

ABSTRACT AND REFERENCES

INFORMATION TECHNOLOGY, INDUSTRY CONTROL SYSTEMS

A METHOD FOR CONSTRUCTING RECRUITMENT RULES BASED ON THE ANALYSIS OF A SPECIALIST'S COMPETENCES (p. 4-14)

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Under conditions of active development of innovative information technologies (IT) and eliminating the boundaries in providing educational services, human resources (staff, including IT specialists) turn into the main strategic resource of organizations, which ensures their long-term competitiveness and achievement of the set goals. Much emphasis in this problem is given to both the specific features of a recruiting company and to a high level of provision of educational services that meet international standards and requirements for the level of competences of would-be IT specialists. Therefore, the development of new conceptual approaches and promising information technologies of managing human resources acquires special relevance and practical significance. The article highlighted specific features of tasks of managing qualified human resources (MQHR), which allows identifying them as a task of multicriteria analysis and decision making in the fuzzy environment. A generalized conceptual model for decision making in the problems of MQHR was proposed. It was substantiated that in order to enhance effectiveness and transparency of decisions in MQHR, it is appropriate to use multicriteria optimizations based on the TOPSIS method, the advantages of which were shown. A modification of the algorithm for using TOPSIS for making recommendations in recruiting qualified human resources was proposed. The modification implies the integration of additional components of the content management in the decision making algorithm, which provides for the calculation based on the method of analysis of hierarchies (MAH) of coefficients of level or course of attained educational services. Using the TOPSIS and MAH methods and the scale of assessment of competence of qualified human resources, experimental calculations with ranking of alternatives were performed using the example of recruiting, which demonstrated effectiveness of the proposed approach.

Keywords: content management, human resources, recruiting, decision making, fuzzy environment, fuzzy sets.

References

- Dzheffri, M. (2015). Recruiting 5.0: Psikhologicheskiiye profili v sotsial'nykh setyakh. Available at: <http://www.hr-portal.ru/blog/rekruting-50-psihologicheskie-profilii-v-socialnyh-setyah>
- Rashkevych, Y. (2014). Bolons'kyy protses ta nova paradyhma vyshchoyi osvity. Natsional'na ramka kvalifikatsiy. Rezul'taty navchannya. Kompetentnosti. YEKT, Lviv, 168.
- Lytvyn, V., Pukach, P., Bobyk, I., Vysotska, V. (2016). The method of formation of the status of personality understanding based on the content analysis. *Eastern-European Journal of Enterprise Technologies*, 5 (2 (83)), 4–12. doi: 10.15587/1729-4061.2016.77174
- Shakhovska, N., Vysotska, V., Chyrun, L. (2016). Features of e-learning realization using virtual research laboratory. 2016 XIth International Scientific and Technical Conference Computer Sciences and Information Technologies (CSIT), 143–148. doi: 10.1109/stc-csit.2016.7589891
- Lytvyn, V., Vysotska, V., Veres, O., Rishnyak, I., Rishnyak, H. (2016). Classification Methods of Text Documents Using Ontology Based Approach. *Advances in Intelligent Systems and Computing*, 229–240. doi: 10.1007/978-3-319-45991-2_15
- Shakhovska, N., Vysotska, V., Chyrun, L. (2016). Intelligent Systems Design of Distance Learning Realization for Modern Youth Promotion and Involvement in Independent Scientific Researches. *Advances in Intelligent Systems and Computing*, 175–198. doi: 10.1007/978-3-319-45991-2_12
- Lytvyn, V., Vysotska, V., Chyrun, L., Chyrun, L. (2016). Distance learning method for modern youth promotion and involvement in independent scientific researches. 2016 IEEE First International Conference on Data Stream Mining & Processing (DSMP), 269–274. doi: 10.1109/dsmp.2016.7583557
- Haugeland, J. (2012). Programmer Competency Matrix. Perspectives on Software, Technology and Business. Available at: <http://sijinjoseph.com/programmer-competency-matrix/>
- Mammadova, M. H., Jabrailova, Z. H. (2015). Multi criteria optimization of human resource management problems based on the modified topsis method. *Eastern-European Journal of Enterprise Technologies*, 2 (4 (74)), 48–62. doi: 10.15587/1729-4061.2015.40533
- Chen, P.-C. (2009). A Fuzzy Multiple criteria decision making model in employee recruitment. *IJCSNS International Journal of Computer Science and Network Security*, 9 (7), 113–117.
- Chien, C.-F., Chen, L.-F. (2008). Data mining to improve personnel selection and enhance human capital: A case study in high-technology industry. *Expert Systems with Applications*, 34 (1), 280–290. doi: 10.1016/j.eswa.2006.09.003
- Akhlagh, E. (2011). A rough-set based approach to design an expert system for personnel selection. *World Academy of Science, Engineering and Technology*, 54, 202–205.
- Nobari, S. (2011). Design of fuzzy decision support system in employee recruitment. *Journal of Basic and Applied Scientific Research*, 1 (11), 1891–1903.
- Mammadova, M., Jabrailova, Z., Nobari, S. (2012). Application of TOPSIS method in decision-making support of personnel management problems. 2012 IV International Conference “Problems of Cybernetics and Informatics” (PCI), 195–198. doi: 10.1109/icpci.2012.6486485
- Spencer, L. M., Spencer, S. M. (2008). Competence at work models for superior performance. Wiley India Pvt. Limited, 384.
- Pasichnyk, V., Shestakevych, T. (2016). The Model of Data Analysis of the Psychophysiological Survey Results. *Advances in Intelligent Systems and Computing*, 271–281. doi: 10.1007/978-3-319-45991-2_18
- Jabrailova, Z. G., Nobari, S. M. (2011). Processing methods of information about the importance of the criteria in the solution of personnel management problems and contradiction detection. *Problems of information technology*, 2, 57–66.

