ECONOMICS AND MANAGEMENT OF ENTERPRISE

RESEARCH OF EMPLOYEES' MOTIVATIONAL POTENTIAL IN THE SOCIAL MANAGEMENT SYSTEM

page 4–7

The process of motivational potential of the enterprise in the social management system is discussed in the article. The main aim of the study is to develop structure and relationship elements that create the concept of employees' motivation and justification of its implementation. The elements that create the concept of employees' motivation are discussed. Principles that facilitate the practical implementation of this concept are: consistency, effectiveness and objectivity. The presented concept allows to identify internal and external factors of influence on behavior and needs of employee, establish factors that inhibit the development of employees' motivational potential to find ways to neutralize them; provide development of employees' motivational potential by establishing optimal ratio between wages and productivity of employees. The method and algorithm designed to select the integrated management tools enhance the motivation of the organization on employees. The research results can be applied to the heads of commercial enterprises and scientists studying the motivational potential in the system of employees' social management.

Keywords: motivational potential, development, social management, concept, elements, principles.

References

1. Maslow, A. N. (1970). *Motivation and Personality.* Ed. 2. N.Y.: Harper & Row, 369.
2. McClelland, D. (1975). *Power: The inner Experience*. N.Y.: Irvington, 672.
3. Diatlov, A. N., Plotnikov, M. V., Mutovin, I. A. (2007). *Obshchii menedzhment: Kontseptsii i kommentarii.* Moscow: Al'pina Biznes Buks, 400.
4. Kolot, A. M. (2003). *Sotsialno-trudovi vidnosyny: teoriia i praktyka rehuliuvannia*. Kyiv: KNEU, 230.
5. Lutai, L. A. (2006). Rol motyvatsii v upravlinni dystsyplinoiu pratsi. *Menedzher. Visnyk Donetskoho derzhavnoho universytetu upravlinnia, 4(38)*, 130–138.
6. Masiuk, Yu. (2008). Vdoskonalennia systemy upravlinnia personalom ta rol HR-pidrozdilu u stratehichnomu upravlinni pidpryiemstv sfery posluh. *Visnyk Lvivskoho universytetu. Seriia ekonomichna, 39*, 313–317.
7. In: Porshnev, A. G., Razu, M. L., Tihomirova, A. V. (2003). *Menedzhment: teoriia i praktika v Rossii.* Moscow: ID FBK-PRESS, 528.
8. Martynenko, M. M. (2008). *Osnovy menedzhmentu*. Kyiv: Karavela, 496.
9. Avetysova, A. O., Pupchenko, L. I., Yurchenko, Yu. Yu. (2007). *Osnovy pidpryiemnytskoi i upravlinskoi diialnosti*. Donetsk: DonNUET, 184.
10. Rud, Yu. N. (2013). Sutnist ta tendentsii rozvytku systemy sotsialnoho upravlinnia personalom na torhovelnykh pidpryiemstvakh Ukrainy. *Nauka y Ekonomyka, 4*, 149–153.

FORMATION OF THE SYSTEM OF CONTROL INDICATORS OF EXTERNAL FUNDRAISING FOR ENGINEERING ENTERPRISES

page 8–11

The method of forming the system of process indicators for external fundraising is considered in the article. The main aim of the study is to determine the key aspects of the control system and the development of sets of indicators on which it is advisable to monitor the processes of external fundraising. Therefore, it was revealed that system of indicators for monitoring external fundraising should help the enterprise adapt to the external business environment and facilitate the financing regulation processes of industrial and economic activity. The key task of control is matching external fundraising processes to established strategic, tactical and operational objectives of the company. It was developed the complex system of external fundraising indicators, which consists of four groups of indicators: activity, structure, risk and overall effectiveness that allows monitoring adverse changes in key parameters of external fundraising and effectively adjust the process of implementation of management decisions on external fundraising for engineering enterprises. Research results can be applied by financial managers to access the administrative decisions in the process of fundraising from the external sources.

Keywords: external fundraising, control of external fundraising, fundraising indicators.

