



## TECHNIQUE FOR QUALITY ASSESSMENT OF EXTERNAL APPEARANCE OF PAINT COATINGS

page 4–7

The data on the regularities of making an external appearance quality of coatings on a cement substrate has been given. The regularities of changing the surface roughness of cement concrete paint coatings, depending on the rheological properties of paints, cement porosity of the substrate, the way of applying paints, have been determined. The increase of the surface roughness of coatings with decreasing conditional dynamic viscosity of paints has been found out. Based on probabilistic and deterministic approaches the model of external appearance quality of coatings, taking into account the surface porosity of the substrate and the surface tension of paint, has been proposed. It has been suggested assessing the quality of paint coating surfaces by a fractal dimension indicator. The relation between numerical values of the fractal dimension indicator and the quality class of external appearance of coatings has been found. The model of profile length of the coating surface from the D fractal dimension has been proposed.

**Keywords:** paint coatings, external appearance quality, fractal dimension.

### References

- Orentlikher, L. P., Loganina, V. I. (1993). *Zashchitno-dekorativnyye pokrytiya betonnykh i kamennykh sten: Sprav. posobiye*. M.: Stroyizdat, 136.
- Loganina, V. I., Karpova, O. V., Mishin, A. S. (1998). *Krasochnyye sostavy na osnove polimermineral'nykh svyazuyushchikh*. Penza, 109.
- Najjar, D., Bigerelle, M., Hennebelle, F., Iost, A. (22 May 2006). Contribution of statistical methods to the study of worn paint coatings surface topography. *Surface and Coatings Technology*, Vol. 200, Issues 20–21, 6088–6100.
- Hennebelle, F., Najjar, D., Bigerelle, M., Iost, A. (1 May 2006). Influence of the morphological texture on the low wear damage of paint coated sheets. *Progress in Organic Coatings*, Vol. 56, Issue 1, 81–89.
- Kalashnikov, V. I., Demyanova, V. S., Duboshina, N. M. (2000). Suhie mixes based on local materials. *Build materials*, № 5, 30–33.
- Malyshev, V. P. (1981). *Veroyatnostno-determinirovannoye planirovaniye eksperimenta*. Alma-Ata: Nauka KazSSR, 116.
- Orentlikher, L. P., Loganina, V. I., Danilov, A. M., Kuimova, Ye. I. (2002). Primeneniye veroyatnostno-determinirovannogo metoda planirovaniya eksperimenta pri razrabotke modeli kachestva vneshnego vida pokrytiya. *Izvestiya vuzov. Stroitel'stvo. Novosibirsk*, № 7, 43–46.
- Zolotukhin, I. V. (1998). Fraktaly v fizike tverdogo tela. *Sorovskiy obrazovatel'nyy zhurnal*, № 7, 108–113.
- Loganina, V. I., Volkov, I. V., Golubev, V. V. (2008). Otsenka napryazhenno-deformirovannogo sostoyaniya lakkrasochnogo pokrytiya v zavisimosti ot kachestva yego vneshnego vida. *Izvestiya vuzov. Stroitel'stvo*, № 7, 26–30.
- Application of profilometry and fractal analysis to the characterization of coatings surface roughness. (January–April 1996). *Progress in Organic Coatings*, Vol. 27, Issues 1–4, 219–226.

## THE ANALYSIS OF THESE SUBJECTS FOR RELEVANCE DETERMINATION OF RESEARCH AREAS

page 7–10

The analysis of subjects of theses on the specialty 05.16.05 – «Metal forming» in Russia for the period 2000–2011 and theses on the specialty 05.03.05 – «Processes and machines of metal forming» in Ukraine for the period 2000–2012 was conducted in the paper. Considering PhD theses on technical disciplines as the highest level of scientific development in specific professional areas, it was decided to investigate retrospectively the subject array of all scientific works, defended in Russia for the period 2000–2011 and in Ukraine for the period 2000–2012.

236 theses on the named specialty were defended in Russia, 92 % of which by males and 8 % by females. In the field of non-ferrous 45 (19 %) metals, the theses of metal forming of aluminum alloys prevail, next come copper alloys and other. 191 (81 %) PhD theses are devoted to ferrous metal forming. Longitudinal rolling of strips and sheets is the most studied.

155 abstracts for the period 2000–2012 were considered during the study of theses in Ukraine.

Systematization of theses, defended in Russia and Ukraine for the 2000–2012, expressed in graphs was conducted.

Several theses, devoted to the rheological properties of matter and ultra-fine grain materials obtaining in metal forming were also noted.