18. Güngör, Z., Serhadlıoğlu, G., Kesen, S. E. (2009). A fuzzy AHP approach to personnel selection problem. *Applied Soft Computing*, 9 (2), 641–646. doi: 10.1016/j.asoc.2008.09.003
19. Dursun, M., Karsak, E. E. (2010). A fuzzy MCDM approach for personnel selection. *Expert Systems with Applications*, 37 (6), 4324–4330. doi: 10.1016/j.eswa.2009.11.067
20. Wang, Y.-J., Lee, H.-S. (2007). Generalizing TOPSIS for fuzzy multiple-criteria group decision-making. *Computers & Mathematics with Applications*, 53 (11), 1762–1772. doi: 10.1016/j.camwa.2006.08.037
21. Kelemenis, A., Askounis, D. (2010). A new TOPSIS-based multi-criteria approach to personnel selection. *Expert Systems with Applications*, 37 (7), 4999–5008. doi: 10.1016/j.eswa.2009.12.013
22. Kravets, P., Kyrkalo, R. (2009). Fuzzy logic controller for embedded systems. *Proceedings of the 5th International Conference on Perspective Technologies and Methods in MEMS Design*.
23. Mykich, K., Burov, Y. (2016). Algebraic Framework for Knowledge Processing in Systems with Situational Awareness. *Advances in Intelligent Systems and Computing*, 217–227. doi: 10.1007/978-3-319-45991-2_14
24. Veres, O. M., Lytvyn, V. V., Pasichnyk, V. V., Vysotska, V. A., Kis, Y. P., Kravets, P. O. (2016). Osvitn'o-profesiyana prohrama «Systemnyy analiz» dlya spetsial'nosti 124. *Pershyy (bakalavrs'kyy) riven' vyshchoyi osvity*. Available at: <http://ism.lp.edu.ua/uk/node/69>

STUDYING THE MECHANISMS OF FORMATION AND DEVELOPMENT OF OVERWEIGHT AND OBESITY FOR DIAGNOSTIC INFORMATION SYSTEM OF OBESITY (p. 15-23)

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The structure of the semantic attribute spaces is developed. The resulting space reflects an ordered presentation of variability for obesity process considering somatotype of person. This allows to consistently deepen body shaping process in detail and obtain a continuous transition from one type of metabolic disorders to another. This contributes to more accurate preclinical diagnosis and its taxonomy.

It was determined in operation that a measure of deviation from the normal structure of the somatotype of biological development is measured in fractions sigma deviation. It is a characteristic of formation in obesity and helps to explain the mechanisms of its development. The range of one sigma deviation corresponds to the functional optimum of somatic type variation.

The research results can be used to trace individual dynamics development of body changes regarding statistical norm.

The obtained results contribute to opportunities for modeling the running of this pathology. The results need to be applied in the creation of information system obesity diagnosis for further automation of this process. Automation of the obtained results using the diagnostic information system of obesity improves the quality of diagnosis of this disease. In the future, it is necessary to analyze in detail the representatives of different age and sex, the territorial and

constitutional groups for proper evaluation of the process of formation for the various samples.

Keywords: semantic space, biological age, lipid metabolism, estimation criteria, obesity.

