{\partial c_1}{\partial x} \right) - \frac{\partial}{\partial y} \left(\nu(c_1) \frac{\partial c_1}{\partial y} \right) = a \frac{\partial h}{\partial t}, \quad (2)$$

$$\nu'_x(c_1) = -k(c_1, h_1) \frac{\partial h_1}{\partial x} + \nu(c_1) \frac{\partial c_1}{\partial x}, \quad \nu'_y(c_1) = -k(c_1, h_1) \frac{\partial h_1}{\partial y} + \nu(c_1) \frac{\partial c_1}{\partial y}, \quad (3)$$

$$\frac{\partial \left(D_2(c_2) \frac{\partial c_2}{\partial x} \right)}{\partial x} + \frac{\partial \left(D_2(c_2) \frac{\partial c_2}{\partial y} \right)}{\partial y} - \nu_x(c_2) \frac{\partial c_2}{\partial x} - \nu_y(c_2) \frac{\partial c_1}{\partial y} - \gamma_2(c_2 - C^*) = \sigma_2 \frac{\partial c_2}{\partial t}, \quad (4)$$

$$\mu(h_2) \frac{\partial h_2}{\partial t} = \frac{\partial}{\partial x} \left(k(c_2, h_2) \frac{\partial h_2}{\partial x} \right) + \frac{\partial}{\partial y} \left(k(c_2, h_2) \frac{\partial h_2}{\partial y} \right) - \frac{\partial}{\partial x} \left(\nu(c_1) \frac{\partial c_1}{\partial x} \right) - \frac{\partial}{\partial y} \left(\nu(c_1) \frac{\partial c_1}{\partial y} \right) + f(t, x, h_2), \quad (5)$$

$$\nu_x(c_2) = -k(c_2, h_2) \frac{\partial h_2}{\partial x}, \quad \nu_y(c_2) = -k(c_2, h_2) \frac{\partial h_2}{\partial y} \quad (6)$$

under corresponding boundary conditions at margins of filtration and moisture transfer field and also under conjugation conditions at a free margin.

For a boundary problem (1)-(6), using the method of numeric conforming reflections and locally unidimensional O.A.Samarsky method there had been constructed a monotonous differential scheme of the problem, its numeric solution had been obtained, numerous experiments had been carried out and their analysis had been performed.

MODELING THE DENSITY DISTRIBUTION OF STOCK PRICES

Voloshchuk S.D.

Vadym Hetman Kyiv National Economic University, Ukraine

sr.voloshchuk@gmail.com

The changing of stock prices is stochastic and continuous in time process. Therefore, it can be modeled by using differential equations with distributed parameters. If $x = x(t)$ – share price at a certain time t , the function of the density distribution of shares is introduced as the limit [1]

$$u(x, t) = \lim_{\Delta x \rightarrow 0} \frac{\Delta Q(x, t)}{\Delta x}, \quad x \in [0, \infty), t \in [0, \infty),$$

where $\Delta Q(x, t)$ – number of shares whose price at time t belong to a small price segment $[x, x + \Delta x]$. In [1] shows that the function $u(x, t)$ is the solution of the parabolic differential equation.

Let's consider the model of the density distribution of shares at some finite interval of prices $[X_1, X_2]$ and finite time interval $[0, T]$. The lower price limit $X_1 > 0$ we'll select so that the density of shares by X_1

price will be equal to zero. In addition, at the initial time $t = 0$ stocks density is definite by continuous functions $\varphi_i(x), i = \overline{1, n}$ which are determined on the intervals $[X_1^{(i)}, X_2^{(i)}] \in [X_1, X_2], i = \overline{1, n}$. So the model of shares density distribution will be look as follow:

$$\begin{aligned} \frac{\partial u(x, t)}{\partial t} &= \alpha x^2 \frac{\partial^2 u(x, t)}{\partial x^2} + \beta x \frac{\partial u(x, t)}{\partial x} + \gamma u, x \in [X_1, X_2], t \in [0, T], \\ u(x, t) \Big|_{t=0, x \in X_i} &= \varphi_i(x), x \in X_i = [X_1^{(i)}, X_2^{(i)}] \in [X_1, X_2], i = \overline{1, n}, \\ u(x, t) \Big|_{x=X_1} &= 0, t \in [0, T]. \end{aligned}$$

The function $u(x, t)$ we'll get by the method that was developed in [2]. As the result we'll get the set Ω_u of functions that are solutions of the equation, and initial-boundary conditions will be performed by the mean-square criterion.

