PROPERTIES OF WHISKERS. MECHANICAL STRENGTH TEST

page 4–7

Whiskers have a number of special properties that distinguish them from macrocrystals. The most remarkable feature of whiskers is their elastic properties. The first quantitative assessments of the elastic properties of whiskers were made quite recently. It was shown that the whiskers before a deformation of about 1—2 % behave elastically enough. Only a flexural deformation leading to the surface layers deformation of up to 3 % did start plastic deformation. These values of limiting elastic deformation were close to the theoretical estimates. A literature review, conducted in this perspective of the research, has shown that in a certain number of scientific publications, mostly foreign, the issues of the mechanical studies of whiskers were displayed. According to the results, the results of various earlier studies of the strength characteristics of the different groups of whiskers were considered in the paper, the results of these studies in terms of the practical use of crystals were analyzed, the factors of influence of mechanical tests on the lattice structure and properties of whiskers were defined.

Keywords: strength characteristics, whiskers, mechanical tests.

References

1. Berezhkova, H. V. (1969). *Nitevidnye kristally*. M.: Hosizdat, 158.
2. Gordo, J. E. (1964). *Endeavour, № 23*, 8.
3. Fraenkel, I. Z. (1926). *Phys., № 37*, 572.
4. Zwicky, F. Z. (1923). *Phys., № 24*, 131.
5. De Voer, J. H. (1936). *Trans. Faraday Soc., № 32*, 10.
6. Mackenezie, J. K. (1948). *Thesis Univ. Bristol, № 11*, 21—24.
7. Orowan, E. (1940). *Proc. Roy. Soc., № 52*, 8.
8. Hirth, G. P. (1958). *Nature, № 182*, 296—299.
9. Veik, H. (1959). *Problemy sovremennykh metallov, T. 5*, 128.
10. Kostiuk, V. H., Zilinh, K. K., Serebriakov, A. V. (1963). Fizika tverdoho tela. *FTT, T. 5*, 306—310.
11. Vrenner, S. S. (1959). *Growth and Perfection of Crystals, № 12*, 157. N. Y.: John Willey.
12. Eisner, R. L. (1959). *Growth and Perfection of Crystals, № 21*, 191. N. Y.: John Willey.
13. Serebriakov, A. V., Kostiuk, V. H., Zilinh, K. K. (1965). Fizika tverdoho tela. *FTT, T. 7*, 858.
14. Vrenner, S. S. (1956). *J. Appl. Phys., № 27*, 1484.
15. Eivner, R. L. (1960). *Kremnii, T. 2*, 245.
16. Marsch, D. M. (1959). *J. Scient. Instrum., № 36*, 165.
17. Marsch, D. M. (1961). *J. Scient. Instrum., № 38*, 229.
18. Nadhornyi, E. M., Stepanov A. V. (1961). Fizika tverdoho tela. *FTT, T. 3*, 1068.
19. Lemke, F., Kpaft, R. (1962). *Pribory dlia nauchnykh, T. 2*, 46.
20. Wollers, N., Sshapink, W. (1961). *J. Scient. Instrum., № 38*, 250.
21. Sabrera, N., Prise, P. B. (1959). *Growth and Perfection of Crystals, № 3*, 204. N. Y.: John Willey.
22. Brenner, S. S., Morelok, S. R. (1957). *Rev. Scient. Instrum., № 28*, 652.
23. Fridman, V. Ya. (1966). *Fizika tverdoho tela, T. 8*, 1079.
24. Prise, R. V., Vehmiluea, D. A., Webb, W. W. (1958). *Acta metallurgica, № 6*, 524.
25. Levell, A. P. (1966). *Mater. Res. and Standarts, № 6*, 64.
26. Bokshtein, S. Z., Kishkin, S. T., Hazarova, M. P., Svetlov, I. L. (1967). Fizika tverdoho tela. *FTT, T. 9*, 1887.
27. Bokshtein, S. Z., Zaitsev, H. N., Nazarova, M. I., Svetlov, I. L. (1968). Fizika tverdoho tela. *FTT, T. 10, № 2*, 564.
28. Guulai, Z. Z. (1954). *Phys., № 138*, 317.
29. Venables, J. D. (1963). *Appl. Phys., № 34*, 293.
30. Hulse, O. J. (1961). *Amer. Ceram. Soc., № 44*, 572.
31. Dikina, L. S., Shpunt, A. A. (1962). Fizika tverdoho tela. *FTT, T. 4*, 556.
32. Strelkov, P. H., Shpunt, A. A. (1962). Fizika tverdoho tela. *FTT, T. 4*, 2258.
33. Fridman, V. Ya., Shpunt, A. A. (1963). Fizika tverdoho tela. *FTT, T. 5*, 790.
34. Fridman, V. Ya., Shpunt, A. A. (1964). Fizika tverdoho tela. *FTT, T. 6*, 489.
35. Aleksandrov, A. P., Zhurkov, S. N. (1933). *Yavlenie khrupkoho razryva*. M.: Izd. HTTI, 215.
36. Burov, K. A., Klassen-Nekliudova, M. V., Andrievskaia, H. A., Tenson, H. D., Tomilovskii, Yu. E., Chernyshova, M. A. (1945). *Nauchnyi zhurnal ZhTF, T. 15*, 407.
37. Ollo, W. (1955). *J. Amer. Ceram. Soc., № 38*, 122.
38. Thomas, W. (1958). *Nature, № 181*, 1006.
39. Taulor, G. F. (1924). *Phys. Rev., № 23*, 655.
40. Pearson, G. L., Read, W. T., Feldman, W. L. (1957). *Acta metallurgica, № 5*, 181.
41. Read, W. T., Pearson, G. L. (1957). *Dislocations and Mechanical Properties of Crystals*. N. Y. — London: John Willey, 537.
42. Parker, R. L., Hardy, S. C. (1962). *J. Chem. Phys., № 37*, 1606.
43. Hol'denberh, C. U., Bychkova, A. I. (1967). *Fizika tverdoho tela. FTT, T. 9*, 674.