References

1. Kaminska, T. H. (2013). Kompleksnyi hospodarskyi kontrol kruhoobihu kapitalu pidpryiemstva. *Ekonomika ta upravlinnia pidpryiemstvom, 1*, 221–225.
2. Drury, C. (2009). *Management Accounting for Business. Ed. 4*. Cengage Learning EMEA, 584.
3. Tereshchenko, O. O., Stetsko, M. V. (2013). Systema pokaznykiv u kontseptsii finansovoho kontrolinhu u sferi biznesu. *Finansy Ukrainy, 11*, 66–83.
4. Igoshina, Yu. A. (2014). Sistema vnutrennego kontrolia kak element upravlencheskogo ucheta. *Vestnik NGIEI, 1(32)*, 59–69.
5. Slack, N., Chambers, S., Johnston, R. (2010). *Operations Management. Ed. 6*. Financial Times/Prentice Hall, 686.
6. Lutsenko, S. I. (2013). Vliianie finansovoi gibkosti kompanii na resheniia, sviazannye so strukturoi kapitala. *Finansovyi menedzhment, 6*, 60–68.
7. Velykyi, Yu. V., Yurin, Ye. H. (2013). Orhanizatsiini etapy vnutrishnoho audytu na pidpryiemstvi. *Investytsii: praktyka ta dosvid, 24*, 53–55.
8. Kovalev, V. V., Volkova, O. N. (2007). *Analiz hoziaistvennoi deiatel'nosti predpriiatiia*. Moscow: Velbi «Prospekt», 424.
9. Anthony, R. N., Govindarajan, V. (2004). *Management control systems. Ed. 11.* Boston; London: McGrawHill/Irwin, 851.
10. Pitt, M., Koufopoulos, D. (2012). *Essentials of Strategic Management*. Sage Publications, 472.

MATHEMATICAL METHODS, MODELS AND INFORMATION TECHNOLOGIES IN ECONOMICS

SOLUTION OF OPTIMIZATION TASKS BY MEANS OF GOOGLE SPREADSHEETS

page 12–15

This paper explores the possibility of using free cloud services such as Google Drive to create the economic and mathematical tools to practice their constant use in small and medium business. The main aim of the research is to develop a methodology and best practices for solving optimization problems by means of cloud technologies. Using modern means of communication allow employees collecting and analyzing data without intending to a specific office and computer. This article is an example of

creating a virtual template that allows you to quickly calculate the best routes between the cities of Ukraine, which are selected by the user. It is proposed to create in Google spreadsheets like patterns using an arsenal of built-in features, add-ons including the creation of js macros to promptly solve the repetitive business tasks. The research results can be used by managers of small firms engaged in marketing, service of geographically distributed sites and so on.

Keywords: cloud services Google Drive, Google spreadsheets, Solver add-in, traveling salesman problem, the best route.

References

1. Tsisar', I. F., Neiman, V. G. (2002). *Komp'iuternoe modelirovanie ekonomiki*. Moscow: Dialog-MIFI, 304.
2. Reinelt, G. (1994). The Traveling Salesman: Computational Solutions for TSP Applications. *Lecture Notes in Computer Science*. Berlin: Springer-Verlag, 840.
3. Reinelt, G. (1992). Fast Heuristics for Large Geometric Traveling Salesman Problems. *ORSA Journal on Computing, Vol. 4, № 2*, 206–217. doi:10.1287/ijoc.4.2.206
4. Kreneva, S. G., Len', A. S. (2015). Optimizatsiia transportnyh potokov raspredeleniia gotovoi produktsii s ispol'zovaniem matematicheskih modelei tovarodvizheniia. *Mezhdunarodnyi nauchnyi zhurnal «Innovatsionnaia nauka», 5*, 151–156.
5. Danilevich, S. B., D'iachkova, O. V. (2006). Avtomatizatsiia nahozhdeniia optimal'nogo marshruta sredstvami MS Excel i pMetro. *Logistika: problemy i resheniia, 2*, 74–76.
6. Dantzig, G. B., Ramser, J. H. (1959). The Truck Dispatching Problem. *Management Science, Vol. 6, № 1*, 80–91. doi:10.1287/mnsc.6.1.80
7. Toth, P., Vigo, D. (2002). *The Vehicle Routing Problem*. Philadelphia: Society for Industrial and Applied Mathematics, 367. doi:10.1137/1.9780898718515
8. Bazylevych, R. P., Kutelmakh, R. K. (2009). Doslidzhennia efektyvnosti isnuiuchykh alhorytmiv dlia rozviazannia zadachi komivoiazhera. *Visnyk NU «Lvivska politekhnika», 650*, 235–245.
9. Rasmussen, R. (2011). TSP in Spreadsheets — a Guided Tour. *International Review of Economics Education, Vol. 10, № 1*, 94–116. doi:10.1016/s1477-3880(15)30037-2
10. Diulicheva, Yu. Yu. (2013). Uprovadzhennia khmarnykh tekhnolohii v osvitu: problemy ta perspektyvy. *Informatsiini tekhnolohii v osviti, 14*, 58–64.
11. *Google Drive — failovyi hosting*. Available: https://drive.google.com/