**Keywords:** analysis, theses, specialty, metal forming, processes, machines, systematization, graph.

### References

- Berezhnii, M. M., Mikheeva, V. I., Chubenko, V. A., Movchan, V. P. (2003). Suchasni stan i perspektivi metalurhii Ukraini. *Visnik Krivoriz'koho tekhnichnoho universitetu*, 1, 44–46.
- Berezhnii, M. M., Chubenko, V. A. (2007). Zmina obiemu ta mitsnosti metalu pri kholodnomu prokatuvanni zalezho vid stupenia deformatsii. *Visnik Krivoriz'koho tekhnichnoho universitetu*, 16, 81–84.
- Polukhin, P. I., Fedosov, N. M., Korolev, A. A., Matveev, Yu. M. (1982). *Prokatnoe proizvodstvo*. Ed. 3. M.: Metallurhiia, 695.
- Konovalov, Yu. V. (2008). *Spravochnik prokatchika*. Kniha 1. M.: «Teplotekhnika», 640.
- Hrudev, A. P. (1988). *Teoriia prokatki*. M.: Metallurhiia, 240.
- Vasilev, Ya. D. (2009). *Teoriia povzdovzhn'oi prokatki*. Donetsk: UNITEK, 488.
- Danchenko, V. M., Hrinkevich, V. O., Holovko, O. M. (2008). *Teoriia protsesiv obrobki metaliv tiskom*. Dnipropetrovsk: Porohi, 370.
- Maksimenko, O. P. (2009). *Teoriia protsesiv prokatnoho, trubnogo, koval's'ko-shtampoval'nogo ta volochil'nogo virobnitstva*. Dniprodzerzhinskii derzhavnii tekhnichnii universitet, 208.
- Shlomchak, H. H. (2002). Reolohicheskaia kontsepsiia v teorii prokatki metallov. *Suchasni problemi metalurhii*. «Naukovi visti». Dnipropetrovsk: «Sistemni tekhnolohii», 5, 97–101.
- Berezhnii, M. M., Chubenko, V. A., Khinots'ka, A. A. (2011). *Enerhetichnii balans ta reolohichni vlastivosti oseredku deformatsii pri prokatuvanni shtabi hladkimi valkami*. Krivii Rih: Dionis, 115.

## SMOKE VISUALIZATION UNDER HEAT TRANSFER BY FREE CONVECTION ON HORIZONTAL CYLINDER SURFACE

page 10–14

The method of visualizing a dynamic field in conditions of free convection by introducing a laminar smoke stream into the area which is vertically lower than the existing thermal and dynamic boundary layers has been proposed and examined in the paper. The suggested method is simple, obvious, cheap and fast enough, that allows advising it for applying in the study of free-convective heat transfer problems using air as a heat-transfer agent. As a result of the conducted research, a set of assumptions, giving the basis to calculations and methods of analyzing experiment results has been demonstrated. In particular, among them there can be singled out the following: the laminarity of a heat-transfer agent motion mode, the laminarity of a thermal tracing and boundaries of its sustainable occurrence over a hot surface, the growth of boundary layer thickness in the cylinder stern, symmetry of washing cylinders from different sides from the vertical plane of symmetry, and others. Juxtaposing the results with the data, represented in the literature, shows a high correspondence.

**Keywords:** heat transfer, free convection, horizontal tube, hydrodynamics, boundary layer, visualization.

### References

- Chaplits, A. D., Astapov, A. I. (2007). *Visualization of Gas Flows Through Internal Channels (experimental researches methods and results)*. Dnepropetrovsk: NAS of Ukraine and NSA of Ukraine, Institute of the Technical Mechanics, 210.
- Rudenko, A. I., Tereh, A. M., Semenyako, A. V., Nishchik, A. G., Baranyuk, A. V. (2012). The method of flow visualization of gas flow on the surface of bodies of various shapes. *Eastern-European Journal Of Enterprise Technologies*, 1(9(49)), 51–55.
- Babenko, V. V., Musienko, V. P., Turik, V. N., Milyukov, D. E. (2010). Visualization of flow around a hemispherical indentations. *Applied hydromechanics*, 4, 3–25.
- Sparrow, E. M., Molki, M. (1982). Effect of missing cylinder on heat transfer and fluid flow in an array of cylinders in cross-flow. *International journal of heat and mass transfer*, V. 25, Issue 4, 449–456.

5. Popov, I. A., Usenkov, R. A. (2002). Experimental investigation of heat and mass transfer on vertical faces with discrete roughness during natural convection. *Proceedings of the third Russian National conference on heat transfer, October 21–25, 2002*. Moscow, Vol. 3.
6. Tuz, V. O., Neilo, R. V. (2013). Experimental heat transfer investigation on horizontal cylinder during natural convection. *Eastern-European Journal Of Enterprise Technologies*, 6(5(66)), 17–23.
7. Shlichting, G. (1974). *Boundary layer theory*. Moscow: «Science». 712.
8. Gebhart, B., Jaluria, Y., Mahajan, R. L., Sammakia, B. (1988). *Buoyancy-induced flows and transport*. New York: Hemisphere publishing corp., 678.
9. Sesonske, A. (1961). Velocity and temperature distributions about a horizontal cylinder in free convection heat transfer. *AIChE Journal*, V. 7, Issue 2.
10. Atayilmaz, S. Ö., Teke, İ. (2009). Experimental and numerical study of the natural convection from a heated horizontal cylinder. *International Communications in Heat and Mass Transfer*, 36, 731–738.
11. Harsini, I., Ashjaee, M. (2010). Effect of adiabatic wall on the natural convection heat transfer from a wavy surface created by attached horizontal cylinders. *Experimental Thermal and Fluid Science*, Vol. 34, Issue 6.
12. Afanas'eva, V. V., Afanas'ev, A. V. (2010). Modeling convection based on discrete swirl method. *Proceedings of the Fifth Russian National Conference on Heat Transfer, October 25–29, 2010*. Moscow, Vol. 3.
13. Isachenko, V. P., Osipova, V. A., Sukomel, A. S. (1975). Heat transfer. Moscow, USSR: Energy, 487.
14. Miheev, M. A., Miheeva, I. M. (1977). *Heat transfer*. Moscow «Energy», 344.
15. Van Dyke, M. (1982). *An album of fluid motion*. The Parabolic Press. Stanford California, 184.