LINEARLY ELASTIC SUSPENSION OF THE FLOAT GYROSCOPE IN THE ACOUSTIC FIELD

page 7–10

The system of differential equations of float suspension of a gyroscope, in motions in the absence of transmission of the energy of flexural motion of the shell part on the end-walls is constructed.

The most general case of elastic motions of the suspension surface is considered, a three-dimensional problem — elastic motions along the extension, along the parallel and in the transverse plane (the plane of the frame). The meridian line is assumed to be arbitrarily delineated.

Differential equations of gyroscope suspension in the dimensionless form are derived. As a special case, the equations of the float in the form of a circular cylinder are obtained.

All preliminary works on the creation of a mathematical model with a further solution of the optimization problems of the shell surface of the suspension on the basis of Fourier and Bubnov — Galerkin methods are performed. After the definition of coordinate functions in general form, there is a possibility of further studies involving software.

The presence of spatial mathematical model of gyroscope suspension creates conditions for the choice of technical solutions on reduction of the impact of acoustic fields on the suspension and on the gyroscope accuracy, in particular.

Keywords: float suspension of gyroscope, coordinate functions, elastic state, meridian line.

References

1. Sajdov, V. P. (1965). *The theory of gyroscopes*. Moscow, USSR: High school, 378.
2. Yagodkin, V. V., Khlebnikov, G. A. (1967). *Gyroscopic devices of ballistic missiles*. Moscow, USSR: Military Publishing, 197.
3. Danilin, V. P. (1965). *Gyroscopic instruments*. Moscow, USSR: High school, 539.
4. Braslavskij, D. A., Logunov, S. S., Pelpor, D. S. (1965). *Aircraft Instruments*. Moscow, USSR: Mechanical Engineering, 561.
5. Wrigley, W., Hollister, W., Denhardt, W. (1972). *The theory, design and testing of gyroscopes*. Moscow, USSR: Mir, 416.
6. Denhard, W. G.; In: Rossbach, J. (1966). *Laboratory Testing of Floated Single-Degree-of-Freedom Integrating Inertial Gyro*. USA, Cambridge: Massachusetts Institute of Technology, R-105.
7. Karachun, V. V., Mel'nick, V. N. (2012). Influence of Diffraction Effects on the Inertial Sensors of a Gyroscopically Stabilized Platform: Three —Dimensional Problem. *International Applied Mechanics, 48(4)*, 458—464.
8. Mel'nick, V. N., Karachun, V. V., Levchenko, O. I. (2010). The loss of energy of acoustic waves. *«The main problems of modern science-2010»*. Sofia, Bulgaria, 66—68.

9. Dyer, I. (1960). Noise environments of flight vehicles. *NOISE Control, 6(1)*, 31—40.
10. Heckl, M. A. (1962). Vibrations of point-driven cylindrical shells. *Journal Acoustic Soc. Am., 34(10)*, 1553—1557.
11. Maidanik, Ct. (1962). Response of ribbed panels to reverberant acoustic fields. *Journal Acoustic Soc. Am., 34(6)*, 809—826.
12. Smith, P. W. (1962). Response and radiation of structural modes excited by sound. *Journal Acoustic Soc. Am., 34(5)*, 640—647.

STUDY OF 3D-MODELLING SOFTWARE ENVIRONMENTS

page 11–14

The study of three-dimensional modeling software packages such as Autodesk Maya, Autodesk 3Ds Studio Max, Lightwave 3D, Maxon Cinema 4D, Blender, ZBrush was conducted in the paper. The analysis of software packages allowed to identify the most effective ones. These were Autodesk Maya, Autodesk 3Ds Studio Max and ZBrush packages. The selected software packages were used for the creation of a computer scene, the main elements of which are interior, character and animation. Practical research allowed to determine the areas of the most expedient application of each of the packages. Thus, Autodesk Maya allows to create high-quality animation, Autodesk 3Ds MAX is specialized in the modeling of locations and landscapes, Pixologic ZBrush allows to design the model of a character with high detalization due to the «sculpting» technology. It should be noted that it is inappropriate to use the software packages Autodesk 3Ds MAX and Autodesk Maya for the creation of the model/character with high detalization. The recommendations on the effective use of software packages of three-dimensional modeling were developed. These recommendations can be applied by users with different training levels.

Keywords: three-dimensional modeling, graphics, polygon, spline, primitive, texturing, animation, visualization.