INFLUENCE EVALUATION SIMULATION OF FACTORS ON PERFORMANCE INDICATORS OF ORGANIZATIONAL AND TECHNOLOGICAL OBJECTS BASED ON THE SEASONALITY OF PRODUCTION

page 15–17

This article discusses the use of statistical methods to investigate the influence of factors on performance indicators of organizational and technological facilities, taking into account the seasonality of production in different industries (chemical, food, etc.). The main aim of this study is to develop a model of influence of factors on performance indicators of organizational and technological facilities, taking into account the seasonality of production, which is based on the methods of correlation and regression analysis. Using these methods allows quantifying the relationship between values in environment where there are a great number of factors, some of which are unknown. This article discussed the presentation of changes in performance within the seasonal organizational and technological facilities due to changes in the accounted factors with an average impact of unaccounted factors. The model allows making alternative scenarios for the strategic management of organizational and technological objects, taking into account the seasonality of production. The model is recommended for use in the development of automated control systems of technological systems of continuous type with the seasonal nature of production, including companies and corporations of the sugar industry. The research results can be applied in decision support systems for the sugar industry.

Keywords: performance indicators, organizational and technological object, seasonality of production.

References

1. Prokopenko, T. A., Ladaniuk, A. P. (2014). Informatsionnaia model' upravleniia tehnologicheskimi kompleksami nepreryvnogo tipa v klasse organizatsionno-tehnicheskih sistem. *Problemy upravleniia i informatiki, 5*, 64–70.
2. Ladaniuk, A. P., Shumigai, D. A., Boiko, R. O. (2013). Situatsionnoe koordinirovanie podsistem tehnologicheskih kompleksov nepreryvnogo tipa. *Problemy upravleniia i informatiki, 4*, 117–122.
3. Arhangel'skii, V. I., Bogaenko, I. V., Grabovskii, G. G., Riumshin, N. A. (2005). *Integrirovannoe upravlenie proizvodstvom: organizatsionnye i tehnologicheskie aspekty menedzhmenta predpriiatiiami*. Kyiv: Tehnika, 328.
4. In: Bol'shakov, A. A. (2006). *Intellektual'nye sistemy upravleniia organizatsionno-tehnicheskimi sistemami*. Moscow: Goriachaia liniia-Telekom, 160.
5. Borisov, V. V., Zernov, M. M. (2009). Realizatsiia situatsionnogo podhoda na osnove nechetkoi ierarhicheskoi situatsionno-sobytiinoi seti. *Iskusstvennyi intellekt i priniatie reshenii, 1*, 18–30.
6. Alter, S. (2013). Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. *Journal of the Association for Information Systems, 14(2)*, 72–121.
7. Geida, A. S. (2009). Otsenivanie effektov funktsionirovaniia organizatsionno-tehnicheskih sistem: kontseptsiia avtomatizatsii. *Trudy SPIIRAN, 11*, 63–80.
8. Daneev, A. V., Vorob'ev, A. A., Lebedev, D. M. (2010). Issledovanie dinamiki povedeniia slozhnyh organizatsionno-tehnicheskih sistem v usloviiah vozdeistviia neblagopriiatnyh faktorov. *Vestnik Voronezhskogo instituta MVD Rossii, 2*, 163–171.
9. Prokopenko, T. (2013). Methodological bases of management of technological complexes under uncertainty. *Technology Audit And Production Reserves, 6(4(14))*, 27–29. Available: http://journals.uran.ua/tarp/article/view/19644
10. Kliachkin, V. N. (2009). *Statisticheskie metody v upravlenii kachestvom: komp'iuternye tehnologii*. Moscow: Finansy i statistika, INFRA-M, 304.

POWER AND ENERGY SAVING

STUDY OF ELECTROMECHANICAL AND THERMAL TRANSIENTS DURING STARTING OF INDUCTION MOTORS

page 18–25

This article presents the results of analytical studies of electromechanical and thermal transients during starting of induction motor with cage rotor in conditions of low voltage. The aim of the research is improving the operational reliability of induction motor with cage rotor in conditions of low voltage by development of technical devices for diagnostics based on theoretical foundations of electromechanical and thermal transients at starting. As a result of the research the theory of transient electromechanical and thermal processes in induction motor with cage rotor in conditions of low voltage is found a further development. For the first time it is proposed the starting mode evaluation parameter of system «induction motor — working machine» — the ratio of the moment of inertia of the system to the nominal moment of induction motor. For the first time it is grounded the