**CONTACT CHARACTER OF WORK SURFACE OF CYLINDRICAL GEARS TOOTH WITH CONCHOIDAL ENGAGEMENT LINE DEPENDING**

page 14–17

Load capacity of gears depends on the character of work surfaces contact: two convex contact or contact the convex and concave surfaces. Therefore, the actual solution to the problem is to determine the geometrical parameters of the tooth, providing the most rational given character of their work surfaces contact. This fully applies to the gears with conchoidal engagement line for which this problem has not been studied yet.

There have been gotten the conditions defining the character of tooth work surface contact with conchoidal engagement line depending on the geometrical parameters of the original contour. There have been defined the original contours parameters providing convex-concave tooth contact and the contact of two convex teeth in the engaging meshing pairs. There have been given recommendations as for defining the parameters of the original contour depending on the character of contact in cylindrical spur gear work surfaces.

**Keywords:** cylindrical gear, surface, profile, contour, gearing, contact, conchoidal engagement line.

**References**

1. Shabanov, I. R. (1967). Gearing of conchoidal cohesion line. *Safety and quality of gearings, NII INFORMTIAZMASH 18-67-106*, 1–8.
2. Shabanov, I. R. (1966). Gearing consisting of cylindrical toothed wheels with conchoidal cohesion line and its elements. *Trudy USHI, Том XII, 16*, 20–28.
3. Nosko, P. L., Shishov, V. P., Mukhovaty, A. A. (2012). Comparative analysis of durability contact criteria in non-evolvent cylindrical gearings. *Visnik NTU «KHPi», Kharkiv, NTU «HPI», № 35*, 119–124.
4. Shishov, V. P., Nosko, P. L., Fil, P. V. (2006). *Teoreticheskie osnovy sinteza peredach zatsepleniem: monograph*. Vid-vo SNU im. V. Dal, Luhansk, 408.
5. Boshansky, M. (1997). *Volba geometrickych parametrov konvexno-konkavého ozubenia z hladiska povrchového poskodenia bonu zuba*. SĽF STU, Bratislava, 104.
6. Veres, M., Boshansky, M. (1999). *Teoria celneho rovinneho ozubenia*. STK Bratislava, 112.
7. Veres, M., Boshansky, M., Gachis, J. (2006). *Theory of Convexo-concave and plane cylindrical gearing*. Slovak university of technology, Bratislava, 180.
8. Litvin, F., Fuentes, A. (2004). *Gear Geometry and Applied Theory*. Second Edition, Cambridge University, 125.

9. Boshansky, M., Medzihradsky, J. (2007). *Posudenie vhodnosti pouzitia Sortveru v pevnostnej analize ozubenych kolies metodom MKP*. Acta Mechanica Slovaca, Kosice, 45–53.
10. Shishov, V. P., Pankratov, D. A., Mukhovaty, A. A. (2001). Kriterii ocheni rabotosposobnosti peredach zatsepleniem. *Visnik NTU «KHPi», Kharkiv, NTU «HPI», № 12*, 33–40.

**THE PECULIARITIES OF THE WIND POWER GENERATING AUTONOMOUS SYSTEM EXPLOITATION IN THE UNDERGROUND MOUNTAIN IRON-ORE MINING**

page 17–20

The possibility and specifics of wind power complex functioning in operating underground iron-ore mining were analyzed. Aerodynamic features of ventilation airflows in underground iron-ore mining and their impact on the wind power plant operation were investigated. The design of wind power plant was substantiated and proposed for the practical implementation to realize its optimum possible efficiency. The structure of electromechanical part of the wind power complex and the control system for it with a predicted reliability and quality capacity of power supply to consumers of underground iron-ore mining electric power were developed. The behavior was investigated, and the control law was developed for the regulator of capacitive excitation current of induction generator of wind electromechanical complex with direct wind power conversion into electric power that provides energy-efficient operation modes of wind power plant electromechanical complex. The economic efficiency of using wind power plant in underground iron-ore mining was proved.

