ABSTRACT AND REFERENCES

CONTROL PROCESSES

**DOI: 10.15587/1729-4061.2017.106825**

**A COMPARATIVE ANALYSIS OF THE ASSESSMENT RESULTS OF THE COMPETENCE OF TECHNICAL EXPERTS BY DIFFERENT METHODS (p. 4-10)**

**Oleh Velychko**
State Enterprise "All-Ukrainian State Scientific and Production Centre for Standardization, Metrology, Certification and Protection of Consumer", (SE "Ukrmetrteststandard"), Kyiv, Ukraine
**ORCID**: http://orcid.org/0000-0002-6564-4144

**Tetyana Gordiyenko**
Odessa State Academy of Technical Regulation and Quality, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0003-0324-9672

**Leonid Kolomiets**
Odessa State Academy of Technical Regulation and Quality, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0003-2341-3345

Present methods and facilities for the evaluation of expert's competence are researched. The most suitable methods for the evaluation of expert's competence – the methods of data uncertainties and Analytic Hierarchy Process are analysed in detail and selected. Evaluation of expert's competence in the field of technical regulation (time and frequency measurement) according to the set criteria was carried out. The results were processed by special methodologies, and also universal and specialized software. The specialized software facilities take into account the data uncertainties and application of the method of analytic hierarchy process. With the application of the universal software Microsoft Excel (USA), the ratio of the averages for the criteria used for the evaluation of expert's competence in the field of technical regulation was estimated.

Comparative analyses of the results obtained using the methods for the evaluation of expert's competence taking into account the data uncertainties and applying the method of analytic hierarchy process was carried out. The results of the analysis showed the convergence and correlation of the data obtained, and also confirmed the fitness of the methods for the evaluation of expert's competence. The results showed a small dispersion of the average values for the criteria of evaluation of expert's competence in the limits from 5.2 to 7.9, which testifies to a good balance. Dispersion of the values obtained using the given methods shows correlation.

The methods for the evaluation of expert's competence which take into account the data uncertainties and application of the method of analytic hierarchy process,-are expedient to apply as a useful tool for the comparative estimation of expert's competence on the basis of objective data according to the set criteria for different fields (spheres) of activity. This will assist the increase of evaluation authenticity and will allow forming more competent groups of experts.

**Keywords**: competence, expert, evaluation criteria, technical regulation, data uncertainties, analytic hierarchy.

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**DOI: 10.15587/1729-4061.2017.107244**

**THEORETICAL-APPLIED ASPECTS OF THE COMPOSITION OF REGRESSION MODELS FOR COMBINED PROPULSION COMPLEXES BASED ON DATA OF EXPERIMENTAL RESEARCH (p. 11-20)**

**Vitalii Budashko**
National University «Odessa Maritime Academy», Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0003-4873-5236

**Volodymyr Golikov**
National University «Odessa Maritime Academy», Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0003-1591-3016

Based on the study into internal properties of components of the ship power plants (SPP) in the combined propulsion complexes (CPC) and considering special features in the construction of equations that characterize energy processes in the specific SPP of the particular CPC, we developed the principles of constructing their regression models according to data from experimental research. The function is defined that connects input variables and the output variable based on data of the experiment with the certain number of common observations of the input and output parameters. The check for adequacy of the obtained model was performed according to the experimental data.

Such studies are necessary in order to develop specialized software modeling tools that are used when designing CPC SPP whose structure may vary in certain specified operational limits and situational factors. Similar empirical models also make it possible to improve simulation modeling algorithms involving the use of statistical tests and construction of CPC SPP models based on experimental data.

As the result of present research, according to data obtained in the course of experiment, which contained 14 joint observations of the input and output parametric coordinates of the thruster drives (TDs) of CPC of the ship that operates under dynamic positioning mode, we estimated variation in the coefficients of regression equation and determined coefficients $b_0$=0.4527; $b_1$=–0.1126; $b_2$=0.0848; $b_3$=–0.0277; $b_4$=0.0856, which refine the structure of regression model of SPP of CPC. For different levels of significance and degrees of freedom, the Student's t-criterion was computed for significance level $\alpha$=0.06 and for the number of degrees of freedom 30 $f_y$=30t(0.06; 30)=t(0.06; 2)= =4.823, as well as the Fisher's F-criterion $F_e$ (0.06; 12; 2)=5.43, on the basis of which the conclusion was made that confirms adequacy of the obtained model according to the experimental tests.

Based on the constructed regression model, it is possible to adjust the position of CPC TD relative to each other and to the diametrical plane of the ship, as well as directions of TD rotation in the process of optimization of parameters of physical models of control systems of TD electric engines.