References

1. Nikitin, Yu. P., Kazeka, G. R., Simonova, G. I. (2001). Rasprostranenie komponentov metabolicheskogo sindroma X v neorganizovannoy gorodskoy populyatsii (epidemiologicheskoe issledovanie). *Kardiologiya*, 9, 37–40.
2. Vvisotskaya, E. V., Porvan, A. P., Ambrosov, D. A., Dobrorodnyaya, A. S., Dobrorodnyaya, I. S. (2012). Mathematical model's synthesis for information system of adiposity diagnosis obesity in. *Eastern-European Journal of Enterprise Technologies*, 4/2 (58), 8–12. Available at: <http://journals.uran.ua/eejet/article/view/4208/3971>
3. Kalkulyatoryi. Available at: <http://beregifiguru.ru/Главная/Калькуляторы>
4. Universalnyy Meditsinskiy Kalkulyator (ver. 4.1). Available at: <http://cardioplaneta.ru/program/68-universalnyu-meditsinskiy-kalkulyator-versiya-30.html>
5. Diet Assistant – Weight Loss. Available at: <http://www.facebook.com/DietAssistant>
6. Diagnos.ru. Available at: <http://www.diagnos.ru/ddss/>
7. Online-diagnos. Available at: <http://online-diagnos.ru/diagnosics>
8. EMCIMED. Available at: <http://www.mcmed.ua/ru>
9. Zagrevskiy, V. I., Zagrevskiy, O. I. (2014). Kompyuternaya tehnologiya otsenki pogreshnosti v opredelenii mass-inertsiionnykh harakteristik segmentov tela cheloveka. *Visnyk Chernigivs'kogo nacional'nogo pedagogichnogo universytetu*, 118 (2), 39–44.
10. Uvarova, Yu. A., Uvarov, P. E. (2012) Programmnyy kompleks matematicheskogo modelirovaniya sistemiy fizicheskoy nagruzki. *Vestnik SGUTiKD*, 2 (20), 166–169.
11. Antomonov, M. Yu., Voloschuk, E. V. (2012). Konstruirovaniye integralnykh pokazateley kolichestvennykh priznakov s pomoshchyu odnomernykh i mnogomernykh metodov statistiki. *Kibernetika i vychislitel'naya tehnika*, 167, 61–68.
12. Filatova, O. V. (2014). Raspredeleniye somatotipov i tempov polovogo razvitiya u yunoshey v usloviyah gorodskoy i selskoy mestnosti altayskogo kraya. *Ekologiya cheloveka*, 2, 12–19.
13. Baskevich, O. V. (2015). Interconnection of students' somatic type with somatic health. *Physical Education of Students*, 19 (6), 4–9. doi: 10.15561/20755279.2015.0601
14. Martirosov, E. G., Nikolaev, D. V., Rudnev, S. G. (2006). *Tehnologii i metody opredeleniya sostava tela cheloveka*. Moscow: Nauka, 248.
15. Buren, N. V., Goncharuk, N. V., Zadorozhnaya, E. A., Tamozhanskaya, A. V. (2013). Klinicheskaya antropometriya kak metod donozologicheskoy diagnostiki konstitutsionnykh zabolevaniy. *Slobozhanskiy naukovno-sportivniy visnik*, 3, 75–81.
16. Breytman, M. Ya. (1946). *Differentsiatsiya diagnostika endokrinniyh system*. Moscow: Medgiz, 564.
17. Sak, N. N., Artemeva, G. P. (2005). K morfologicheskim vozmozhnostyam prognosticheskoy otsenki perspektivnosti sportsmena. *Slobozhans'kyj naukovno-sportyvnyj visnyk*, 8, 243–247. Available at: http://www.nbuuv.gov.ua/old_jrn/soc_gum/Snsnv/2005-08/05snnops.pdf
18. Rusakova, D. S., Scherbakova, M. Yu., Gapparova, K. M., Zaynudinov, Z. M., Tkachev, S. I., Saharovskaya, V. G. (2012).

- Sovremennyye metody otsenki sostava tela. *Eksperimental'naya i klinicheskaya gastroenterologiya*, 8, 71–81.
19. Sangwan, D. (2016). A study of body mass index between private and government school children. *International Journal of Physical Education, Sports and Health*, 3 (1), 63–65.
 20. Anischenko, A. P., Arhangelskaya, A. N., Rogoznaya, E. V., Ignatov, N. G., Gurevich, K. G. (2016). Sopostavimost antropometricheskikh izmereniy i rezultatov bioimpedantsnogo analiza. *Vesnik novykh meditsinskih tekhnologiy*, 23 (1), 138–141.
 21. Madden, D. (2006). Body Mass Index and the Measurement of Obesity. *Health econometric and data group*, 2–16.
 22. Chaplygina, E. V., Sikorenko, T. M., Aksenova, O. A., Vartanova, O. T., Nor-Areyan, K. A. (2013). Vozrastnyye osobennosti stepeni vyirazhennosti anatomicheskikh komponentov somatotipa v norme i pri skolioze. *Fundamentalnyye issledovaniya*, 7, 663–665.
 23. Dorohov, R. N., Chernova, V. N., Bubnenkova, O. M. (2015). Harakter raspredeleniya zhirovoy massyi tela lits razlichnogo vozrasta muzhskogo i zhenskogo pola. *Uchenyie zapiski universiteta imeni P. F. Lesgafta*, 9 (127), 91–96.
 24. Azhippo, A. Yu., Pugach, Ya. I., Zhernovnikova, Ya. V. (2015). Problema opredeleniya biologicheskogo vozrasta v sisteme otsenki fizicheskogo razvitiya v donozologicheskoy diagnostiki konstitutsionalnykh zabolevaniy. *Slobozhanskiy naukovno-sportivnyy visnik*, 3, 7–12.
 25. Pugach, Ya. I. (2013). Osnovnyie polozeniya postroyeniya semanticheskikh prostranstv dlya uporyadochennogo predstavleniya rezultatov issledovaniy. *Materialy za IX Mezhdunarodnuyu nauchno-prakticheskuyu konferentsiyu «B'descheto vprosyi ot sveta ta naukata – 2013»*. Sofiya: Bjalg Grad – BG, 5–14.
 26. Balsevich, V. K. (2009). *Ocherki po vozrastnoy kineziologii cheloveka*. Moscow: Sovetskij sport, 220.
 27. Volkenshteyn, M. V. (1978). *Obschaya biofizika*. Moscow: Nauka, 408–418.
 28. Samsonkin, V. N., Druz, V. A., Fedorovich, E. S. (2010). *Modelirovanie v samoorganizuyushchisya sistemah*. Donetsk: Izd. Zaslavskij A. Ju., 104.