References

1. Anurag Ghosh. (2013). Internet. What is 3D Modelling? Available: http://www.wisegeek.com/what-is-3d-modeling.htm#
2. 6 Industries that Use 3D Modeling (2008). Available: http://www.steves-digicams.com/knowledge-center/how-tos/video-software/6-industries-that-use-3d-modeling-software.html#b
3. Keller, E. (2008). *Introducing ZBrush*. Indianopolis, Indiana: Wiley Publishing.
4. In: Gaidamashchuk, A. (2013). 3D Modelling Software Environment Research. *XVII International Youth Forum «Radioelectronics and Youth in XXI century»*. Kharkov: KNURE.
5. Aakash Singh. (2011). Best 3D Software. Available: http://www.ibuzzle.com/articles/best-3d-software.html
6. Silverman, D. (2013). 3D Primer for Game Developers: An Overview of 3D Modelling in Games. Available: http://gamedev.tutsplus.com/articles/glossary/3d-primer-for-game-developers-an-overview-of-3d-modeling-in-games/
7. Prokofyeva, Z. (2013). Hero creating in Maya. Modeling. Available: http://www.avalon.ru/OpenLessons/Maya/ Lessons/Personage-modeling
8. Multimedia Applications Devision of Freescale Semiconductors, Inc. (2010). 3D Math Overview and 3D Graphics Foundations.
9. Flavius Cristea. (2010). Modeling & Rendering an Interior Scene using 3ds Max and Vray. Available: http://cg.tutsplus.com/tutorials/autodesk-3d-studio-max/modelling-and rendering-an-interior-scene-in-3ds-max/
10. Spencer, S., Keller, E., Gaboury, P. (2010). Human anatomy. Indianopolis, Indiana: Wiley Publishing, Inc.
11. Koning, W. F. Adding Controllers to a Rig. Available: http://www.ideepix.nl/aril/3d/maya/?show=28/

CREATING AND ADJUSTMENT OF THE 3D MODEL OF THE CENTRIFUGAL JUICER WITH BALL-TYPE AUTOBALANCER

page 15–18

In the process of work of electric centrifugal juicers (juicers) with the cylindrical sieve the pulp is distributed non-uniformly on a sieve which causing a significant imbalance and vibration of machine case.

To balance these juicers on the go in the operation the authors propose their modernization which consists in replacing the standard platform for mounting the sieve by platform combined with ball auto-balancer.

In order to study the process of balancing by auto-balancer of juicer's cylindrical sieve created its 3D model with using the CAD system SolidWorks and its module Cosmos Motion. The simulation was performed in a technique that can be adopted as the standard for modeling process-balancing in rotor systems. It includes the steps of:

1) creation of models of details of a juicer in SolidWorks;
2) union of details in assembly;
3) kinematic and power processing of assembly by the Cosmos Motion module;
4) choice of criteria of quality of operation of the auto-balancer and juicer (the value of the module of residual acceleration of the case, time of onset of auto-balancing etc.);
5) adjustment of the model (the values of its parameters are selected in maximum accordance with the real machine);
6) test of the model of elementary tasks, the results of which are known or can be easily interpreted.

Proposed an approach to the modeling ball's movement on the auto-balancer's treadmill and viscous resistance forces acting on it, which provides high-speed calculations.

The model of a juicer created by the offered technique is efficient and provides high speed of calculations. Its key parameters correspond to a natural juicer with the ball-type auto-balancer. By means of the created model it is possible to make fully — factorial and multiple-factorial experiments, in particular — with 2-levels, 3-levels, for search of optimum values of parameters of a juicer with the auto-balancer.

Keywords: centrifugal juicer, dynamics, computer modeling, auto-balancer, imbalance, vibrations, balancing.

References

1. Letaev, D. (1992). *Household electrical appliances for the kitchen. Ref. allowance*. Moscow: Legprombytizdat, 96.
2. Partala, O. (2010). *Guide to repair household appliances*. St. Petersburg: Science and Technology, 400.
3. Gusarov, A. (2002). *Device Avtobalansyruyuschye direct action*. Moscow: Nauka, 119.
4. Filimonihin, G. (2004). *Balancing and vibration protection with solid rotors avtobalansyramy corrective weights*. Kirovograd: KNTU, 352.
5. Nesterenko, V. (1985). *Automatic rotor balancing devices and machines with many degrees of freedom*. Tomsk: Publishing House of Tomsk. University Press, 84.
6. Rodrigues, D., Champneys, A., Friswell, M., Wilson, R. (2008). Automatic two-plane balancing for rigid rotors. *International Journal of Non-Linear Mechanics, vol. 43, issue 6*, 527—541.
7. Filimonihin, G., Goncharov, V. (2012). Electric centrifugal juicer semiautomatic. Pat. 77192 Ukraine, IPC G01M 1/32 / applicant and patentee Kirovograd th. Sc. University. — № u201203340; appl. 20.03.2012, publ. 11.02.2013, Bull. № 3, 4.
8. Alyamovsky, A. (2010). *COSMOSWorks. Fundamentals of design of structures for durability in the environment SolidWorks*. Moscow: DMK Press, 784.
9. Kuang-Hua Chang. (2008). *Motion Simulation and Mechanism Design with COSMOSMotion 2007*. Publisher: Schroff Development Corporation (July 14, 2008). Paperback: 142 pages. ISBN-10: 1585034827.

10. Kovalenko, O. (2009). The numeric modelyuvannya processes zrivnovazhennya kulovimi autobalancer diskiv shlifuvalnih hand-held machines. *News girnichogo universitetu, 10*, 72—77.