parameter of diagnosing transient thermal processes at starting of induction motor in conditions of low voltage — extra thermal insulation depreciation in the period after starting. For the first time it is grounded the criterion of extra thermal insulation depreciation in the period after starting — squared power momentum of inrush current, which can be taken as a diagnostic parameter. Investigation of thermal insulation depreciation showed that the thermal transient at the start is adiabatic. Main thermal insulation depreciation is accounted for period after starting. The dependence of extra thermal insulation depreciation on squared momentum of inrush current allows selecting set point value of squared power momentum of inrush current of proposed device, which will facilitate the starting mode of the motor.

Keywords: electric motor, electromechanical, thermal, transient, low voltage, starting.

References

1. Ovcharov, V. V. (1990). *Jekspluatacionnye rezhimy raboty i nepreryvnaja diagnostika jelektricheskih mashin v sel'skohozjajstvennom proizvodstve*. Kyiv: USHA, 168.
2. Sun, D. S. (2012). Research on Voltage-Chopping and Energy-Saving Controlling Technology for Three-Phase AC Asynchronous Motor. *Advanced Materials Research, Vol. 433–440*, 1033–1037. doi:10.4028/www.scientific.net/amr.433-440.1033
3. Hung, N. T., Thien, N. C., Nguyen, T. P., Le, V. S., Tuan, D. A. (2014). Optimization of Electric Energy in Three-Phase Induction Motor by Balancing of Torque and Flux Dependent Losses. *Lecture Notes in Electrical Engineering*, 497–507. doi:10.1007/978-3-642-41968-3_50
4. Grouni, S., Ibtiouen, R., Kidouche, M., Touhami, O. (2010). Novel Loss Optimization in Induction Machines with Optimum Rotor Flux Control. *International Journal of Systems Control, Vol. 1, № 4*, 163–169.
5. Dhaoui, M., Sbita, L. (2010). A New Method for Losses Minimization in IFOC Induction Motor Drives. *International Journal of Systems Control, Vol. 1, № 2*, 93–99.
6. Alssa, K., Eddine, K. D. (2009). Vector Control Using Series Iron Loss Model of Induction Motors and Power Loss Minimization. *World Academy of Science, Engineering and Technology, Vol. 52*, 142–148.
7. Kosmodamianskii, A. S., Vorob'ev, V. I., Pugachev, A. A. (2012). Induction motor drives with minimal power losses. *Russian Electrical Engineering, Vol. 83, № 12*, 667–671. doi:10.3103/s1068371212120073
8. Yang, Y. (2010). Improvement of Electric Submersible Pump in High Temperature. *China Science and Technology Fortune*.
9. Ostrovskii, A. V. (2012). Beziteratsionnaia metodika opredeleniia parametrov shemy zameshcheniia asinhronnogo elektrodvigatelia. *Pratsi Tavriiskoho derzhavnoho ahrotekhnolohichnoho universytetu, Vol. 12, № 2*, 66–72.
10. Ovcharov, S. V., Vovk, A. Ju. (2013). Puti snizheniia energozatrat v mobil'nyh agregatah. *Pratsi Tavriiskoho derzhavnoho ahrotekhnolohichnoho universytetu, Vol. 13, № 4*, 21–26.

DEVELOPMENT OF METHOD FOR OPERATION SUPPORT OF THE COGENERATION SYSTEMS ON BIOGAS FUEL

page 26–31

It is developed a method of maintaining the temperature of the local water temperature during measurement of return water temperature and heater coolant temperature in the inlet and outlet of the engine cooling circuit from the heat exchanger on the basis of the proposed cogeneration system. Decisions on changing the number of plates of the heat exchanger while maintaining a constant coolant flow rate allows to coordinate the discharge-charge of the biogas plant, unloading of the fermented wort, loading of the fresh material and charge-discharge of a cogeneration system using a heat pump for which fermented wort is low-grade energy source. For example, when using the proposed method of coordination of production and energy consumption in the cogeneration plant, for example, GTK 35 M type with a primary capacity 112 kW, which consumes 352,5 m^3/day of biogas, it is possible to obtain biogas savings — 25,4 thousand m^3/year that by increasing the marketability of the biogas plant to 13,94 % makes it possible to reduce the cost of production of electric energy and heat up to 20–30 %. Annual energy savings in terms of fuel equivalent is 19,5 tons, and the cash equivalent of additional produced energy is about 100000 UAH/year.