DEFINITION OF EFFICIENCY INDICATOR AND STUDY OF ITS MAIN FUNCTION AS AN OPTIMIZATION CRITERION (p. 24-32)

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The problem of development rates maximizing of any business structure is solved by system processes optimization, and the best choice taking from a set of available alternatives. In order to solve these problems, an indicator that can be trusted to a central place in the technology of the optimum solutions is needed. Especially it is urgent where full automation of control processes is necessary. This responsibility involves the careful selection and verification of the indicators claiming to be the optimization criterion. According to the retrospective analysis, in this issue it is possible to allocate two interconnected problems.

The first problem is an uncertainty of the “optimization” concept. In fact, the optimization process, for today, is associated with extremum search of some function. In this regard, the second problem is related to the fact that as an optimization criterion, forming the function, it is proposed to use a variety of indicators.

In this work the essence of an efficiency indicator is revealed. The structure of this indicator and the properties which such indicator has to possess are defined. A number of classes of reference operations were created. Each such class provides a possibility of testing those qualities which the efficiency indicator applying for a role of optimization criterion has to possess.

The indicator which has cybernetic structure and successfully passed test on all classes of reference operations has been developed. Results of use of the developed indicator as optimization criterion in the system of liquid portion heating have been given.

Definition for category “efficiency” and “efficiency indicator” has been given.

The received results can be useful to developers of cross-disciplinary indicators, specialists in control processes automation and business processes optimization.

Keywords: efficiency indicator, optimization criterion, comparison criterion, resources efficiency.

References

1. Healey, C. M., Andradóttir, S., Kim, S.-H. (2013). Efficient comparison of constrained systems using dormancy. *European Journal of Operational Research*, 224 (2), 340–352. doi: 10.1016/j.ejor.2012.08.012
2. Syntetos, A. A., Kholidasari, I., Naim, M. M. (2016). The effects of integrating management judgement into OUT levels: In or out of context? *European Journal of Operational Research*, 249 (3), 853–863. doi: 10.1016/j.ejor.2015.07.021
3. Singh, R., Kumar, H., Singla, R. K. (2014). TOPSIS Based Multi-Criteria Decision Making of Feature Selection Techniques for Network Traffic Dataset. *International Journal of Engineering and Technology (IJET)*, 5 (6), 4598–4604.
4. Miskowicz, M. (2010). Efficiency of Event-Based Sampling According to Error Energy Criterion. *Sensors*, 10 (3), 2242–2261. doi: 10.3390/s100302242
5. Anishchenka, U. V., Kryuchkov, A. N., Kul'bak, L. I., Martynovich, T. S. (2008). Optimization of the structure of multi-functional information systems according to the criterion of a required value of the efficiency ratio. *Automatic Control and Computer Sciences*, 42 (4), 203–209. doi: 10.3103/s0146411608040068
6. Zhao, Q., Ding, Y., Jin, H. (2011). A Layout Optimization Method of Composite Wing Structures Based on Carrying Efficiency Criterion. *Chinese Journal of Aeronautics*, 24 (4), 425–433. doi: 10.1016/s1000-9361(11)60050-2
7. Vasilyev, E. S. (2013). Optimization of the architecture of a charge pump device on the basis of the energy efficiency criterion. *Journal of Communications Technology and Electronics*, 58 (1), 95–99. doi: 10.1134/s1064226913010099
8. Harchenko, V. P., Babeychuk, D. G., Slyunyaev, O. S. (2009). Optimization of network information air navigation facilities by the generalized criterion of efficiency. *Proceedings of National Aviation University*, 38 (1), 3–5. doi: 10.18372/2306-1472.38.1650
9. Vasilyev, E. S. (2013). Optimization of the architecture of a charge pump device on the basis of the energy efficiency criterion. *Journal of Communications Technology and Electronics*, 58 (1), 95–99. doi: 10.1134/s1064226913010099
10. Wu, Y., Cheng, T. C. E. (2006). Henig efficiency of a multi-criterion supply-demand network equilibrium model.