SIMULATION MODEL DEVELOPMENT FOR DETERMINATION OF THE MAXIMUM LENGTH OF QUEUED VEHICLES ON COORDINATED INTERSECTION

page 19–26

The simulation model for determining the maximum length of the queued vehicles at the adjacent towards the coordination intersection is proposed, which is written in the Objective-C programming language.

The paper considers the process of the model development, which is based on analytical studies of the process of forming the queued vehicles at the adjacent intersection. Its adequacy is verified, and the results are compared with the values, obtained from VISSIM.

The simulation model is implemented in such a way that the user can easily change the terms of the study due to the changes in input parameters. It can be run both on the PC, and portable devices (mobile phone, tablet computer). However, it is suitable for coordinated street sites with two lanes in one or both directions, where the main and secondary approaches are isolated, and the cycle duration at both adjacent intersections is equal.

Keywords: simulation model, maximum length of queue, coordination site, adjacent signal-controlled intersection, special lane.

References

1. Vikovych, I. A., Zubachyk R. M. (2013). Development of method for ensuring bus priority at controlled intersection. *Eastern-European Journal Of Enterprise Technologies, 5*(3(65)), 27—33.
2. Wasson, J. Abbas, M., Bullock, D., Rhodes, A., Zhu, C. (December 1999). *Reconciled Platoon Accommodation at Traffic Signals*. Indianapolis, 217.
3. Yu. L. (June 1999). *Real-Time Calibration of Platoon Dispersion Model to Optimize the Coordinated Traffic Signal Timing in ATMS Networks*. Texas, Texas Southern University, 51.
4. Kremenets, Y. A., Pechersii, M. B. (2005). *Technical means of traffic management*. Moscow, 279.
5. Havrilov, E. V., Dmytrychenko, M. F., Dolia, V. K. (2007). *Traffic management*. Kyiv, 452.
6. Venttsel, E. S., Ovcharov, L. A. (2000). *Theory of Probability and engineering applications*. Moscow, 480.
7. Havrilov, A. A. (1980). *Simulation road traffic*. Moscow, USSR, Transport, 190.
8. Vikovych, I. A., Zubachyk, R. M. (2013). Development of simulation model for determination of the maximum length of queued vehicles. *Herald of the National Technical University «Kharkiv Polytechnic Institute», 70(1043)*.
9. Inose, H., Khamada, T. (1983). *Road traffic control*. Moscow, USSR, Transport, 248.
10. Farzaneh, M., Rakha, H. (November 2005). *Modeling traffic dispersion*. Virginia Polytechnic Institute and State University, 139.

EVALUATION OF WEIGHT OF COOLANT IN THE REACTOR PLANT DURING FULL LOSS OF FEEDING COOLANT

page 26–29

Despite the complete assurance of specialists in the field of nuclear energy that the safety of nuclear power plants is enough high, this is still a concern for many people. Therefore, this article first presents a method of determining the mass of steam-water mixture in a pressurized water reactor in emergency conditions that will result more rapid reaction of the staff on the situation. The article presents the idea of the method, which consists in the fact that knowing the full weight of the reactor with all the internals and coolant, due to the strain gauge measuring transducers will be known how the weight of the reactor changes and it will be easy to say the proportion of vapor and liquid in it at the time of an emergency. Also the results of the pilot project are described, shown in Figure 2, which can form the basis of realization and implementation of the proposed method for improving nuclear power plants safety.

Keywords: pressurized water reactor 1000, the mass of a water-steam mixture, emergency mode.

References

1. Pelykh, S. N., Maksimov, M. V. (2011). Cladding rupture life control methods for a power-cycling WWER-1000 nuclear unit. *Nuclear Engineering and Design, Vol. 241*, 2956—2963.
2. Pelykh, S. N., Maksimov, M. V., Parks, G. T. (2013). A method for VVER-1000 fuel rearrangement optimization taking into account both fuel cladding durability and burnup. *Nuclear Engineering and Design, Vol. 257*, 53—60.
3. Pelykh, S. N., Maksimov, M. V., Baskakov, V. E. (2013). Grounds of VVER-1000 fuel cladding life control. *Annals of Nuclear Energy. Iss. 58*, 188—197.
4. Kim, S., Jun, H.-Y. (2013). Analysis of an ATLAS 6-in. cold-leg break simulation with MARS code. *Annals of Nuclear Energy, 63*, 268—275.
5. Yang, J., Choi, S.-W., Lim, J., Lee, D.-Y., Rassame, S., Hibiki, T., Ishii, M. (2012). Assessment of performance of BWR passive safety systems in a small break LOCA with integral testing and code simulation. *Nuclear Engineering and Design, 247*, 128—135.
6. Leyer, S., Wich, M. (2012). The Integral Test Facility Karlstein. *Science and Technology of Nuclear Installations*, Article number 439374.
7. Lakehal, D., Labois, M. (2011). A New modelling strategy for phase-change heat transfer in turbulent interfacial two-phase flow. I*nternational Journal of Multiphase Flow, 37*, 627—639.
8. Kim, H., Seung-hyun, B. (2010). A study on accuracy improvement in measuring liquid level inside pressurized vessels. T*ransactions of the Korean Institute of Electrical Engineers, 59*, 1889—1893.
9. Wang, X.-L., Cai, Q., Chen, Y.-Q. (2013). Study on pressurizer water level signal reconstruction based on support vector regression. A*tomic Energy Science and Technology, 47*, 1003—1007.
10. Jang, G.-S., Suh, S.-M., Kim, S.-K., Suh, Y.-S., Park, J.-Y. (2013). A proactive alarm reduction method and its human factors validation test for a main control room for SMART. Annals of Nuclear Energy, 51, 125—134.
11. Shin, Y. C. (2011). APR1400 man-machine interface system. *Nuclear Engineering International, 56*, 12—16.