Keywords: cogeneration system, biogas fuel, heat pump.

References

1. Ciric, R. M., Kuzmanovic, Z. (2014). Techno-Economic Analysis of Biogas Powered Cogeneration. *Journal of Automation and Control Engineering, Vol. 2, № 1*, 89–93. doi:10.12720/joace.2.1.89-93
2. Daingade, P. S., Yadav, S. D. (2013, April). Electronically operated fuel supply system to control air fuel ratio of biogas engine. *2013 International Conference on Energy Efficient Technologies for Sustainability.* Institute of Electrical & Electronics Engineers (IEEE), 740–743. doi:10.1109/iceets.2013.6533476
3. Bileka, B. D., Sergienko, R. V., Kabkov, V. Ya. (2010). Ekonomichnost' kogeneratsionnyh i kombinirovannyh kogeneratsionno-teplonasosnyh ustanovok s gazoporshnevymi i gazoturbinnymi dvigateliami. *Aviatsionno-kosmicheskaia tehnika i tehnologiia, 7(74)*, 25–29.
4. Bileka, B. D., Garkusha, L. K. (2009). Ispol'zovanie GTU i GPD v kogeneratsionnyh sistemah polucheniia teploty. *Dvigateli i energoustanovki aerokosmicheskih letatel'nyh apparatov, 7(54)*, 16–18.
5. Bileka, B. D., Garkusha, L. K. (2012). Kogeneratsionno-teplonasosnye tehnologii v shemah goriachego vodosnabzheniia bol'shoi moshchnosti. *Promyshlennaia teplotehnika, Vol. 34, № 4*, 52–57.
6. Doseva, N. (2014, June 19–25). Advanced exergatic analysis of cogeneration system with a biogas engine. *14th SGEM GeoConference on Energy and Clean Technologies Conference Proceedings, Book 4, Vol. 1*, 11–18. doi:10.5593/sgem2014/b41/s17.002
7. Horobets, V. H., Drahanov, B. Kh. (2010). Ekserhetychnyi analiz efektyvnosti enerhetychnykh system dlia kompleksnoho vyrobnytstva elektrychnoi ta teplovoi enerhii z vykorystanniam ponovliuvalnykh dzherel enerhii. *Vidnovliuvalna enerhetyka, 3(22)*, 5–12.
8. Dev, N., Samsher, Kachhwaha, S. S., Attri, R. (2014, February 22). Development of reliability index for cogeneration cycle power plant using graph theoretic approach. *International Journal of System Assurance Engineering and Management, Vol. 5, № 4*, 700–710. doi:10.1007/s13198-014-0235-4
9. Chaikovskaya, E. (2015). Devising an energy saving technology for a biogas plant as a part of the cogeneration system. *Eastern-European Journal Of Enterprise Technologies, 3(8(75))*, 44–49. doi:10.15587/1729-4061.2015.44252
10. Chaikovskaya, E., Stefanuyk, V., Abrosymov, I. (2015). Coordination energy production and consumption in the composition of the cogeneration system. *Proceedings of the National Technical University «KhPI». Series: New solutions in modern technology, 46(1155)*, 63–67.

DEVELOPMENT OF MODELS AND METHODS OF PARAMETERS OPTIMIZATION OF RELIABILITY IMPROVING SYSTEM IN 10 kV BRANCHED NETWORKS

page 31–38

Different devices, such as signs of damaged areas, line disconnectors, circuit bus-sectionalizing machines and devices for automatic entry of reserve are used to improve the reliability of power supply to consumers in the 10 kV distribution network. Optimization of means of improving reliability is an urgent task. However, existing calculated methods does not take into account the possibility of installing the network of several types of devices or require to perform a large number of iterations when searching for the optimum scheme of their deployment.

To solve this problem it is proposed a mathematical model for evaluate electricity shortage and average time of search fault

location to take into account the existence of different means for improving the reliability of the network.

The importance of these results lies in the fact that based on the proposed model has been developed computer program that allows automatically searching for the optimal layout of devices in a redundant and non-redundant power lines.

Keywords: distribution electric network, reliability, sectionalizing, efficiency, optimization.