- Journal of Industrial and Management Optimization, 2 (3), 269–286. doi: 10.3934/jimo.2006.2.269
11. Anishchenka, U. V., Kryuchkov, A. N., Kul'bak, L. I., Martynovich, T. S. (2008). Optimization of the structure of multifunctional information systems according to the criterion of a required value of the efficiency ratio. *Automatic Control and Computer Sciences*, 42 (4), 203–209. doi: 10.3103/s0146411608040068
 12. Xu, Q., Wehrle, E., Baier, H. (2012). Adaptive surrogate-based design optimization with expected improvement used as infill criterion. *Optimization*, 61 (6), 661–684. doi: 10.1080/02331934.2011.644286
 13. Xia, L. (2016). Optimization of Markov decision processes under the variance criterion. *Automatica*, 73, 269–278. doi: 10.1016/j.automatica.2016.06.018
 14. Mansour, M. R., Delbem, A. C. B., Alberto, L. F. C., Ramos, R. A. (2015). Integrating Hierarchical Clustering and Pareto-Efficiency to Preventive Controls Selection in Voltage Stability Assessment. *Evolutionary Multi-Criterion Optimization*, 487–497. doi: 10.1007/978-3-319-15892-1_33
 15. Shorikov, A. F., Rassadina, E. S. (2010). Multi-criterion optimization of production range generation by an enterprise. *Economy of Region*, 2, 189–196. doi: 10.17059/2010-2-18
 16. Savchuk, T. O., Kozachuk, A. V. (2015). Development of cloud application efficiency evaluation criterion. *Eastern-European Journal of Enterprise Technologies*, 5 (2 (77)), 20–26. doi: 10.15587/1729-4061.2015.50950
 17. Lutsenko, I., Fomovskaya, E., Vikhrova, E., Serdiuk, O. (2016). Development of system operations models hierarchy on the aggregating sign of system mechanisms. *Eastern-European Journal of Enterprise Technologies*, 3 (2 (81)), 39–46. doi: 10.15587/1729-4061.2016.71494
 18. Lutsenko, I., Fomovskaya, E. (2015). Identification of target system operations. 4. The practice of determining the optimal control. *Eastern-European Journal of Enterprise Technologies*, 6 (2 (78)), 30–36. doi: 10.15587/1729-4061.2015.54432
 19. Lutsenko, I., Vihrova, E., Fomovskaya, E., Serdiuk, O. (2016). Development of the method for testing of efficiency criterion of models of simple target operations. *Eastern-European Journal of Enterprise Technologies*, 2 (4 (80)), 42–50. doi: 10.15587/1729-4061.2016.66307
 20. Cirlin, A. M. (1986) *Optimal'noe upravlenie tehnologicheskimi processami*. Jenergoatomizdat, 400.
 21. Lutsenko, I. (2014). Identification of target system operations. Determination of the time of the actual completion of the target operation. *Eastern-European Journal of Enterprise Technologies*, 6 (2 (72)), 42–47. doi: 10.15587/1729-4061.2014.28040
 22. Lutsenko, I. (2015). Identification of target system operations. determination of the value of the complex costs of the target operation. *Eastern-European Journal of Enterprise Technologies*, 1 (2 (73)), 31–36. doi: 10.15587/1729-4061.2015.35950
 23. Lutsenko, I. (2015). Identification of target system operations. development of global efficiency criterion of target operations. *Eastern-European Journal of Enterprise Technologies*, 2 (2 (74)), 35–40. doi: 10.15587/1729-4061.2015.38963
 24. Bartuševičienė, I., Šakalytė, E. (2013) *Organizational Assessment: Effectiveness VS. Efficiency*. Social Transformations in Contemporary Society. Available at: <http://stics.mruni.eu/wp-content/uploads/2013/06/45-53.pdf>
 25. Lutsenko, I. (2016). Principles of cybernetic systems interaction, their definition and classification. *Eastern-European Journal of Enterprise Technologies*, 5 (2 (83)), 37–44. doi: 10.15587/1729-4061.2016.79356

DESIGNING A MONITORING MODEL FOR CLUSTER SUPER-COMPUTERS (p. 32-37)

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Recently there has been an increase in the number of cyber attacks against computational systems. Growth in the amounts of information that passes through computational clusters and savings on staff requires an application of effective means of monitoring computational resources for the purpose of prediction and elimination of cyber attacks. An analysis of hacker attacks revealed that the break-in was not detected by technical equipment.

We examined a concept of building existing systems of monitoring of cluster super-computers. Deficiencies are established in the monitoring systems, which lead not only to the reduction in efficiency of computational clusters but to their safety violations. We described a formal model for the detection of anomalies in the functioning of a computational cluster. The model is the sets of the states of the system depending on functional tasks, it separates processes of targeted functioning of the system from the interface processes of interaction with the network infrastructure and provides for the possibility of their use in neural network technology for detecting anomalies in the functioning of a computational cluster. This model makes it possible to locally control parameters for each process and, based on the formed vector, to detect anomalous influence on the system as a whole.

Data of the study can be used for the improvement of already existing subsystems of monitoring of super-computer technologies, as well as form a foundation for creating fundamentally new neural network multi-agent system of monitoring of the detection of anomalous incidents in the performance of computational clusters.

Keywords: super-computer, monitoring system, detection of anomalies, computational systems, multi-agent approach.

References

1. Voevodyn, V. V. (2012). *Superkompiuternie tekhnolohyy v nauke, obrazovanny y promishlennosty*. Moscow: Yzdatelsvo Moskovskogo universiteta, 232.
2. DDOS-ataky v pervom kvartale 2016 hoda. Available at: <https://securelist.ru/analysis/malware-quarterly/28429/ddos-ataki-v-pervom-kvartale-2016-goda> (Last accessed: 22.07.2016).
3. Bronk, C., Tikk-Ringas, E. (2013). The Cyber Attack on Saudi Aramco. *Survival*, 55 (2), 81–96. doi: 10.1080/00396338.2013.784468
4. Knopová, M., Knopová, E. (2014). The Third World War? In *The Cyberspace. Cyber Warfare in the Middle East*. Acta Informatica Pragensia, 3 (1), 23–32. doi: 10.18267/j.aip.33
5. Ruban, I. V. (2015). An approach to cyber security support. *Information processing systems*, 11, 6–8.
6. Kora, A. D., Soidridine, M. M. (2012). Nagios based enhanced IT management system. *International Journal of Engineering Science and Technology (IJEST)*, 4 (4), 1199–1207.