**Keywords:** wind power plant, wind power complex, economic efficiency.

**References**

1. Sinchuk, O. M., Boiko, S. M., Shcherbak, M. A. (2012). Pro zalezhnist' enerhetichnikh koordinat vitroenerhetichnoi ustanovki z vertikal'noiu vissiu obertannia vid aerodinamichnikh umov shakh. *Tekhnichna Elektrodinamika. Tematichnii vipusk «Silova elektronika ta enerhoefektivnist'», 4*, 171–172.
2. Sen'ko, V. I., Boiko, S. M., Shcherbak, M. A., Zhukov, A. O. (2013). Matematichna model' sistemi keruvannia elektrotekhnichnim kompleksom vitroenerhetichnoi ustanovki na bazi fuzzy kontrolera. *Elektrotekhnichni i enerhozberhaiuchi sistemi. Tematichnii vipusk «Problemi avtomatizovanoho elektroprivoda. Teoriia i praktika», Vip. 3*, 117–129.
3. Sinchuk, O. N., Boiko, S. N. (2012). Nechiotkaia lohika i sohlasovanniya rezhimov raboty vitroenerheticheskoi ustanovki so skorost'iu potoka v usloviiakh rudnykh shakht «Tekhnicheskie nauki – ot nauki k praktike». *Materialy XIV mezhdunarodnoi zaochnoi nauchno-prakticheskoi konferentsii, 10 oktiabria 2012*. Novosibirsk: Sibirskaiia assotsiatsiia konsul'tantov, 50–55.
4. Yavorskii, B. M., Detlaf, A. A. (1971). *Spravochnik po fizike dlia inzhenerov i studentov vuzov*. M.: Nauka, 134–269.
5. Prakhovnik, A. V., Solovei, A. I., Prokopenko, V. V. and others. (2001). *Enerheticheskii menedzhment*. K.: IEE NTUU «KPI», 470.
6. Wang, Q., Chang, L.-C. (September 2004). An intelligent maximum power extraction algorithm for inverter-based variable speed wind turbine systems. *IEEE Transactions on Power Electronics, Vol. 19*, 1242–1249.
7. Nakamura, T., Morimoto, S., Sanada, M., Takeda, Y. (2002). Optimum control of ipmsg for wind generation system. *Power Conversion Conference (PCC), Vol. 3*, 1435–1440.
8. Yanto, H. A., Chun, T. L., Jonq, C. H., Sheam, C. L. (2009). Modeling and control of household-size vertical axis wind turbine and electric power generation system. *Power Electronics and Drive Systems, 2009. PEDS 2009. International Conference*. Dept. of Mech. Eng., Nat. Taiwan Univ. of Sci. & Technol., Taipei, Taiwan, 7. DOI:10.1109/PEDS.2009.5385804.
9. Sreedhar, R. G. (2005). Modeling and power management of a hybrid windmicroturbine power generation system. *A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Electrical Engineering*. Bozeman, Montana: Montana State University, 154.
10. Muller, S., Deicke, M., De Docker, R.-W. (October 2000). Adjustable speed generators for wind turbines based on doubly-fed induction machines and 4-quadrant igbt converters linked to the rotor. *IEEE Industry Applications Conference, Vol. 4*, 2254–2259.

## CADASTRAL JUSTIFICATION OF LAND ALLOTMENT IN HIGHWAY PROJECTS

page 20–23

This article deals with the land allotment for construction of new highways and reconstruction of existing highways and their subsequent use. On the basis of current methods in highway sphere the parameters of sanitary protection zones after reconstruction of state highways have been defined in accordance with the parameters of international auto transport corridors in open terrain. The functional land zoning of auto transport corridors has been developed and the parameters of their rights of way have been defined with the appliance of environmental measures. The roadsides of various technical categories have been defined according to the directions of auto transport corridors with regard to the use of adjacent areas. The dimensions of reserved areas of auto transport corridors with implementation of environmental and public health protection measures have been justified, considering highway protection from the negative impact of processes and phenomena in the adjacent areas. The results of the research can be applied in planning of the network of international highways. Cadastral justification of land allotment will enable the rational use of the territory in road projects.

**Keywords:** highway, auto transport corridor, right of way, land management.

### References

1. *Evropeyskoe soglachenie o mejdunarodnih avtomagistralyah.* (2008). Ekonomicheskij i socialnij sovet OON. Jeneva, 67.
2. *Doklad mejpravitelstvennogo soveschania dla razrabotki mejpravitelstvennogo soglachenia po seti Aziatskijh avtomobilnih dorog.* (2003). Ekonomicheskij i socialnij sovet OON. Bangkok, 10.
3. *Protokol o mejdunarodnyh avtomobilnyh dorogax Sodrujestva Nezavisimih Gosudarstv.* (1998). Available: [http://zakon4.rada.gov.ua/law/show/997\\_890](http://zakon4.rada.gov.ua/law/show/997_890)
4. Randolph, J. (2002). *Environmental Land Use Planning and Management.* Washington: Island Press, DS, 664.
5. Mateichyk, V., Hrut'ba, V., Gorid'ko, N. (2012). *Program-target model of environmental logistics system of a transport enterprise.* Rzeszow: Politechnika Rzeszowska im. Ignacego Lukasiewicza, 84–94.
6. Meyer, K. (1986). Das Waldsterben aus oekologische Sicht. *Automobil Industrie*, № 4, 473–483.
7. Evgenyev, I. E., Karimov, B. B. (1997). *Avtomobilnye dorogi v okruzhayuchey srede.* Moskva: Transdornauka, 285.
8. Kavtaradze, D. N. (1997). *Ekologicheskie principy ocenki vozdeystvia avtodorog na okruzhayuschuyu sredu. Nauka i texnika v dorozhnoy otrasli*, № 2, 8–10.
9. Perovych, I., Vanchura, R. (2013). Comparative Characteristics of pollution road transport lands on the local ground areas in Ukraine and Germany. *Druzicove metody v geodezii a katastru.* Brno, 70–71.
10. Oefner, G. (1994). Schadstoffemissionen an Autobahnbaustellen. *Informationen – Verkehrsplanung und Strassenwesen. Universitaet der Bundeswehr Muenchen, H. 40*, 147–164.
11. Goncharenko, F. P., Prusenko, E. D., Skorchenko V. F. (1999). *Ekspluatatsiyne utrimannya ta remont avtomobilnih dorog za ckladnix pogodnix ta ekologichnyx umov.* Kyiv: Urojay, 264.