References

1. Ерофеенко В.Т., Козловская И.С. Уравнения с частными производными и математические модели в экономике. – М: Едиториал УРСС, 2004. – 248 с.
2. Скопецкий В.В., Стоян В.А., Кривонос Ю.Г. Математичне моделювання прямих та обернених задач динаміки систем з розподіленими параметрами. – Київ: Наукова думка, 2002. – 361 с.

ON THE INITIAL-BOUNDARY VALUE PROBLEMS FOR THE NONLINEAR SCHRÖDINGER EQUATION WITH A SPESIAL GRADIENT TERMS

¹G. Yagub, ²N.S.Ibrahimov, ¹N. Yildirim Aksoy

¹Kafkas University, Turkey

²Baku State University, Azerbaijan,

gabilya@mail.ru, natiqibrahimov@mail.ru

nyaksoy55@hotmail.com

We consider the initial-boundary value problem for the nonlinear Schrödinger equation with a special gradient terms of finding the function $\psi = \psi(x, t)$ from the conditions:

$$i \frac{\partial \psi}{\partial t} + a_0 \Delta \psi + i a_1(x) \nabla \psi - a(x) \psi + v(x) \psi + a_2 |\psi|^2 \psi = f(x, t), (x, t) \in \Omega, \quad (1)$$

$$\psi(x, 0) = \varphi(x), x \in D, \psi|_S = 0, \quad (2)$$

where $i = \sqrt{-1}$ imaginary unit, $\Delta = \frac{\partial^2}{\partial x_1^2} + \frac{\partial^2}{\partial x_2^2}$, $\nabla = \left(\frac{\partial}{\partial x_1}, \frac{\partial}{\partial x_2} \right)$ $T > 0$,

$b_0 > 0$, $a_0 > 0$, are given numbers, $D \in R^2$ is a convex bounded domain, $x \in D$, $0 \leq t \leq T$, $\Omega_t = D \times (0, t)$, $\Omega = \Omega_T$, $\psi = \psi(x, t)$ are wave function, a_2 - is a complex number that satisfy the conditions:

$$a_2 = \operatorname{Re} a_2 + i \operatorname{Im} a_2, \operatorname{Re} a_2 < 0, \operatorname{Im} a_2 > 0, \operatorname{Im} a_2 \geq 2|\operatorname{Re} a_2|;$$

$a(x), v(x), a_1(x), \varphi(x), f(x, t)$ are measurable functions that satisfy the conditions:

$$0 \leq a(x) \leq \mu_0, \quad \forall x \in D, \quad \mu_0 = \operatorname{const} > 0, \quad \|v\|_{L_2(D)} \leq b_0, b_0 = \operatorname{const} > 0,$$

$$|a_1(x)| \leq \mu_1, \quad \left| \frac{da_1(x)}{dx} \right| \leq \mu_2, \quad \forall x \in D, \quad \mu_1, \mu_2 = \operatorname{const} > 0, \quad \varphi \in W_2^0(D), \quad f \in W_2^{0,1}(\Omega);$$

the symbol $\overset{0}{\forall}$ means “for almost everywhere”.

In this paper, the theorems of existence and uniqueness of solutions of first initial-boundary value problem (1), (2) and second initial-boundary value problem for equation (1) are proved. To prove the theorems applies method of Galerkin.

SOME MARGINAL DISTRIBUTIONS OF DISEASE DURATION

Yeleyko Y. I., Kushnir I.B.

Ivan Franko National University of Lviv, Ukraine

kushnir.iruna@gmail.com

We consider the process of disease as a semi-Markov process $\xi_\varepsilon(t)$ $t \geq 0$, $t \in T$, depends on a small parameter $\varepsilon > 0$ in space $E = E_1 + E_2 + E_3 + \{n\}$ [1]. ζ_i^ε will be denoted the time to absorption in the state $\{n\}$.

Theorem. Suppose the semi-Markov process satisfies conditions:

1. Exist ε state $i \in E$, such that $p_{in}^\varepsilon > 0$, as with every state of the disease possible fatal incident.
2. Markov chain, which is determined by a matrix $Q = \{q_{kl}, \quad k, l = 1, 2, 3\}$, is irreducible, then for $i \in E_k, \quad k = 1, 2, 3$

$$\lim_{\varepsilon \rightarrow 0} P\{\xi_i^\varepsilon \leq x\} = L_k(x),$$

where $L_k(x)$ – overall Erlang distribution with Laplace transform

$$L_k(x) = \sum_{k,l=1}^3 \sum_{m=1}^3 q_{kl}^{-1}(s) q_{lm}.$$

References

1. Korolyuk V.S., Turbin A.F. Semi-Markov processes and their applications / V.S. Korolyuk, A.F. Turbin. – K.: Naukova Dumka, 1976. - 184 p.