**Keywords**: ship power plant, combined propulsive complex, regression modeling, adequacy, experimental tests.

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**DOI: 10.15587/1729-4061.2017.108591**

## DEVELOPMENT OF THE CONTROLLING SYSTEM IN THE MANAGEMENT OF DAIRY CLUSTERS (p. 20-26)

**Natalia Vasylieva**
Dnipropetrovsk State Agrarian and Economic University, Dnipro, Ukraine
**ORCID**: http://orcid.org/0000-0003-4100-0659

**Oleksandr Velychko**
Dnipropetrovsk State Agrarian and Economic University, Dnipro, Ukraine
**ORCID**: http://orcid.org/0000-0003-2700-0329

The present research focuses on the development of mathematical procedures for controlling the regional management over product clusters. In order to improve mathematical support for the strategic controlling, we modified the rating assessment by applying business, technological, and social indicators of a dairy sector, due to which it becomes possible to run a quantitative external analysis of efficiency of the regional management. Mathematical procedures of operational controlling allowed us to identify the reserves of internal environment in the activities of regional clusters of the dairy sector. The first option of controlling is formalized by the model of finding the shortest paths to spread innovations from the regional leaders of dairy clusters. The second reserve of controlling is based on modeling the optimal cost-cutting by the criterion of maximal increase in profitability under conditions of using own feed crops. The third reserve of controlling was confirmed by the rank statistical tests related to improving productivity due to the effect of large-scale production of milk. Article contains results of practical approbation of the proposed system of mathematical procedures for controlling regional management over dairy clusters.

**Keywords**: strategic and operational controlling, mathematical procedures for controlling, dairy cluster, regional management.

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**DOI: 10.15587/1729-4061.2017.108589**

## COMMUNICATION MANAGEMENT IN SOCIAL NETWORKS FOR THE ACTUALIZATION OF PUBLICATIONS IN THE WORLD SCIENTIFIC COMMUNITY ON THE EXAMPLE OF THE NETWORK RESEARCHGATE (p. 27-35)

**Kateryna Kolesnikova**
Odessa National Polytechnic University, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0002-9160-5982

**Dmytro Lukianov**
Belarusian State University, Minsk, Belarus
**ORCID**: http://orcid.org/0000-0001-8305-2217

**Viktor Gogunskii**
Odessa National Polytechnic University, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0002-9115-2346

**Volodymyr Iakovenko**
Company «Tobii Technology» AB, Stockholm, Sweden
**ORCID**: http://orcid.org/0000-0002-5728-031X

**Ganna Oborska**
Advertising agency "Formula uspecha", Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0002-0245-9080

**Artem Negri**
«INTERNETSTORES» GmbH, Esslingen am Neckar, Germany
**ORCID**: http://orcid.org/0000-0002-5527-9710

**Andrii Koliada**
GmBH Luxoft UA, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0003-3934-8058

**Katerina Dmitrenko**
Odessa National Polytechnic University, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0002-3307-6410

**Tetiana Olekh**
Odessa National Polytechnic University, Odessa, Ukraine
**ORCID**: http://orcid.org/0000-0002-9187-1885

**Katsiaryna Bespanskaya-Paulenka**
Belarusian State University, Minsk, Belarus
**ORCID**: http://orcid.org/0000-0001-7898-8969

Development of social networks of scientists in the World Wide Web creates new schemes for wider awareness of the global scientists' community of scientific research findings. In this case, existing information technologies are facing difficulties in resolving contradictions, generated by a broad stream of scientific publications and complexity of access to these publications. Resolution of this controversy is carried out thanks to "digitalization" of scientific content, which predetermines possibility of implementation of new principles for information disseminating, such as SMM (Social Media Marketing).

To substantiate and assess SMM, we accepted the hypothesis about possibility of phenomenological presentation of lifecycle of scientific publications with the states of readers' community: $S_1$ – unawareness; $S_2$ – awareness; $S_3$ – positive attitude; $S_4$ – citation; $S_5$ – negative attitude. In view of these states, the model of publication lifecycle based on a Markov chain was constructed. It was proposed to use SMM principles from professional marketing agencies in relation to promotion of scientific content on the Internet. A distinctive feature of this approach is that proposed Markov chain is adjusted to different possible states of reader's community on assessment of publication by establishing the values of transition probabilities, which are chosen for particular states based on the expert evaluation.

We investigated the influence of expansion of readers' audience, provision of presentation clarity, articles uniqueness, professional orientation, and data objectivity on the distribution of publication readership. Effectiveness of publications promotion with an active authors' participation to follow up on their publications in social scientific networks was shown.