## RESEARCH OF INFLUENCE THE MOLLUSKS' HYDROLYZATE ON THE CLINICAL CONDITION OF CHILDREN

page 24–26

This article covers the issues of the use of a «Rapamid» dietary supplement in the diet of children – residents of contaminated territories. The authors conducted a clinical study of the supplement.

The main purpose of the research is to assess the therapeutic and radioprotective properties of the hydrolyzate of «Rapamid» molluscs among children who are contaminated by radiation.

It was established that a complimentary prescription of «Rapamid» dietary supplement to the normal diet and to the basic therapy contributed to more pronounced effect on children with pathologies of the digestive system.

The authors defined a positive influence of the «Rapamid» supplement on processes of cavity digestion that was demonstrated by a decrease in symptoms of diseases such as creatorrhoea, amyloorrhoea,

steatorrhoea and dysbiotic manifestations. It is noted that consuming of «Rapamid» dietary supplements contributed to increasing of hemoglobin and red blood cells.

Radioprotective properties of dietary supplement «Rapamid» were identified in the conducting research.

It was confirmed by a decrease of the intensity of free-radical processes in human biosphere and more dramatic decline in the content of incorporative cesium-137 compared to a control group.

The dynamics of hematological indices of children during the intake of the supplement was also investigated.

The authors focus attention on good acceptability and absence of side-effects of «Rapamid» dietary supplement.

**Keywords:** «Rapamid» dietary supplement, radioprotective properties, cesium-137, hematological indices.

### References

1. *Vplyv harchuvannja na zdorov'ja dytyny.* Available: <http://ua.textreferat.com/referat-15693-1.html>
2. Romanenko, A. Ju., Stepanova, Je. I. (2006). Stan zdorov'ja ditej, jaki postrazhdaly vnaslidok Chornobyl's'koi katastrofy (za danymy 20-richnyh sposterezhen'). *Zhurn. AMN Ukrainy*, T. 12, № 2, 296–306.
3. Luk'janova, O. M. (2001). Zdorov'ja ditej – nashe majbutnje. *Medychnyj vesvit*, № 1, 20–23.
4. Stepanova, Je. I., Lapushenko, O. V., Kondrashova, V. G., Kolpakov, I. Je. (2004). Naslidky Chornobyl's'koi katastrofy dlja zdorov'ja dytjachogo naselennja Ukrainy. *Dovkillja ta zdorov'ja*, № 2, 59–62.
5. Stepanova, Je. I. (2006). Dynamika pokaznykiv zahvorjuvanosti ta poshyrenosti hvorob organiv travlennja u ditej – meshkanciv radioaktyvno zabrudnenyh terytorij za 20 rokov pislja Chornobyl's'koi katastrofy. *Zbirnyk naukovykh prac «Problemy radiacijnoi medycyny ta radiobiologii»*, 43–56.
6. Stepanova, Je. I., Kolpakov, I. Je., Kondrashova, V. G. (2006). Stan zdorov'ja ta osoblyvosti funkcionuvannja organiv ta system u ditej, jaki postrazhdaly vnaslidok Chornobyl's'koi avarii'. *Dvadcat' rokov Chornobyl's'koi katastrofy. Pogljad u majbutnje*, 174–175.
7. Korzun, V. N., Stepanova, Je. I., Kurilo, L. V., Torbin, V. F. (1997). Yonyzrujushhaja radyacija y pytanye ditej. *Chornobyl' interinform*, 121.
8. Jerohin, V. Je., Rjabushko, V. I., Golub, M. O.; Instytut biologii pivdennyh moriv im. O. O. Kovalevs'kogo NAN Ukrainy. (25.06. 2010). Pat. 50761 Ukraini (UA), MPK A23L 1/333 (2006.01), A01K 61/00. *Sposib oderzhannja gidrolizatu z moljuskiv*. № u200912823. Pending 10.12.2009. Bjul. № 12.
9. Makoveckaja, L. Y. (2009). Modyfikacija oksyltel'nogo metabolizma byologichesky aktivnym preparatom Rapamid u myshej s raznoj radyochuvstvytel'nost'ju. *Jaderna fizyka ta energetyka*, Vol. 10, № 3, 14–18.
10. Mancini, G., Carbonara, A. O., Heremans, J. F. (1965). Immunochemical quantitation of antigens by single radial immunodiffusion. *Immunochemistry*, Vol. 2, № 3, 235–254.
11. Dvadcat' p'jat' rokov Chornobyl's'koi katastrofy. Bezpeka majbutn'ogo. (2011). *Nacional'na dopovid' Ukrainy*, 356.

## ANALYSIS OF STRUCTURE OF PUBLIC DEBT AS A BASIC STAGE OF INFORMATION TECHNOLOGY

page 27–30

The structure of public debt as a basic stage of information technology for investigating direct public and publicly guaranteed debt was developed and analyzed in the paper. It includes the following steps: research base formation, econometric models development, analysis of public debt volume changes, depending on internal and external economic factors and forecasting public direct and publicly guaranteed debt volume changes in the near-term outlook. The important role of public debt in the economic life of the country was substantiated in the paper. The role and the influence of the studied object on the state budget balance and consequently on the economy as a whole were pointed out. External direct and publicly guaranteed debt formation sources were revealed, and external public debt effects on the state economy were described. The basic elements of public debt, such as debt type, debt effects, direct and publicly guaranteed debt formation sources were outlined. Direct public and publicly guaranteed debt functioning study, based on the statistical data analysis allows to control peak situations, when the state budget burden, caused by the public debt repayment and servicing is excessive.