MEDIA TECHNOLOGIES IN EDUCATION A NEW CULTURE OF TEACHING AND LEARNING

Mariam Zakariashvili, Irakli Tchitchashvili

Telavi State University, Georgia

mbagrati@yaho.com, iraklijt@gmail.com

Technological advances present a challenge to the educational system today. One of the main problems is how to integrate media technologies into education. The issue is relevant to the extent that the current generation, who are now referred to as the "digital age Aborigines", can benefit from the achievements of modern digital technology enough. Furthermore, they require a learning environment rich in digital resources.

In the field of education, there are many opinions on how to plan a lesson so as to maximize the use of media technologies. Formation and development of such methods is still ongoing. In education, there are initiatives that focus on the links between media technologies and education, which implies the integration of media technologies into all subjects across the curriculum and thus make it an integral part of every lesson. The new model of learning through media technology has created new demands, new culture of teaching and learning, which is actively supported by teachers and psychologists.

The process of learning and teaching through media technology is linked to offline and online educational computer programs, which are grouped according to the peculiarities of their management. Namely, they are grouped as follows: the teaching programs; the training programs; open teaching systems; educational games; experiments and simulations; virtual environment of communication and collaboration; databases.

When it comes to learning through media technology, they usually refer to the use of media resources that are pedagogically reasonable as well as suitable for training purposes. Such resources have their own function and they can be used in the educational process effectively. But the problem may arise in connection with the compatibility of the curriculum with the resources, teaching time management, as well as costs associated with resource acquisition licensing, lack of proper training and support, possible negative effects, and others.

Currently, the virtual space offers us a variety of software applications for creating multimedia resources, namely: **Windows Live Movie Maker**-is for video creation and editing **Animoto**- allows us to create music videos; **Voicethread**- is for making videos and voice input; **Dvolver** – is for creating short animated films; **AutoCollage** – is for creating a photo collage; **BrainPop Featured Movie** – is for creating short animated films; **English with Leo** – we learn English willingly; **Flashcards by Microsoft** - is for creating interactive tests; **Fresh Paint** – is for primary education, to practice the art; **Kodu** – is suitable for creating educational games; **LearningApps** – to build interactive learning games. **Photosynth** – is for creating three-dimensional images and panoramas; **Windows Photo Gallery** - to create resources needed for digital narrations.

Teachers can create interactive media resources according to specific learning objectives through a variety of learning applications mentioned above, as well as with the help of some other applications, existing in the virtual space, and they can have a positive impact on teaching and learning process in this way.

FUNDAMENTALS OF FUZZY PORTFOLIO OPTIMIZATION THEORY UNDER UNCERTAINTY

Zaychenko Yu.P.

Institute for Applied system analysis NTUU”KPI”, Ukraine
zaychenkoyuri@ukr.net

The problem of invest portfolio optimization under uncertainty is considered. The beginning of modern investment theory was in the article H. Markowitz, "Portfolio Selection", which was released in 1952. In this article mathematical model of optimal portfolio of securities was first proposed. For many years the classical theory of Markowitz was the main theoretical tool for optimal investment portfolio construction,

after which most of the novel theories were only modifications of the basic theory.

However, the global market crisis of recent years has shown that the existing theory of investment portfolio optimization exhausted itself and a revision of the basic theory of portfolio management is strongly needed.

New approach in the problem of investment portfolio construction under uncertainty is connected with fuzzy sets theory. The fundamentals of novel theory of investment portfolio optimization under uncertainty is presented in this paper based on fuzzy set theory and efficient forecasting methods.

The direct problem of fuzzy portfolio optimization and dual problem are considered [1]. In the direct problem structure of a portfolio should be determined which provides the maximum profitableness at the given risk level. In dual problem the portfolio structure should be determined which provides the minimum risk level at the set level of critical profitableness. In order to decrease uncertainty due to unknown real share prices at the moment of portfolio construction the fuzzy inductive modeling method GMDH previously developed by author is suggested for share prices forecasting, for portfolio optimization. The experimental investigations of the suggested theory were carried out and comparison with classical portfolio model is presented and discussed.