SIGNAL DETECTION AND PARAMETER ESTIMATION IN TRACKING RADIOTECHNICAL SYSTEMS

page 30–34

The methods of signal processing in a radio-technical tracking system, providing detection of signals and measurement of their parameters are considered in the paper. Using a time lag of signal properties allows realizing the tracking receiving system with a small number of parallel processing channels, providing small errors of signal parameters estimation when using limited computing resources. The main purpose of the research is to study the possibilities of realization of detection-measurement tracking systems with a small number of channels, comparable by characteristics with multi-channel parallel processing systems. The simulation method and statistical processing of results were used during the study. The research results can be used in the development and modernization of radio-technical systems of information transmission and extraction. The application of tracking radio-technical systems allows more full use of computing

resources of the processing system in solving the problems of detection of signals and measurement of their parameters.

Keywords: radio-technical systems, detection of radio signals, tracking signal processing system.

References

1. Tihonov, V. I., Harisov, V. N. (2004). *Statisticheskiy analiz i sintez radiotehnicheskih ustroystv i system [Statistical analysis and synthesis of a radioelectronic devices and systems].* M.: Radio i Svyaz, 608.
2. Falkovich, S. E. (1970). *Ocenka parametrov signala [Signal parameter estimation].* M.: Sov. Radio, 336.
3. Akimov, P. S. and others; In: Kolosov, A. A. (1989). *Obnaruzhenie signalov [Signal detection].* M.: Radio i Svyaz, 224.
4. Shirman, Ya. D. (1970). *Teoreticheskiye osnovy radiolokacii: uchebnoe posobie dlya vuzov [Radar theory. Tutorial for universities].* M.: Sov.Radio, 560.
5. Nathanson, F. E., Reilly, J. P., Cohen, M. N. (1999). *Radar design principles — signal processing and environment*. NJ: SciTech, 724.
6. Meikle, H. (2001). *Modern radar systems*. Boston: Artech House, 581. ISBN 1-58053-294-2.
7. Basseville, M., Nikiforov, I. (1993). *Detection of Abrupt Changes: Theory and Application*. Prentice-Hall, 469.
8. Purdy, R. J. and others. (2000). Radar signal processing. *Lincoln Laboratory Journal, Vol. 12, № 2*, 297—320.
9. Lytvyn-Popovych, A. I. (2012). Obnaruzhenie signalov v usloviyah apriornoy parametricheskoy neopredelennosti [Signal detection in a priori uncertainty conditions]. *Radiotekhnika, vol. 168*, 16—21.
10. Lytvyn-Popovych, A. I. (2012). Obnaruzhenie i izmerenie parametrov signalov v parallelnyh sistemah obrabotki [Signal detection and parameter estimation in parallel processing systems]. *Radiotekhnika, vol. 170*, 125—131.
11. Lyons, R. G. (2011). *Understanding digital signal processing*. Prentice-Hall. ISBN 0-201-63467-8.
12. Lytvyn-Popovych, A. I. (2011). Obrabotka radiolokazionnyh signalov v parallelnyh vychislitelnyh sistemah [Radar signal processing in parallel computing systems]. *Radiotekhnika, vol. 166*, 165—172.
13. NVIDIA® Tesla® GPU Accelerators. Available: http://www.nvidia.com/object/personal-supercomputing.html
14. Lytvyn-Popovych, A. I., Shchekin, S. R. (2013). Apriori information usage in meteo radar signal processing. Technology Audit And Production Reserves, 3(1(11)), 24—28.

WAYS TO REDUCE ROAD TRAFFIC LOAD OF CITY TRANSPORT NETWORKS

page 35–38

At the present time, there is a problem of choosing the most effective, scientifically grounded directions of activity to reduce the road traffic load of city transport networks. The paper gives the analysis and the developed classification of modern ways on the reduction of the road traffic load of city transport networks. As a result, the measures most relevant for modern conditions — organization of park-and-ride facilities in the peripheral areas of cities and construction of parallel highways were chosen. The structural diagram of the developed method of studying the efficiency of selected measures to reduce the road traffic load of transport networks is given. The method is based on the modeling of traffic flows using a mathematical model of the transport network load. The use of the given method allows determining the parameters of dependency of the level of traffic load of the transport network on the characteristics of applied measures and, therefore, establishing the appropriateness of their use.

Keywords: transport network, traffic flow, modeling of traffic flows, traffic, efficiency.