**Keywords**: SMM, scientometrics, social networks, digitalization, digital content, ResearchGate, DOI.

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**DOI: 10.15587/1729-4061.2017.103979**

## DEVISING A FUZZY MODEL FOR COMPILING A PLAN OF ACTIVITIES AIMED AT DEVELOPING HUMAN CAPITAL IN UNIVERSITY (p. 35-44)

**Lev Mazelis**
Vladivostok State University of Economics and Service, Vladivostok, Russia
**ORCID**: http://orcid.org/0000-0001-7346-3960

**Kirill Lavrenyuk**
Vladivostok State University of Economics and Service, Vladivostok, Russia
**ORCID**: http://orcid.org/0000-0002-9092-3196

Under contemporary conditions, top managers in a university, during implementation of strategic development program, face the problem of creating the optimal portfolio of activities. At the same time, human capital is one of the priority areas of investment; raising its level is an important condition for sustainable development that makes it possible to achieve on time strategic objectives set by the university. We propose a method for the formation of optimal portfolio of activities in the area of human capital development, taking into account the uncertainties that occur when making management decisions. An economic-mathematical model is considered whose objective function is an integral indicator that takes into account a degree of achievement of strategic tasks by structural divisions of the university. Optimization variables are the Boolean variables for the inclusion of activities for employees in the portfolio at a certain moment of time. Solution to the model is found numerically using the developed software. The solution is a plan of activities in the area of human capital development for structural units of the university. The plan is structured by time, units, employees, and directions of investment.

We examine the example of determining a portfolio of activities in the area of human capital development for three structural divisions of the university in order to achieve the university's objectives on the horizon of planning over 5 years. Results of the calculations make it possible to form a "road map" in the field of human capital development and prove to be one of the main components in investment strategy of the university.

**Keywords**: human capital, economic-mathematical modeling, strategic activities, university management, fuzzy-multiple approach.

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**DOI: 10.15587/1729-4061.2017.108936**

**MODELING OF THE ENTERPRISE FUNCTIONING STABILITY USING THE AUTOMATIC CONTROL THEORY APPARATUS (p. 45-55)**

**Lidiya Guryanova**
Kharkiv Educational and Scientific Institute of the University of banking, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0002-2009-1451

**Ihor Nikolaiev**
Central Ukrainian National Technical University, Kropyvnytskyi, Ukraine
**ORCID**: http://orcid.org/0000-0003-3384-1757

**Ruslana Zhovnovach**
Central Ukrainian National Technical University, Kropyvnytskyi, Ukraine
**ORCID**: http://orcid.org/0000-0001-6758-3421

**Stanislav Milevskiy**
Kharkiv Educational and Scientific Institute of the University of banking, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0001-5087-7036

**Olha Ivakhnenko**
Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0002-6179-3644

**Oksana Panasenko**
Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0003-0951-6495

**Svitlana Prokopovych**
Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0002-6333-2139

**Liubov Chagovets**
Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0003-4064-9712

**Dmytro Vasylenko**
Kirovohrad Institute of Commerce, Kropyvnytskyi, Ukraine
**ORCID**: http://orcid.org/0000-0002-2249-0499

**Olga Rudachenko**
O. M. Beketov National University of Urban Economy in Kharkiv, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0001-9597-5748

Despite a large number of diverse methods and approaches to studying the enterprise stability, forecasting of stable development in the Ukrainian economy did not yield sufficiently precise results. Therefore, the main purpose of the study was to develop a complex of economic and mathematical models for estimating and analyzing the enterprise functioning stability in the dynamics, which will allow timely diagnosis of its instability and taking effective management decisions. The proposed complex of models is based on the logistic approach and the classical apparatus of the systems automatic control theory.

The structural model of the enterprise was developed, which resulted in its generalized transfer function in the market environment. The generalized transfer function is the basis of the construction of a simulation model for assessing the enterprise functioning stability. This approach allowed the use of algorithmic mathematical methods – the criteria of Hurwitz and Mikhailov to study the stability of the enterprise functioning in the dynamics. According to the performance indicators of the two enterprises, practically applying the models developed in the work, the research and analysis of the stability of their functioning were carried out. As a result, the appearance of the Mikhailov's hodograph for a stable and unstable system is clearly demonstrated, and the stability margin is determined.

It is important that the obtained models and results, with the appropriate adaptation, can be extrapolated to study the stability of the production and sales enterprise functioning in different economic sectors of different countries of the world. The prospect of further research is seen in the development of an information and analytical system that uses the models for assessing and analyzing the enterprise functioning stability and allows you to change the structural model quickly, adjusting it to certain features of a particular enterprise. This will allow you to determine the level of stability for any investigated system operatively.

**Keywords**: functioning stability, structural model, simulation model, logistic approach, production and sales system, automatic control theory.