Reference

1. Zaychenko Yu., Sydoruk I. Direct and dual problem of investment portfolio optimization under uncertainty// International Journal "Information Technologies&Knowledge". – 2014. - Vol.8 ,N3. – P.225-242.

SOME METHODS OF EVALUATION TRANSACTION COSTS

¹Zbroinska B., ^{1,2}Yeleyko Ya.

¹Jan Kochanowski University, Poland

²Ivan Franko National University of Lviv, Ukraine

Yikts@yahoo.com

In recent decades, transaction costs have become very important in the investment process. Firstly - it's indirect costs that are not taxed, but they are present at almost all investment processes, so their total amount is quite large, and it is not involved in the direct investment, but they have some affects in the investment climate. Known Coase theorem

states, that investment is most effective if transaction costs are equal zero. Thus, their evaluation is important and actual.

Let n - investment projects are presented in the investment market in cash $X_1, X_2, \dots, X_n$.

There are investment companies that are ready to finance them for $k_1, k_2, \dots, k_n$ years with interest rates with interest rates $\rho_1, \rho_2, \dots, \rho_n$ respectively. In order to ensure the solvency of the customers investment companies sent them investment experts, and their services are charged on the investment project, and impact on the interest rates. Consider, that the average cost for experts in these projects, are $x_1, x_2, \dots, x_n$. If this expert group is not satisfied with their conclusions of investors then investors sent another group of experts and so on. Suppose that the probability of confidence in the results of expert opinions on the projects is equal $p_1, \dots, p_n$ respectively, and the maximum number of expert groups in this case is equal $m_1, m_2, \dots, m_n$. We also assume, that the number of expert groups on the projects describes by binomial distribution with parameters (p_i, m_i) , $i = 1, 2, \dots, n$ respectively. If we assume the average cost of some expert group the same for each of the projects $X_1, X_2, \dots, X_n$, then average costs for experts will be $p_i m_i \cdot x_i$, $i = 1, 2, \dots, n$, and their standard deviation $\sqrt{p_i(1-p_i)m_i} \cdot x_i$. We also consider the problem of determining the real interest rate in the investment project, task and customer acceptance of the project according to the criteria of the customer.

DYNAMIC ANALYSIS OF PLANNING THE CONTINGENT OF STUDENTS AT UNIVERSITIES CONSIDERING REGIONAL FACTORS

Tamar Zirakashvili

Georgian Technical University

tamuna.zirakashvili@mail.ru

The contingent of students at high schools and universities should be planned according to the market demands, which is a dynamic process itself. The most important factor is based on , considering the usage of data of the governmental programs , in the spheres of employment.

According to the Statistic Department of Georgia, the number of employed people in different regions is quite small and unsatisfying . There is also an immense dis-balance among the regions in terms of business development. The greatest share of employment occurs to be in Tbilisi. This factor has a negative influence on job market. Finding a job is too hard for almost everyone - university graduates or trainees of different training courses.

Different economical experts believe that this statistics proves the fact of wasting great potential power of educated youth and hindering them to participate in the development of Georgian economics. The majority of people, and among them us, think that the biggest barrier in doing business in the country is the lack of laborers who have received adequate education. This very important factor causes so called "structural unemployment". Most graduates do not have sufficient skills suitable for job market. The reasons causing this problem are different but the most important incorrect planning of contingent accepted by high schools and universities, which is quite chaotic nowadays. To be more precise, there is a huge dis-balance in the needs of specialists in the job market. The above mentioned problem is mainly caused by choosing the university faculties by applicants according to their popularity among people, not according to their needs. It leads to overfilling the job market with specialists in those "popular" fields but on the other hand there is a lack of specialists in other fields, which is unwillingly filled with unqualified people.

Thus, while planning the contingent of acceptable applicants at universities it is absolutely necessary to consider strategical plans of regional development as well as possibilities of preparing adequate specialists. The mentioned factors are very important as the regional high schools and universities will be involved in supplying the local job market with suitable specialists. Furthermore, it will reduce the migration of professionals, as well.

The given report represents the results of our research in planning the contingent of students considering regional factors. Twelve-year period is taken for analysis, which is adequate to three - round phase for the first university degree - bachelor's degree. This period is discretely divided in the sample with one-year interval.

The main factor of planning is supplying the Georgian job market with data about professional specialists, as well as about regional potential in preparing qualified specialists. The formalized model of

educational systems given in the model defines supplying the job market of Georgia with necessary specialists.