Referenses

1. Gavrilov, E. V., Dmytrychenko, M. F., Dolya, V. K.; In: Dmytrychenko, M. F. (2007). *Systemologiya na transporti. Organizaciya dorozhnogo rukhu, Vol. 4*. Kyiv: Znanya Ukrainy, 452.
2. Rankin, V. U., Klafi, P., Halbert, S. (1981). *Avtomobilnye perevozki i organizaciya dorozhnogo dvizheniya*. Moskva: Transport, 592.
3. Inose, X. T., Hamada, T. (1983). *Upravlenie dorozhnym dvizheniem*. Moskva: Transport, 248.
4. Eresov, V. I. (1984). Shlyahi pidvyshenya efectyvnosti upravlinya dorozhnim rukhom. *Avtomobilni dorogy i dorozhne budivnyctvo, № 34*, 95—99.
5. Zhivoglyadov, V. G. (2005). *Theoriya dvizheniya transportnykh I peshekhodnykh potokov*. Rostov-na-Donu. Izd. Vuz. Sev., 182.
6. Lobashov, O. O. (2010). Pro vplyv rivnya rozvytku transportnoyi merezhi mista na efectyvnist dorozhnogo rukhu. *Informatsiyno-keruyuchi systemy na zaliznichnomu transporti, № 5—6*, 45—47.
7. Lobashov, O. O., Dulfan, S. B. (2013). Vplyv parametriv transportnykh merezh znachnykh i nayznachnishykh mist na shvydkist transportnykh potokiv. *Komunalne gospodarstvo mist, Vyp. 109*, 107—110.
8. Helbing, D., Hennecke, A., Shvetsov, V., Treiber, M. (2001). MASTER: Macroscopic traffic simulation based on a gas-kinetic, non-local traffic model. *Transpn. Res. B, № 35*, 183—211.
9. Shvetsov, V. I., Dubov, Yu. A. (1997). Expected distributions in the intervening opportunities model. *Envir. & Plan. A, № 29*, 1229—1241.
10. Shvetsov, V. I., Helbing, D. (1999). Macroscopic dynamics of multilane traffic. *Phys. Rev. E, № 59*, 6328—6339.
11. Lobashov, O. O. (2010). Methodyka doslidzhennya vplivu transportnoyi merezhi na parametry transportnykh potokiv u mistah. *Informatsiyno-keruyuchi systemy na zaliznichnomu transporti, № 2*, 24—25.

SOFTWARE OF CONCRETE MIX DESIGN SYSTEM FOR CONSTRUCTIONS OF RAILWAYS

page 38–40

This article discusses the use of information systems in concrete technology and the results of research and software development in this area. The main purpose of this study is to develop and test an information system to solve the problem of concrete mix design for constructions of railways. Using information technology allows the technician or researcher promptly receive nominal and working dosages for concretes with different design requirements, to evaluate the effectiveness and the feasibility of use of concrete components. This article discussed the requirement for concrete and constructions of railways and software for the concrete design, its functionality. Author's method of designing the concrete for constructions of railways lies in the basis of the algorithm. The computer program is an implementation of intellectual decision support systems (expert systems). This allows us to solve the task of designing the concrete with specified properties by the characteristics of the components in an interactive and convenient form. The results can be applied to solve various tasks in the research and production of building materials.

Keywords: software, information system, the design of concrete, railway constructions.

References

1. Skramtaev, B. G., Shubenkyn, P. F., Bazhenov, U. M. (1966). *Sposobi opredeleniya sostava betona razlichnykh vidov.* Moscow, USSR. Stroyizdat, 159.
2. Bazhenov, U. M. (1975). Sposobi opredeleniya sostava betona razlichnikh vidov. *Moscow, USSR. Stroyizdat,* 272.
3. Voznesenskii, V. A., Virovoy, V. N., Kersh, V. Y. and others. (1983). Sovremennie metodi optimizatsii kompozitsionnikh materialov. *Kiev, Ukraine. Budivel'nik,* 144.

4. Syzov, V. P. (1995). Ratsyonal'niy podbor sostavov tyazhelogo betona. *Moscow, Russia. Stroyizdat,* 174.
5. Dvorkin, L. I., Dvorkin, O. L. (1999). Proektirovanie sostavov betona s zadannimi svoystvams. *Rovno, Ukraine. RGTU,* 202.
6. Fayner, M. S. (2001). Novie zakonomernosti v betonovedenii i ih prakticheskoe prilozhenie. *Kiev, Ukraine. Naukova dumka,* 448.
7. Koval', S. V. (2004). Betonы, moiyfitsirovannie dobavkami: modelirovanie i optimizatsiya. *Stroitel'nie materiali.* 6, 23—25.
8. Bazhenov, U. M., Vorob'ev, V. A., Ylyukhyn, A. V. (2006). Osnovnie podhodi k komp'yuternomu materialovedeniu stroitel'nykh kompozitsionnykh materialov. *Stroitel'nie materiali,* 7, 2—4.
9. Syzova, N. D., Mikheev, I. A. (2010). Alhorytm resheniya zadachi proektyrovaniya sostava betona metodami matematicheskogo planirovaniya əksperimenta. *Eastern-European Journal of enterprise technologies. 2/6*(34), 8—10.
10. Plugin, M. A., Kalinin, O. A., Miroshnichenko, S. V., Plugin, A. A. and others. (2005). The method of determining the composition of ductile, trischynostiykoho and water impermeable concrete. *Pat. UA 62613 Ukraine. IPC 7S04V28/12,* Appl. 15.04.03, publ. 15.06.05, Bull. № 6.
11. Latorec, K. V., Mikheev, I. A. (2011). The analysis of application of modern information technology for the problems decision of ready-mixed concrete manufacture. *Eastern-European Journal Of Enterprise Technologies, 2*(6(50)), 32—34.
12. Sliwinski, J. (1999). *Beton zwykly — projektowanie i podstawowe wlastiwosci.* Krakow, Poland. Polski Cement Sp. z o.o., 164.