References

1. Shkura, V. P. (2011). Ob avariinosti v 2010 godu i pokazateli nadezhnosti v elektricheskih setiah 6–150 kV energosnabzhaiushchih kompanii, kotorye vhodiat v sostav NAK «EKU». *Elektricheskie seti i sistemy, 2*, 32–42.
2. Arzhannikova, A. E. (1997). Opredelenie rasstoianiia do mesta korotkogo zamykaniia v setiah 6–10 kV. *Energetik, 12*, 22.
3. Boruhman, V. A. (1979). Ustanovka ukazatelei povrezhdionnogo uchastka linii 6–10 kV tipa UPU-1. *Elektricheskie stantsii, 10*, 84.
4. Dong Xinzhou, Chen Zheng, He Xuanzhou, Wang Kehong, Luo Chengmu. (2002). Optimizing solution of fault location. *IEEE Power Engineering Society Summer Meeting, Vol. 3*, 1113–1117. doi:10.1109/pess.2002.1043442
5. Grib, O. G. (2009). Metod opredeleniia mest korotkih zamykanii. *Energosnabzhenie. Energetika. Energoaudit, 11*, 29–31.
6. Kozyrskyi, V. V., Prytaka, Y. P. (1995). *Elektropostachannia silskoho hospodarstva*. Kyiv: Urozhai, 304.
7. Kozyrskyi, V. V., Prytaka, Y. P. (1987). Sektsionirovanie razomknutyh elektricheskih setei s uchetom neopredelennosti ishodnyh dannyh. *Izvestiia VUZov SSSR. Energetika, 12*, 14–19.
8. Budzko, I. A., Zul', N. M. (1990). *Elektrosnabzhenie sel'skogo hoziaistva*. Moscow: Agropromizdat, 496.
9. Zorin, V. V., Popov, V. A., Ekel', P. E. (1988). Modeli optimizatsii nadezhnosti raspredelitel'nyh elektricheskih setei. *Energetika i elektrifikatsiia, 3*, 46–49.
10. Sirotenko, M. A. (2013). Vychislitel'naia programma poiska optimal'nogo kolichestva i mest razmeshcheniia sredstv povysheniia nadiozhnosti v raspredelitel'nyh elektricheskih setiah 10 kV. *Visnyk Kharkivskoho natsionalnoho tekhnichnoho universytetu silskoho hospodarstva im. P. Vasylenka. Seriia: Problemy enerhozabezpechennia ta enerhozberezhennia v APK Ukrainy, Vol. 142*, 62–63.

MECHANICAL ENGINEERING TEXNOLOGY

KINETICS INVESTIGATION OF CHANGING THE OIL FILM THICKNESS DEPENDING ON THE MATERIAL OF FRICTION PAIRS

page 39–41

This article discusses the problems of dependence of changes of the effective viscosity of the ATF synthetic gear oil depending on the material of friction pairs. The aim of this article is to investigate the factors influencing the carrying capacity of the oil film. Tests were conducted on СМЦ-2 friction machine on the rollers, which are made of 40Х steel (HRC = 40) and ШХ-15 steel (HRC = 60) at loads σ_{max} = 450, 570 and 680 MPa. Starting bulk oil temperature was 18 °C. The thickness of the lubricating layer was measured by the fall of a normal glow discharge. It was proved that a decrease in the hardness of contact surfaces leads to dominance in contact elastohydrodynamic factors of growth of the total thickness of the lubricating layer at the pushing, which is associated with a decrease in pressure-viscosity oil coefficient correlated growing influence of the dimensionless parameter of the material. The research results can be used in laboratories, manufacturers of lubricants in forming or improving their composition. From the kinetics analysis of formation of the lubricant layer at the contact surfaces of different hardness we can conclude that on the carrying capacity of the oil film in contact affect rheological characteristics of the oil and the dimensionless parameter of the material which depends on pressure-viscosity oil coefficient.

Keywords: oil, lubricating layer, viscosity, boundary layer.

References

1. Garkunov, D. N. (2001). *Tribotehnika (znos i beziznosnost'). Ed. 4*. Moscow: MSHA, 616.
2. Ahu Fahriye Acar, Fahrettin Ozturk, Mustafa Bayrak. (2010). Effects of variations in alloy content and machining parameters on the strength of the intermetallic bonding between diesel piston and ring carrier. *Materials and technology, Vol. 44, № 6*, 391–395.
3. Petrusevich, A. I. (1963). Rol' gidrodinamicheskoi maslianoi plenki v stoikosti i dolgovechnosti poverhnostei detalei mashin. *Vestnik mashinostroeniia, 1*, 20–26.
4. Grubin, A. N. (1949). *Osnovy gidrodinamicheskoi teorii smazki tiazhelonagruzhennyh krivolineinyh poverhnostei. Book 33*. Moscow: Mashgiz, 150.
5. Gormakov, A. N. (2005). *Issledovanie tribotehnicheskih harakteristik materialov*. Tomsk: TPU, 21.
6. Alehin, V. P. (1983). *Fizika prochnosti i plastichnosti poverhnostnyh sloev materiala*. Moscow: Nauka, 280.
7. Demkin, N. B., Izmailov, V. V. (1975). Plastic contact under high normal pressure. *Wear, Vol. 31, № 2*, 391–402. doi:10.1016/0043-1648(75)90172-6
8. In: McArdle, C. B. (1992). *Side-Chain Liquid Crystal Polymers*. Translated from English. Moscow: Mir, 567.
9. Poltser, G., Maisener, F.; Translated from German: Ozerskiy, O. N.; In: Dobychin, M. N. (1984). *Osnovy treniia i iznashivaniia*. Moscow: Mashinostroenie, 264.
10. Andreev, A. V. (1978). *Peredacha treniem*. Ed. 2. Moscow: Mashinostroenie, 176.