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**DOI: 10.15587/1729-4061.2017.108929**

## DEVELOPMENT OF INFORMATION CONSOLIDATION SYSTEM IN THE REFLECTIVE MANAGEMENT OF LARGE-SCALE ECONOMIC AND PRODUCTION SYSTEMS (p. 56-65)

**Andriy Pylypenko**
Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0002-6520-3146

**Alexander Popov**
Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine
**ORCID**: http://orcid.org/0000-0003-0550-7890

We presented conceptual basis for the organization of information support of management of large-scale economic and production systems, which takes into account the principles of knowledge economy and relies on information consolidation tools. Using technology of conceptual design, the authors developed the scheme of subject-area of information consolidation for management of integrated associations of enterprises. The use of the concepts of this scheme enabled us to substantiate the system of hypotheses regarding construction of an information consolidation system to satisfy the needs of management of large-scale economic and production systems. Practical implementation of these hypotheses is based on the developed totality of conceptual provisions that are correlated with the stages of organization of the information consolidation

system. The succession of such stages is presented with the use of the methodology of structural analysis and modeling. For formalized representation of the essence of consolidation processes, the concentrical theoretical-multiple approach was used, which made it possible to represent the hierarchy of satisfying information needs of a large-scale economic and production system. It was also proved that formation of such information needs should take into account the principles of reflective management. To do this, we represented the scheme of revealing mutual reflective influences of participants of large-scale economic and production system that models two levels of reflective interaction.

**Keywords**: information consolidation, large-scale economic and production system, reflective management, theoretical-multiple approach.

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**DOI: 10.15587/1729-4061.2017.108945**

**DETERMINATION OF OPTIMAL TRANSFORMATION RATIOS OF POWER SYSTEM TRANSFORMERS IN CONDITIONS OF INCOMPLETE INFORMATION REGARDING THE VALUES OF DIAGNOSTIC PARAMETERS (p. 66-79)**

**Olexander Rubanenko**
Vinnytsia National Technical University, Vinnytsia, Ukraine
**ORCID**: http://orcid.org/0000-0001-5957-4146

**Oleg Kazmiruk**
Vinnytsia National Technical University, Vinnytsia, Ukraine
**ORCID**: http://orcid.org/0000-0001-7614-6960

**Valentyna Bandura**
Vinnytsia National Agrarian University, Vinnitsa, Ukraine
**ORCID**: http://orcid.org/0000-0001-8074-3020

**Victor Matvijchuk**
Vinnytsia National Agrarian University, Vinnitsa, Ukraine
**ORCID**: http://orcid.org/0000-0002-7837-5174

**Olena Rubanenko**
Vinnytsia National Agrarian University, Vinnitsa, Ukraine
**ORCID**: http://orcid.org/0000-0002-2660-182X

On the base of damage rate analysis of power transformers and methods of EES modes control, the necessity of using the results of on-line diagnostics of LTC transformers not only for determinations of the expediency of further operation or equipment repair but also for calculation of optimal transformation coefficients (with account of the suggested RRCT) for their application in the process of modes control has been proved.

The mathematical model of RRCT is developed ~~to~~ by applying the methods of neural-fuzzy modeling, this model, taking into account both current and retrospective values of diagnostic parameters enables to study the impact of diagnostic parameters of RRCT and determine its current value, which is necessary for automatic and automated reliable and optimal control of EES modes.

The improved method of determination of optimal control actions, realized by the LTC transformers by means of comparative analysis of the results of calculation of EES modes with quasi-resistances of the circuit branches, enables to select the transformer and calculate transformation ratios that provide minimal losses of active power, minimal amount of LTC switching.

The error of RRCT determination by means of the developed mathematical fuzzy model as compared with the training sample of the model and the opinion of independent experts does not exceed the error of the devices, measuring diagnostic parameters.

Such results are explained by complex usage of probability theory methods, neuro-fuzzy modeling and modern software Matlab.

Such peculiarity of the suggested method of determining optimal control actions by LTC transformers, as the account of RRCT, in the process of EES mode control provides such advantages as reduction of the damage rate of the equipment, reduction of active power losses in EES. The peculiarities of the method of determining optimal control actions by LTC transformers, with the account of their technical state, open up the prospects of development and introduction of modern microprocessor-based systems of optimal automatic control of LTC transformers in EES.

Usage of quasi-resistors of circuit branches, which, unlike the transformers, used for calculation of nominal resistances of the lines, take into account the state of the transformers and possible losses of utility companies due to the possible damages, enables to calculate the EES mode in case of transformers transformation ratio change and by means of comparison of calculated power losses, select the most efficient transformer.

Further progress of the given research includes the development of mathematical models of other kinds of high voltage equipment involved in the process of ESS modes control, damage of which is possible.

**Keywords**: on-line diagnostics, optimal control, normal modes, active power losses.

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