ELECTRODYNAMIC ENERGY IN SPHERICAL NANOPARTICLES LAYERED

page 41—44

In the electrostatic approximation considered layered spherical nanoparticle interaction with electromagnetic radiation. The distribution of the fields in the layers with the application of translational matrix is shown. Determined the intensity of energy released due to the presence of losses. The problem considered in radial symmetry. For a homogeneous field acting along one of the axes of symmetry in globular particle squared electric intensity is expressed in two terms proportional to Legendre polynomials.

Nanoparticles have unique optical properties, and because of their size opening up broad prospects for their use in various fields of science and technology. Now researchers attracted much attention so-called bimetallic nanoparticles composed of silver and gold core shell, or vice versa. By changing the content of gold and silver in these particles it is possible to control the frequency plasmons in surfactant and intensity of absorption. This is because the frequency of the surface plasmon of gold and silver significantly separated in the optical range and the absorption of silver nanoparticles is much more than gold.

Keywords: nanoparticles; radial symmetry; translational matrix; integral transformations

References

1. Prashant, K. J., El-Sayed, I. H., El-Sayed, M. A. (2007). Au nanoparticles target cancer. *Nanotoday, V. 2, № 1,* 18—29.
2. Govoronov, A. O., Zhang, Wei. (2006). Gold nanoparticle ensembles as heaters and actuators: melting and collective plasmon resonances. *Nanoscale Res Lett., № 1,* 84—90.
3. Boren, K., Khafmen, D. (1986). Pohloshchenie i rasseianie sveta malymi chastitsami. *M.: Mir,* 664.
4. Chatterjee, K., Banerjee, S., Chakravorty. D. (2002). Plasmon resonance shifts in oxide-coated silver nanoparticles. *Phys. Rev., B. 66, 085421-1 — 085421-7.*
5. Lerman, L. B. (2009). Viniknennia dodatkovikh plazmovikh rezonansiv u sharuvatikh malikh chastinkakh. *Nanosistemi, nanomateriali, nanotekhnolohii, V. 7, № 1,* 37—47.
6. Hrechko, L. H., Lerman, L. B., Vodopyianov, D. L., Shostak, S. V. (2007). Poliarizovnist' strukturno-neodnoridnikh kul'ovikh chastinok. *Visnik Kiïvs'koho universitetuSeriia: fiz-mat nauki, № 1,* 20—32.
7. Hrechko, L. H., Lerman, L. B., Shkoda, N. H. (2006). Rozsiiuvannia elektromahnitnoho viprominiuvannia na bahatosharovii kuli. *Visnik Kiïvs'koho universitetu. Ser. fiz.-mat., № 3,* 376—384.
8. Korn, H., Korn, T. (1973). Spravochnik po matematike. *M.: Nauka,* 831.
9. Tikhonov, A. N., Samars'kii, A. A. Uravneniia matematicheskoi fiziki. *M.: Nauka,* 355.
10. Porodko, L. V., Lerman, L. B. (2011). Taking into account the finite speed of propagation of heat in the laser heating of solid surface. *Chemistry, Physics and technology of surface, V. 2, № 3,* 343—346.

SPECTRAL ANALYSIS OF ASTEROIDS DISTRIBUTION ON SEMIMAJOR AXIS. LS-METHOD

page 44—46

Existing methods of the analysis of distributions of orbits of small bodies of the Solar system for the presence of periodic components are based on the construction of the corresponding histograms of the number. In the case when the analyzed data contain a powerful systematic component (trend), and a required signal, if present, has low power in comparison with a random component, the detection of a useful signal becomes a difficult task. To avoid errors such as false signal detection, the additional use of the analysis of distributions of orbits without creation of histograms of the number is proposed in the paper. The method is based on the analysis of variation series of the density of orbits in the sample sorted by the analyzed parameter. Thus, the specified series, unlike the similar one obtained in the creation of histograms, is uneven that, respectively, imposes constraints on a choice of the method of the spectral analysis. The research of a sample of NEA (near-Earth asteroids) orbits by both methods and their comparative analysis are given in the paper.

Keywords: spectral analysis, uneven series, elements of orbits, asteroids.

Referenses

1. Cherkas, Yu. V., Voloshchuk, Yu. I. (2012). Application of spectral analysis for searching of periodic components in the semimajor axis' distributions of asteroids. *Applied Radio Electronics,* Vol. 11, № 2, 335—341.
2. Quiroga, R. J., Mello, J. C. (1992). Period distributions in pulsating and binary stars. *Astrophysics and Space Science, vol. 193, no. 2,* 247—267.
3. Quiroga, R. J. (1984) Angular momenta in the Solar System. II. *Earth, Moon and Planets,* 30, N 2, 102—121.
4. Hu, Zhong-Wey, Chen, Zhi-Xiong. (1987). Distance law and formation of satellite systems. *Astronomische Nachrichten,* 308, 359—362.
5. Terebizh, Yu. V. (1992). *Time series analysis in astrophysics.* Nauka, Moscow, 392.
6. Marple, S. L. (1987). *Digital spectral analysis with applications.* Prentice Hall, Englewood Cliffs, NJ, 492.
7. Stoica, P. (1997). *Introduction to Spectral Analysis.* Prentice Hall, New Jersey, 319.
8. Anderson, T. W. (1971). *The statistical analysis of time.* John Wiley & Sons, Inc., 704.
9. Brillinger, D. R. (1975). *Time series. Data analysis and theory.* Holt, Rinehart and Winston, Inc., 504 p.
10. NASA. Near Earth object program. Available: http://neo.jpl.nasa.gov/cgi-bin/neo_elem

TRANSPORTATION MODEL WITH THE LIMITATION OF CARRYING CAPACITY, MOVING TIME AND QUANTITY OF TRANSPORT

page 47–51

This article dwells upon meta heuristic approach of problem solving of transport routing for industry that has scarce resources in its activity. Such resources are: carrying capacity, moving time and quantity of transport.