THE PROBLEMS OF PROVIDING OPERATIONAL RELIABILITY OF DRILL STRING ELEMENTS

page 41–44

Critical review of the literature and publications towards research aimed at solving the problem of providing operational reliability of drill string (DS) are conducted in the article. The analysis concluded that no single approach to solving problems and studies that have focused primarily on the practical application of the theoretical foundations and constantly connected with results of their industrial implementation.

The first priority in solving scientific and technological problems is to develop an algorithm to ensure operational DS reliability that would allow as quickly as possible to assess the actual burden and the failure risks of its elements.

The second stage is improving the system of registration of actual loads acting on DC and system of their processing as well as operating time monitoring system of DC elements from the date of receipt in the drilling company and until disposal.

To develop a method for assessing the risk of failure of DS elements considering the accumulated information at the design stage and directly in the process.

The study can be used to improve forecasting methods and assessment of resource of DS elements.

Keywords: arrangement of drill string bottom, reliability, durability, resource.

References

1. Florence, G. (2010). *Can Unconventional Gas be a Game Changer in European Gas Markets?* Oxford Institute for Energy Studies, 120.
2. Golden Rules for a Golden Age of Gas. (2012). *International Energy Agency*. Paris: OECD/IEA, 148.

3. *Energy Resource Potential of Methane Hydrate. An introduction to the science and energy potential of a unique resource.* (2011). Washington: U. S. Department of Energy, 24.
4. Artym, V. I., Yatsyniak, I. I., Hrytsiv, V. V., Yurych, A. R. (2012). Analiz koroziino-vtomnykh ruinuvan elementiv burylnoi kolony. *Rozvidka ta rozrobka naftovykh i hazovykh rodovyshch, 2(43)*, 197–202
5. Ivasiv, V. M., Hrydzhuk, Ya. S., Yurych, L. R. (2014). Analysis of destruction causes of drill string elements. *Technology Audit And Production Reserves, 6(4(20))*, 15–17. doi:10.15587/2312-8372.2014.31838
6. Rachkevych, R. V. (2006). *Vdoskonalennia metodiv prohnozuvannia dovhovichnosti burylnoi kolony v uskladnenykh umovakh burinnia sverdlovyn*. Ivano-Frankivsk: Ivano-Frankivsk National Technical University of Oil and Gas, 20.
7. Artym, V. I. (2010). *Pidvyshchennia ekspluatatsiinoi nadiinosti trubnykh i shtanhovykh kolon dlia burinnia ta vydobuvannia nafty i hazu*. Ivano-Frankivsk: Ivano-Frankivsk National Technical University of Oil and Gas, 36.
8. Hrytsiv, V. V. (2013). *Udoskonalennia metodiv prohnozuvannia resursu elementiv burylnoi kolony*. Ivano-Frankivsk: Ivano-Frankivsk National Technical University of Oil and Gas, 20.
9. Dzhus, A. P. (2011). *Prohnozuvannia dovhovichnosti elementiv burylnoi kolony indykatoramy vtomy*. Ivano-Frankivsk: Ivano-Frankivsk National Technical University of Oil and Gas, 20.
10. Hrydzhuk, Ya. S. (2013). *Prohnozuvannia dovhovichnosti elementiv burylnoi kolony pry vibratsiinomu navantazhenni*. Ivano-Frankivsk: Ivano-Frankivsk National Technical University of Oil and Gas, 20.