TECHNICAL REALISATION OF PROCEDURES THAT CALIBRATES THE METERS OF NATURAL GAS CONSUMPTION

Revaz Zhvania, Tamar Menabde

Georgian Technical University

t.menabde@gtu.ge

The structural scheme of the device for calibration of natural flow meters (see Figure 1.). Under the scheme the notation:

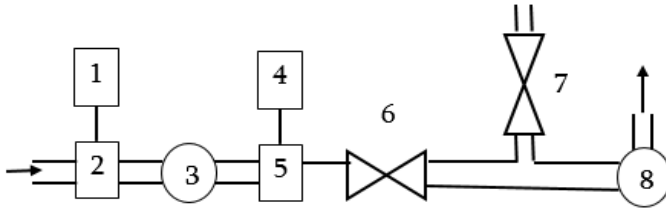


Fig.1

1- manometer 2- calibrated counter (CC); 3 - receiver; 4 - gas volume corrector; 5 - the reference counter (EC); 6 - closing and regulating valve; 7 – airentrance tap (faucet); 8 - compressor.

Metrological checking of the COP takes place based on an analysis of the formula of basic relative error

$$\delta = [v(1 - \Delta p / p_0) / v_0 - 1]100\%$$

whereat V -the volume measured by the CC, V_0 – adjusted indication (EC); p_0 – absolute pressure in EC; Δp - absolute pressure difference CC and EC [1]

It should be noted that under all of the following letter designations refers to the arithmetic mean of their rated values adjusted. The formula for calculating the total uncertainty on the basis of the according to analysis

$$U_c(\delta) = \sqrt{[v - u(v)]^2 + [c_{v_0} \cdot u(v_0)]^2 + [c_{\Delta p} \cdot u(\Delta p)]^2 + [c_{p_0} \cdot u(p_0)]^2}$$

In which we have for the sensitivity coefficients: $C_v = LM$; $C_{v_0} = LMN$; $C_{\Delta p} = LP$; $C_{p_0} = LR(1-M)$, whereat L, M, N, R - constants, calculated using the above estimated values $V, V_0, \Delta p, P_0$ by the

relations: $L=100/V$; $V=1-\Delta p/p_0$; $N=V/V_0$; $R=V/p_0$. To calculate the ratio of the standard measurement uncertainty are used:

$$u(v) = \sqrt{\sum_{i=1}^n (v_i - v)^2 / n(n-1)}$$

$$u(v_o) = \sqrt{\sum_{i=1}^n (v_{oi} - v_o)^2 / n(n-1)}$$

$$u(p_0) = 0,4 * p_{\max} / 100\sqrt{3}$$

$U(\Delta p) = \Delta / \sqrt{3}$, whereat Δ - absolute error of the manometer. Compiled budget uncertainty, expanded measurement uncertainty $U = K U_c(\partial)$, whereat $K=2$ coverage factor level of confidence 95% [2,3]

References

1. Cuade to Expression of Uncertainty in Measurement/First edition-ISO. 1993. Switzerland.-101 p.
2. Menabde T., Zhvania R. Gas flow meter sealing-calibration to be carried out of operational analysis of the results obtained by pre-processing. Ministry of Science and Community Development Foundation, an international scientific journal "Intelligence" Tbilisi, 2012, №1 (42). P.133-135.
3. Menabde T., Zhvania R. Uncertainty of the theory of the use of natural gas flow meter sealing-calibration of the data processing and the final result of the conclusion of the process. Transactions automated control systems Tbilisi. Publishing House "Technical University", 2012. - №1(12). - P. 47-52.

FEATURES AND PROBLEMS OF IMPLEMENTATION OF ENTERPRISE RESOURCE PLANNING (ERP-SYSTEMS)

Rafyan T. A., Karapetyan A.T.

Yerevan State University, Armenia

aram.karapetyan@gmail.com, tatevik.rafyam@ysu.am

ERP (Enterprise Resource Planning) - integrated automated management system of production, financial management and asset management focused on continuous balancing and optimization of enterprise resources through a dedicated integrated suite of application software that provides a common data model and processes for all areas of activity of other words. Such systems have their own sub-systems

that are focused on one or the other activities of the enterprise. ERP-system is a specific software package that implements the ERP strategy. Concept of ERP formulated in 1990 by analyst Gartner as MRPII (Manufacturing Resource Planning) and CIM (Computer integrated Manufacturing) options improved methods.

The main objective of ERP system is to achieve a competitive qualities of optimization of business processes and reduce expenses of the company level.

Advantages and disadvantages of ERP systems are considered.