The general algorithm of developed method bases on imperative problem solving without accounting one of limitation. Simplified problem is solving for quantity unserved consumers of meta heuristic method. The main idea of a method is to merge solving method of Clarke-Wright with the method of simulated annealing.

To solve the problem and analyze the effectiveness of developed algorithm the program product has been created. In the present paper the results of calculated experiments and calculated deviation of model solution from received results have been demonstrated. Mean error of the method and the time of finding the solution witnesss that developed method have an ejective solution for acceptable time.

Keywords: problem of transport routing, optimal solution, meta heuristic method, routing cost.

References

1. Clarke, G.,Wright, J. W. (1964). Scheduling of vehicles from a central depotto a number of delivery points. *Operations Research, 12*, 568—581,
2. Gendreau, M., Laporte, G., Potvin, J.-Y. (1999). Metaheuristics for thevehicle routing problem. *Technical Report CRT-963*. Centre deRecherchesur les Transports, Universite de Montreal.
3. The VRP. Available: http://neo.lcc.uma.es/radi-aeb/WebVRP
4. Sariklis, D., Powell, S. (2000). A heuristic method for the open vehicle routing problem. Journal of the Operational Research Society, 51, 564—573.
5. Ralphs, T., Hartman, J., Galati, M. (2001). Capacitated Vehicle Routing and Some Related Problems. Industrial and system engineering Lehigh University, Rutgers University, 1—31.
6. Pichpibula, T., Kawtummacha, R. (2012). Animproved Clarke and Wright savings algorithm for the capacitated vehicle routing problem. *Science Asia, 38*, 307—318.
7. Molchanovskiy, O., Lyubon'ko, A. (2012). Construction of initial solution for the vehicle routing problem with pick up and delivery. *Materials of III Ukrainian scientific-practical conference «Information technologies-2012»*, 256—260.
8. Clarke-Wright method. Available: http://lib.convdocs.org /docs/index-152162.html?page=4
9. Simulated annealing. Available: http://ru.wikipedia.org/wiki /Simulated annealing
10. Understanding Simulated Annealing. Available: http:// www.heatonresearch.com/node/727
11. Testexamples. Available: https://www.assembla.com/code/victorillac/git /nodes/5e17b1fcfed9fef7da913a0773279b578d6a911a /Instances/cvrp/augerat.sol

ALGORITMS INTELLECTUAL DEVELOPMENT OF BRAGORECTIFICATION SETTING

page 51–54

This article is about bragorectification setting as a complex object of regulation, operating under uncertainty. From the viewpoint of analysis and synthesis automatic control BRS is complex machine of consistent-parallel structure. It is proved that automatic control systems analysis and synthesis BRS of alcohol plants are multifunction objects. The analysis of existing control algorithms, discussed the advantages and disadvantages of these algorithms. Properties of automated rectification device are showed through interconnection of input options causes changes of output parameters. Therefore, automated rectification device BRS belongs to multi-connected systems of automation. Variables determine the state of all processes are devised into input and output. They display the shape of objects. A single of the most effective approaches to management based on intellectual algorithm. The analysis of existing control algorithms has done. Advantages and disadvantages of these algorithms have taken into consideration.

Keywords: bragorektification setting, systems analysis, intellectual algorithms, linguistic approximation.

References

1. Stabnikov, V. N., Nikolaev, A. P., Mandelshteyn, M. L. (1982). *Rectification food industry. Teoriya process machine intensification*. M.: Light and Food Industry, 232.
2. Mandelshteyn, M. L. (1969). Mathematical model and static specification of the distillation column. *Enzyme and alcohol industry, 1*, 11—16.
3. Tsigankov, P. S. (1984). *Distillation unit of the alcohol industry*. M.: Light and Food Industry, 336.
4. Smityuh, Y. V. (2004). Model brahorektyfikatsiynoyi settings as a control object. *Proceedings of the Kirovograd National Technical University, Issue 15*, 229—234.
5. Haken, G. M. (1985). *Synergetics. Hierarchy of instabilities in self-organizing systems and devices*. Translation from English. New York: Wiley, 423.
6. Pospelov, D. A. (1986). *Contingency management: theory and practice*. Moscow: Nauka, 288.
7. Smityuh, Y. V. (2006). Optimizatsiya management process bragorektifikatsii. *Automation. Avtomatizatsiya. Electrical equipment and systems, 2(18)*, 117—124.
8. Smityuh, Y. V. (2004). Study process bragorektifikation s positions ynergistically management approach. *Food processing industry, 3*, 142.
9. Kishenko, V. D. (2007). *Intelektualni System: Abstract lektsiy s subject 'Intelektual systems'*. K.: NUHT, 133.
10. Iglin, S. P. (2005). *Mathematical calculations based MATLAB*. BHV: Petersburg, 640.