**Keywords:** public debt, state guarantees, information system, debt structure, budget balance.

**References**

1. Public Debt in Emerging Markets. (September 2003). *International Monetary Fund, World economic outlook*. Available: [www.imf.org/external/pubs/ft/weo/2003/02/index.htm](http://www.imf.org/external/pubs/ft/weo/2003/02/index.htm)
2. Panizza, U. (2008). Domestic and external public debt in developing countries. *United Nations conference on trade and development, No. 188*. Available: [http://unctad.org/en/docs/osgdp20083\\_en.pdf](http://unctad.org/en/docs/osgdp20083_en.pdf)
3. Anderson, Ph. R. D., Caputo Silva, A., Velandia-Rubiano, A. (2010). Public Debt Management in Emerging Market Economies. Policy Research Working Paper. *The World Bank, Banking and Debt Management Department, Global Capital Markets Development Department*. Available: [http://treasury.worldbank.org/bdm/pdf/PDM-EM\\_HasThisTimeBeenDifferent\\_Anderson.etal.pdf](http://treasury.worldbank.org/bdm/pdf/PDM-EM_HasThisTimeBeenDifferent_Anderson.etal.pdf)
4. Borensztein, E., Chamon, M., Jeanne, O., Mauro, P., Zettelmeyer, J. (2004). *Sovereign debt Structure for crisis prevention*. Washington, D. C.: International Monetary Fund. Available: [www.imf.org/external/pubs/nft/op/237/op237.pdf](http://www.imf.org/external/pubs/nft/op/237/op237.pdf)
5. Hostland, D., Karam, P. (2006). Assessing debt sustainability in emerging market economies using stochastic simulation methods. *World Bank Policy Research Working Paper 3821*. Available: <http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-3821>
6. Kopits, G. (2004). Rules-based fiscal policy in emerging markets. *Palgrave Macmillan*. New York, 286.
7. *Ministry of Finance of Ukraine*. Available: [www.minfin.gov.ua](http://www.minfin.gov.ua)
8. Kyrychenko, O. A., Kudrytskyi, V. D. (2009). Suchasni teorii upravlinnia zovnishnoi zaborgovanistiu. *Aktualni problemy ekonomiky, № 7(97)*, 15–27.
9. *External debt statistics: guide for compilers and users*. (2003). Washington, D. C.: International Monetary Fund. Available: [www.imf.org](http://www.imf.org)
10. *National Bank of Ukraine*. Available: [www.bank.gov.ua](http://www.bank.gov.ua)
11. Matvieieva, I. M. (2009). Structura zovnishnogo borгу Ukrainy ta osoblyvosti obslugovuvannya. *Zb. Nauk. Prats. Ekonomiko-matematychno modelivannya sotsialno-ekonomichnikh system, MNNTSITaS, Vip. 14*, 187–202.
12. Ivashchuk, O. T., Kravchiuk, N. Y. (2004). Killisni metody finansovogo prognozuvannya borgovoi strategii dergavy: kontseptualizatsiia, metodologiya, praktyka. *Svit finansiv (TANG), Dergavni finansy v umovakh demokratii, Vip. 1*, 34–48.

**DESIGNING HELICAL SURFACES RELATED TO COORDINATE CURVATURE LINES**

page 30–34

A method of designing surfaces based on a directional helix line is considered in the paper. The surface is formed by means of a moving trihedral, shifting along the directional line with a uniform curvilinear generatrix, located in its normal plane. The main objective of the research lies in developing an analytical description of the surface in the way that its coordinate lines coincide with curvature lines. As on the surface, which is not related to the curvature lines, the search of the latter is resolved itself to setting up differential equations, which generally cannot be solved, the method of designing the surface, a priori related to the network of coordinate curvature lines, is proposed in the paper. The given method allows obtaining parametric equations of a surface with a specified property. For this purpose, the algorithm retains a special turn of a generatrix curve in a normal plane of a moving trihedral shifting along a directional helix line. The obtained results can be used in calculating the strength of shells, as they are simplified significantly in such surface representation. With the generatrix curve of an optional form the obtained surface will be quasi-helical and in the case, when the generatrix is a circle with the center at the top of the moving trihedral, helical, i. e. a tubular surface.

**Keywords:** helical surface, curvature lines, moving trihedral, Frenet formulas, second curvature, curvature.

**References**

1. Stepanov, B. A., Deev, L. V. (2006). Prochnost vintovih gvozdey na vyidergivanie. *Sb. dokladov nauch.-tehn. konferentsii professorsko-prepodavatel'skogo sostava Instituta Stroitelstva i Arhitekturi*. M.: MGSU, 246–250.