OPTIMIZATION OF MODES OF PLASMA TREATMENT CRANE RAILS

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Crane operation is accompanied with wear and tear of rails and crane wheels. Actual direction is the renovation and improvement of efficiency of these parts. Modern technologies of restoration of wheels and rails provide surface deposition or treatment with high-frequency currents. A promising direction is a surface treatment of highly concentrated streams of energy: with a laser beam, plasma jet. It is proposed to increase the efficiency of crane rails of surface plasma treatment. The work was carried out on the selection of treatment regimens. Simulation of the thermal impact of the plasma jet on a solid body of a complex shape was performed. Defined were multiple ranges of plasma hardening regimes that meet the requirements of production. The structural transformation of the material in the crane rails plasma treatment was investigated. It is concluded that in carbon and low alloy crane steels plasma exposure zone is characterized by a high degree of dispersion hardened structure and higher toughness as compared to the quenching with high-frequency current. Both shift (within the upper zone of plasma influence) are realized, and fluctuation (in the lower zone of the plasma effect) mechanisms of phase transformations. With high-speed plasma heating is a major transformation of granular or lamellar pearlite into austenite. The level of operational properties of hardened steel, which is achieved in this case is determined by the kinetics of the completeness and pearlite → austenite transformation. For carbon and low alloy rail steels plasma hardening of achievable properties can effectively replace the bulk hardening, hardening by high-frequency, or surface deposition. The range of conditions for plasma treatment was determined which allows to obtain a surface layer with a certain performance properties.

Keywords: rail, crane, plasma, structure, transformation, work-hardened layer, hardness.

References

1. Malinov, V. L. (2011). Resursosberegaiushchie innovatsionnye naplavochnye materialy i uprochniaiushchie tehnologii, obespechivaiushchie dinamicheskoe deformatsionnoe martensitnoe prevrashchenie. *Visnik Priazovs'kogo derzhavnogo tehnichnogo universitetu, Vol. 22*, 96–103.
2. Malinov, L. S., Malinov, V. L. (2011). Resursosberezhenie za schet primeneniia ekonomnolegirovannyh splavov i uprochniaiushchih tehnologii, obespechivaiushchih poluchenie mnogofaznyh metastabil'nyh struktur i upravlenie strukturnymi i fazovymi prevrashcheniiami. *Novi materiali i tehnologii v metalurgii ta mashinobuduvanni, № 1*, 93–105.
3. Malinov, V. L. (2011). Vliianie margantsa na strukturu i iznosostoikost' naplavlennogo metalla tipa nizkouglerodistoi stali. *Avtomaticheskaia svarka, № 8*, 15–20.
4. Rudiuk, A. S., Azarkevich, A. A., Lebedev, A. D., Popov, E. S., Goncharenko, E. V., Trufanova, O. I. (2013). Povyshenie kachestva i rasshirenie sortamenta zakalennyh rel'sov iz konverternoi stali. *Metall i lit'e Ukrainy, № 6(241)*, 25–29.
5. Degtiarev, S. I., Skoblo, T. S., Sapozhkov, V. E. (1998). Issledovanie i razrabotka tehnologii poverhnostnoi induktsionnoi zakalki zheleznodorozhnyh rel'sov iz nizkolegirovannoi stali. *Metallovedenie i termicheskaia obrabotka materialov, № 2*, 7–12.
6. Liasotskii, I. V., Shtanskii, D. V. (1993). Obrazovanie austenita i kinetika rastvoreniia tsementita v staliah s rekristallizovannoi strukturoi zernistogo perlita pri lazernom nagreve. *Fizika metallov i metallovedenie, Vol. 75, № 1*, 109–118.
7. Samotugin, S. S., Leshchinskii, L. K. (2002). *Plazmennoe uprochnenie instrumental'nyh materialov.* Donetsk: Novyi mir, 338.
8. Rouquette, S., Guo, J., Le Masson, P. (2007). Estimation of the parameters of a Gaussian heat source by the Levenberg-Marquardt method: Application to the electron beam welding. *International Journal of Thermal Sciences, Vol. 46, № 2*, 128–138. doi:10.1016/j.ijthermalsci.2006.04.015
9. Yang, J., Hou, X., Xing, X., Wang, C., Yang, Y., Ren, X., Yang, Q. (2015). Effect of FCAW Current on the Hardfacing Layer — Microstructure and Wear Resistance. *Welding journal, Vol. 94, № 11*, 358–365.
10. Heinze, C., Schwenk, C., Rethmeier, M. (2012). Numerical calculation of residual stress development of multi-pass gas metal arc welding. *Journal of Constructional Steel Research, Vol. 72*, 12–19. doi:10.1016/j.jcsr.2011.08.011