7. Cigala, V., Mahale, D., Shah, M., Bhingarkar, S. (2011). Job-Oriented Monitoring of Clusters. *International Journal on Computer Science and Engineering*, 3 (3), 1333–1337.
8. Stefanov, K., Voevodin, V., Zhumatiy, S., Voevodin, V. (2015). Dynamically Reconfigurable Distributed Modular Monitoring System for Supercomputers (DiMMon). *Procedia Computer Science*, 66, 625–634. doi: 10.1016/j.procs.2015.11.071
9. Sydorov, Y. A., Oparyn, H. A., Skorov, V. V. (2014). Ynstrumentalnii kompleks metamonytorynha raspredelennikh vichyslytelnykh sred. *Parallelnie vichyslytelnie tekhnolohyy*, 159–167.
10. Tarasov, A. G. (2010). Integration of computing cluster monitoring system. In *Proc. of the First Russia and Pacific Conference on Computer Technology and Applications (RPC 2010)*, 221–224.
11. Tirenko, A. (2016). IT na rubezhe epokh. *Otkritie systemi. SUBD*, 1, 46–47.
12. Nemniuhyn, S. A. (2002). Parallel'noe proqrammyrovanye dlia mnohoprotsessornikh vichyslytel'nykh system. *St. Petersburg*, 255.
13. Olad'ko, A. Iu. (2012). Podsystema monytorynha y audyta ynformatsyonnoï bezopasnosti v operatsyonnoï systeme Linux. *Yzvestiya Iuzhnoho federal'noho unyversyteta. Tekhnicheskyye nauky*, 137 (12), 22–28.

DEVELOPING A TECHNIQUE FOR IMPROVING THE EFFICIENCY OF ITERATIVE METHODS FOR THE CALCULATION OF THE MULTICOMPONENT RECTIFICATION PROCESS (p. 38-44)

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Studies of the technological base of mobile control over the processes of rectification are based on determining the concentration and temperature profiles of the installation in the established regime at different coordinates of the point of application of controlling influence.

A problem of the calculation of static characteristics of the process is in the iterative determination of such concentrations of components in the bottoms so that the bidirectional calculations, based on them, and carried out to the control section of a rectifying column, make it possible to obtain identical results. The θ -method is the effective technique for the provision of convergence of such calculations. However, when calculating multi-plate rectifying columns with several feeding inputs, in which the separation of multicomponent mixtures occurs, it is necessary to use a simple procedure for the reduction in time spent searching for the solution.

The problem of reducing the necessary number of iterations is solved by the exponentiation of coefficient θ , which is determined by the introduced tuning parameter of the algorithm. The extreme dependence of the number of iterations on this exponent is proven.

Performed calculations of the column for separating the multicomponent product of the MTBE synthesis proved that the proposed modification of the θ -method of convergence of iterative calculations of the operating modes of rectifying columns makes it possible to reduce the time, necessary for the search for the solution, by 50 %. In this case, it is not necessary to obtain high quality of initial approximations of compositions of the separation

products. The method is characterized by high stability and workability in a wide range of change in the input magnitudes.

Keywords: mathematical modeling, multicomponent rectification, iteration methods, the θ -method of convergence, mobile control.

References

1. Laptev, A. G., Farakhov, M. I., Mineev, N. G. (2010). *Osnovy rascheta i modernizatsiya teplomassoobmennykh ustanovok v neftekhimii*. Kazan': Kazanskii gosudarstvennyi energeticheskii universitet, 574.
2. Belobrova, E. V., Sheikus, A. R., Korsun, V. I. (2014). Automatic control of heat-mass exchange processes with movable distributed regulatory impact. *Eastern-European Journal of Enterprise Technologies*, 5 (2 (71)), 51–55. doi: 10.15587/1729-4061.2014.28037
3. Levchuk, I. L., Sheikus, A. R., Trishkin, V. Ya. (2015). Sposob upravleniya protsessom rektifikatsii s pomoshch'yu raspredelennykh upravlyayushchikh vozdeystvii. *Herald of the National Technical University "KhPI"*. Subject issue: New solutions in modern technologies, 14, 100–105.
4. Rapoport, E. Ya. (2005). *Analiz i sintez sistem avtomaticheskogo upravleniya s raspredelennymi parametrami*. Moscow: Vycsha shkola, 292.
5. Castner, W. R. (1983). *The Lewis-Matheson method on computer*. New Jersey Institute of Technology, 272.
6. Bansal, S., Manjare, S. D. (2016). Theoretical investigation on the performance of multicomponent distillation column for the separation of hydrocarbon mixture using inside out approach. *International Journal of Chemical Engineering and Applications*, 7 (4), 282–288. doi: 10.18178/ijcea.2016.7.4.590
7. Banka, S. R. (2015). Computer aided design of distillation column. *Journal of Applied Sciences Research*, 11 (17), 8–12.
8. Komissarov, Y. A., Sang, D. Q. (2014). Multicomponent distillation calculations using computer simulation principles. *Theoretical Foundations of Chemical Engineering*, 48 (3), 280–287. doi: 10.1134/s0040579514030087
9. Buryakov, V. G., Khodzinskii, A. N. (2008). Razrabotka odnogo klassa matematicheskikh modelei rektifikatsii mnogokomponentnykh smesei. *Komp'yuternaya matematika*, 2, 13–24.
10. Monroy-Loperena, R., Vacahern, M. (2013). A simple, reliable and fast algorithm for the simulation of multicomponent distillation columns. *Chemical Engineering Research and Design*, 91 (3), 389–395. doi: 10.1016/j.cherd.2012.09.005
11. Olafadehan, O. A., Adeniyi, V. O., Popoola, L. T., Salami, L. (2013). Mathematical modelling and simulation of multicomponent distillation column for acetone-chloroform-methanol system. *Advanced Chemical Engineering Research*, 2 (4), 113–123.
12. Belobrova, E. V., Korsun, V. I., Mysov, O. P., Trishkin, V. Ya. (2007). Matematicheskoe modelirovanie protsessa rektifikatsii. *Issledovanie tekhnologicheskikh osnov podvuzhnogo upravleniya. Herald of Khmelnytskyi national university*, 1 (3), 36–37.
13. Asadi, S. (2014). Simulation of the multicomponent distillation of spearmint essential oil by a predictive Soave-Redlich-Kwong equation of state and comparison with experiments. *Chemical Industry and Chemical Engineering Quarterly*, 20 (3), 417–423. doi: 10.2298/ciceq130208024a