2. Lyukshin, V. S. (1978). *Teoriya vintovih poverhnostey v proektirovani rezhuschih instrumentov*. M.: Mashinostroenie, 368.
3. Sakun, V. A. (1970). *Vintovie kompressori*. L.: Mashinostroenie, 400.
4. Hisameev, I. S., Maksimov V. A. (2000). *Dvuhrotornie vintovie i pryamozubie kompressori: Teoriya, raschet i proektirovanie*. Kazan: Fen, 638.
5. Lyulko, V. N. Nekotorie zadachi issledovaniya protsessov szhatiya gaza i sozdaniya novih konstruksiy vintovih kompressornih mashin. *Vestnik SumGU, № 3(49)*, 75–81.
6. Tevlin, A. M. (1962). Vintovoe proektirovanie i ego primenenie dlya resheniya geometricheskikh zadach. *Izvestiya visshih uchebnih zavedeniy, Vip. 2*, 130–141.
7. Ivanov, Yu. N. (1963). *Primenenie vintovogo proektirovaniya k profilirovaniyu sopryazhennih poverhnostey*. Omsk: YuMPI, 115.
8. Schurov, I. A. (1996). Raschet profilya diskovogo instrumenta dlya obrabotki vintovoy poverhnosti. *STIN, № 1*, 19–21.
9. Slav, L. I. (1978). Profilirovanie diskovoy frezi dlya obrabotki vintovoy poverhnosti. *Stanki i instrumentyi, № 5*, 28–30.
10. Tevlin, A. M., Slav, L. I. (1971). Profilirovanie diskovoy frezi dlya obrabotki konicheskoy vintovoy poverhnosti. *Stanki i instrument, № 6*, 30–32.
11. Gaydar, O. G. (2001). Poverhnosti obolochek, otnesennyye k liniyam krivizni. *Trudi mezhdunarodnoy nauchnoy konferentsii «Arhitektura obolochek i prochnostnoy raschet tonkostennih stroitelnih i mashinostroitelnih konstruksiy slozhnoy formi»*. M.: RUDN, 64–69.
12. Lapshin, M. L. (1976). Konstruirovaniye karkasa liniy krivizni poverhnostey tehnikeskoy formy. *Nachertatel'naya geometriya i eyo prilozhenie*. Saratov, 10–12.
13. Skidan, I. A. (1990). Metod nahozhdeniya poverhnostey, otnesennykh k liniyam krivizni. *Prikladnaya geometriya i inzhenernaya grafika, Vip. 49*, 29–32.
14. Skidan, I. A., Ulitska, N. Yu. (2003). Problema vidnesennya poverhni do sitki z liniy krivizni. *Prikladnaya geometriya ta inzhenerna grafika: Pratsi Tavriyskoyi derzhavnoyi agrotehnikhnoyi akademiyi, Vip. 4, T. 19*, 7–14.
15. Mukvich, M. M. (2009). Konstruyuvannya trubchastih poverhon iz prostorovoyu visyuu, opisanih sim'yami koordinatnih liniy krivizni. *Prikl. geometriya ta inzh. grafika, Vip. 81*, 195–200.

**METHOD FOR DETERMINING INTEGRAL INDICATORS QUALITY OF LIFE FOR**

page 35–39

This article provides an analysis of the quality of life, which is determined by the vital potential of society, social groups and individuals, and compliance characteristics of processes, tools, conditions and results of their positive social life needs, values and objectives. For valuation used the following methods: rating method, the method of linear scaling, the method of scoring, the method of assessing the quality of life of the population of the region relative to the group of regions. The variants of aggregate indicators of quality of life, reflecting certain qualitative properties of the system. Quality of life is based on the following principles: a comprehensive assessment; comprehensiveness and universality of the principle of the specificity of the research object. Based on the analysis of quality of life assessment models, proposed an integral indicator of the quality of life, including the following criteria: quality of the population, welfare, social security and environmental quality.

**Keywords:** analysis, model, method, a set of criteria, the assessment of quality of life, integral indicator.

**References**

1. *Materials of the website of the State Statistics Committee of the Russian Federation*. Available: <http://www.gks.ru/>
2. Fromm, E. (1968). *The Revolution of Hope*. New York – Evanston – London, 36.
3. Bazarov, A. G. (2001). *Territorial differentiation of the quality of life of the population of the republic of Buryatia*. Dissertation author's abstract on scientific degree Jobseekers candidate of geographical sciences. Ulan-Ude, 11.
4. In: Pregel, B. (1973). *Maitriser le Futur*. Paris, 47.
5. Gabor, D. (1970). *Innovation: Scientific, Technological and Social*. London: Oxford University Press, 51.
6. Daniel, J. (1971). *Deux idees neuves*. Le nouvel observateur, Vol. X, 4–10.

7. Gavrilova, T. V. (2004). Principles and methods of research quality of life. *Quality of Life Technologies*, T. 4, № 2.
8. Drobysheva, V. V. (2004). *Evaluating the effectiveness of the regional program management quality of life*. TGTU, 174.
9. Zubrilin, Yu. V., Malikov, N. S., Akimova, S. V. (2003). Strategy for improving the quality of life of the region. *Living standards in the regions of Russia*, № 5, 77–78.
10. Szalai, A., Andrews, F. M. (1980). *The quality of life – comparative studies*. Sage, London, 8.
11. Aivazyan, S. A. (2000). *Integral indicators of quality of life: their construction and use of socio-economic governance and inter-regional comparisons*. Moscow: CEMI, 37.