DEVELOPMENT OF THE SYSTEM OF AUTOMATIC CONTROL OF STEAM BOILERS AT ELECTRIC POWER PLANTS DURING COMBUSTION OF LOW QUALITY FUEL (p. 44-51)

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A general principle of energy saving control of a steam boiler at thermal power stations is presented, which implies the formation and subsequent minimization of function of energy losses. This provides the possibility to ensure minimum losses of energy (maximum efficiency) under all basic modes of normal work of equipment. Parameters of the combustion activator are included in functional dependences and initial models of a boiler unit as the object of control, which makes it possible to form reference models of a steam boiler, necessary for solving the problem of energy saving control during the combustion of low quality fuels.

A method for increasing the accuracy of measurement and the control of feeding solid fuel to the furnace of a boiler at thermal power stations is proposed. This makes it possible to regulate fuel consumption more accurately and to have more precise information for determining technical and economic indices of work of the power unit. A new system of automated control of feeding additives, which activate the process of combustion, was proposed. The system of automated control of additives makes it possible to accurately regulate consumption of additives depending on the quality and amount of fuel supplied to the furnace. This provides for the possibility to maximally use the potential of activators of combustion for different grades of solid fuel. The proposed system may be used at thermal power plants that operate on the low quality fuel. The implementation of the proposed solutions will make it possible to increase efficiency of the power units of coal-dust TPP at the combustion of low quality fuels by the magnitude of up to 4 %, as well as to completely eliminate the addition of natural gas.

Keywords: steam boiler, thermal power plant, energy saving, energy losses, activator of combustion.

References

- Duel, M. A., Shelepov, I. G. (2007). Avtomatizaciya teploenergeticheskikh ustanovok teplovih i atomnih elektrostanciy. Kharkov, 312.
- Saccomanno, F. (2003). Electric power systems: Analysis and control. IEEE Press Series on Power Engineering. doi: 10.1002/0471722901
- Goncalves, C. V., Vilarinho, L. O., Scotti, A., Guimaraes, G. (2006). Estimation of heat source and thermal efficiency in GTAW process by using inverse techniques. Journal of Materials Processing Technology, 172 (1), 42–51. doi: 10.1016/j.jmatprotec.2005.08.010
- Johnson, M. A., Moradi, M. H. (Eds.) (2005). PID control. London: Springer. doi: 10.1007/1-84628-148-2
- Glattfelder, A. H., Schaufelberger, W. (2003). Control systems with input and output constraints. London: Springer. doi: 10.1007/978-1-4471-0047-8
- Abou khachfe, R., Jarny, Y. (2001). Determination of heat sources and heat transfer coefficient for two-dimensional heat flow – numerical and experimental study. International Journal of Heat and Mass Transfer, 44 (7), 1309–1322. doi: 10.1016/s0017-9310(00)00186-1
- Zvit NDR za temoyu gospdogovoru z TOV NVP “Adioz” (m. Kyiv) № 11–10: Obrobka ta analiz rezultativ teplovih balansobih viprobuvan kotla TP-100 energobloku 200 MVt Zmiivskoi TES (2012). Kharkiv: UIPA.
- Artyuh, S. F., Duel, M. A., Shelepov, I. G. (2001). Avtomatizirovannie sistemi upravleniya tehnologicheskimi procesami v energetike. Kharkiv: Znanie, 416.
- Kang, C. A., Brandt, A. R., Durlofsky, L. J. (2016). A new carbon capture proxy model for optimizing the design and time-varying operation of a coal-natural gas power station. International Journal of Greenhouse Gas Control, 48, 234–252. doi: 10.1016/j.ijggc.2015.11.023
- Kanyuk, G. I., Mezerya, A. Y., Suk, I. V. (2016). Metodi i modeli energosberegayusego upravleniya energeticheskimi ustanovkami elektrostanciy. Kharkiv: Tochka, 328.
- Kanyuk, G. I., Mezerya, A. Y., Laptinova, K. V. (2013). Pat. № 84389 UA. Prystrij vymiru vytraty tverdoho palyva teplovyyx elektrostanciy. MPK F22B 35/00. No. u 201302082; declared: 19.02.2013; published: 25.10.2013, Bul. 20.
- Kanyuk, G. I., Mezerya, A. Y., Laptinova, K. V. (2013). Pat. № 82811 UA. Prystrij avtomatyzovanoho dozuvannja podaci prysadok v topku kotla teplovyyx elektrostanciy. MPK F22B 35/00. No. u 201302031; declared: 19.02.2013; published: 12.08.2013, Bul. 15.

ANALYTICAL DETERMINATION OF THE ELECTROMECHANICAL SYSTEM STARTING PROCESS EFFICIENCY INDEX WITH REGARD TO THE DISTRIBUTED NATURE OF INPUT PRODUCTS CONSUMPTION (p. 51-59)

Valerii Tytiuk

Currently, an approach based on the lumped-parameter resource consumption model is used to determine the starting process efficiency index. This is due to the simplicity of analytical expressions for the efficiency index. In actual practice, the resource consumption of the starting process is time-phased in nature, which may lead to biased estimates of the efficiency index and inaccurate operation of the optimization system.

In the paper, the actual form of the signal of the cost estimate of input products over time was determined using mathematical modeling of the controlled start system. It is proposed to use a fractional rational function to approximate these signals. The parameters of this approximation at different values of the control action were obtained using the Matlab Curve Fitting Toolbox.

The analytical expressions for determining the resource consumption, potential effect and efficiency index of the starting process were obtained on the basis of the proposed approximation. It was found that the position of the maximum efficiency index on the x-axis, obtained when using the lumped-parameter and distributed-parameter starting operation models varies slightly (within the 5 % margin of error). This will reasonably facilitate hardware implementation of optimal control systems of starting processes through the application of the lumped-parameter starting operation model.

Keywords: controlled start, distributed resource consumption, approximation, analytical expression of starting efficiency index.

References

- Zahirniak, M. V., Nevzlin, B. I. (2009). Elektrychni mashyny. 2nd edition. Kyiv: Znannia, 399.

2. Trigeassou, J.-C. (2013). *Electrical Machines Diagnosis*. John Wiley & Sons, 352.
3. Chernyi, A. P., Rodkyn, D. Y., Kalynov, A. P., Vorobeichyk, O. S. (2008). Monitoryng parametrov elektrycheskykh dvyhatelei elektromekhanicheskyykh system. Kremenchug: ChP Shcherbatykh A. V., 246.
4. Klepykov, V. B., Kutovoi, Yu. N. (2004). K pryrode avtokolebatelnykh rezhymov v elektropryvodakh sharovykh melnyts. Naukovyi visnyk Dnipropetrovskoho natsionalnoho hirnychoho universytetu, 3, 29–30.
5. Hladyr, A. Y. (2003). Eksperymentalnye puskovye kharakterystyky nasosnoho ahrehata s uchetoм momenta trohanya. Visnyk Kremenchutskoho derzhavnoho politekhnichnoho universytetu, 2 (19), 247–249.
6. Shue, L., Chao, F. (2013). Design and Simulation of Three-phase AC Motor Soft-start. 2013 Third International Conference on Intelligent System Design and Engineering Applications, 554–557. doi: 10.1109/isdea.2012.135
7. Bhuvaneswari, G., Charles, S., Nair, M. G. (2008). Power quality studies on a Soft-start for an induction motor. 2008 IEEE/PES Transmission and Distribution Conference and Exposition, 1–6. doi: 10.1109/tdc.2008.4517215
8. Zhuang, F., Shu, L. (2010). Electric Motor Soft-Start Control Based on Fuzzy Theory. 2010 Third International Conference on Intelligent Networks and Intelligent Systems, 430–433. doi: 10.1109/icinis.2010.125
9. Liu, L., Jiang, J., Zhang, L. (2011). Research of Electric Motor Multi-type Soft Start Control Mode Based on over-load Protection. International Journal of Image, Graphics and Signal Processing, 3 (2), 16–22. doi: 10.5815/ijigsp.2011.02.03
10. Kai, L., Lin, C. X., Qiang, T. (2008). Dynamic identification and control of IM soft-start using ANN. 2008 IEEE International Conference on Industrial Technology, 1–6. doi: 10.1109/icit.2008.4608418
11. Tytjuk, V. (2015). Effect of electromechanical equipment wear on startup process indicators. Eastern-European Journal of Enterprise Technologies, 6 (2 (78)), 23–29. doi: 10.15587/1729-4061.2015.55924
12. Lutsenko, I. (2015). Identification of target system operations. Development of global efficiency criterion of target operations. Eastern-European Journal of Enterprise Technologies, 2 (2 (74)), 35–40. doi: 10.15587/1729-4061.2015.38963
13. Süli, E., Mayers, D. (2003). *An introduction to numerical analysis*, Cambridge university press, Cambridge, UK, 429.