#### THE EFFECTIVENESS OF CORRECTION OF MULTISTAGE WATTMETERS ADDITIVE ERROR

page 40–43

The dependences for the suppression ratios of additive noise of two-, three- and four-stage integrating wattmeters, taking into account the integration efficiency and low and high frequencies influence were considered in the paper. The effect of input variable phase with respect to noise was defined. It is shown that at the alternating noise spectrum, dispersion in readings, caused by the additive error influence at four-stage operation mode will be greater than for instruments, operating at fewer stages. It was determined that the constant drift component is not included in the readings at the four-stage operation mode. It was revealed that for the low-frequency components of the noise signal, the suppression ratio largely depends on the integration time and the noise signal phase. The research results, described in the paper can be applied in the designing high-precision multistage digital wattmeters, in the operation conditions of enterprises, which use secondary switched-mode power supplies for equipment and instruments operation, as well as in the practice of metrological services when performing electrical measuring instruments verification.

**Keywords:** multistage wattmeter, additive error, noise effect, integration period, signal phase.

#### References

1. Sadovskii, H. A. (2009). *Teoreticheskie osnovy informatsionno-izmeritel'noi tekhniki [Theoretical Foundations of information and measuring equipment]*. Moscow: Vyshaia shkola, 241.
2. *Measuring the power of the microwave oscillations*. Available: <http://www.support17.com/component/content/817.html?task=view>. Last accessed 15.01.2014
3. *Use of vector diagrams to analyze asymmetric modes. Power in three-phase circuits*. Available: <http://www.ups-info.ru/?link=160649>. Last accessed 14.01.2014
4. Hubar, V. I. (2007). *Vymiruvannia elektrichnykh parametrov sygnaliv [The measurement of electrical parameters of signals]*. Kyiv: Universytet «Ukraina», 352.
5. Kondratov, V. T., Bohdanova, O. A. (2002). *Metody izmerenia elektricheskoi moshchnosti: osnovnye poniatiia i opredeleniia, klasifikatsiia [Methods of measurement of electrical power: basic concepts and definitions, classification]*. Kyiv, 57.
6. Tuz, Yu. M. (2008). *Strukturnye metody povysheniia tochnosti izmeritel'nykh ustroistv [Structural methods for improving the accuracy of measuring devices]*. Kyiv, 256.
7. Sinitskii, O. P. (1973). *Issledovanie I razrabotka tsyphrovyykh malokosinusnykh vattmetrov s korektsiei pohrechnosti [Research and development of digital a small cosine wattmeter with the correction of errors]*. Kyiv: KPI, 38.
8. Sinitskii, O. P., Tkach, A. P. (2010). Analiz skhemy vattmetra s korektsiei pohreshnosti ot sobstvennogo potrebleniia moshchnosti vkhodnyimi tsepiami [Wattmeter circuit analysis with error correction on its own power consumption of the input circuits]. *Vymiruvanna ta obchysluvalna tekhnika v tekhnolohichnykh protsesakh*, № 1, 67–70.
9. Sinitskii, O. P., Tkach, A. P. (2010). Analiz tsyphrovoho vattmetra s ispolzovaniem raznovremennoho preobrazovanniia vkhodnykh velichin [Analysis of digital power meter using the conversion of input values at different times]. *Vymiruvanna ta obchysluvalna tekhnika v tekhnolohichnykh protsesakh*, № 2, 86–89.
10. Kondratov, V. T. (2009). Fundamentalnaia teoriia izbytochnykh izmerenii: obobshchonnaia struktura i ee osobennosti [Fundamental theory of redundant measurements: a generalized structure and its features]. *Visnyk Khmel'nytskoho universytetu*, № 3, 116–130.

#### MODELS OF DIAGNOSING GAS ANALYTICAL SYSTEMS AND INCREASING THEIR RELIABILITY

page 43–47

The methodology of diagnosing multichannel gas analytical systems (GAS) has been considered, and their operational efficiency has been estimated. The causes of measurement data losses have been analyzed. Modern multichannel GASs are based on the microprocessor systems (MPS), which possess significant options of automating and optimizing the measurement process, and allow processing data rapidly. Therefore, for improving the value of  $W(t)$ , reducing GAS maintenance costs and using MPS effectively, the organization of GAS self-diagnosis becomes economically viable and technically reasonable.

The method of estimating the recovery time of a gas analytical system has been proposed. The dependences of a test signal influence on an output signal of the gas analyzer have been given. A significant aspect of constructing analyzers with test signals is the question of existence, shape and duration of a test gas pulse signal in various pipelines. The solution of a test signal distribution equitation as impurities through pipelines, can serve as the answer to it. The comparison of test and functional diagnosis has been carried out, and average temporal characteristics of operation and restoration of systems have been determined.

**Keywords:** methodology of diagnosis, multi-channel gas analytical systems, measurement data, microprocessor systems (MPS).

#### References

1. Hlazunov, L. P., Smirnov, A. N. (1982). *Proektirovanie tekhnicheskikh sistem diahnostirovaniia*. L.: Enerhoatomizdat, 168.
2. Shibanova, H. P. (1977). *Kontrol' funktsionirovaniia bol'shikh sistem*. M.: Mashinostroenie, 360.
3. Primis'kii, V. P. (2002). Metodolohiia pobudovi avtomatichnykh hazoanalizatoriv z testovim sygnalom. *Metodi ta priladi kontroliu iakosti*, № 9, 60–63.
4. Herasimov, B. N. (1989). *Mikroprotsessornye analiticheskie pribory*. M.: Mashinostroenie, 248.
5. Borodavka, B. N., Bezruk, Z. D., Dashkovsk'kii, O. A., Primis'kii, V. P. and others. (2005). Hazoanalitichnii tekhnolohichnii kompleks z mikroprotsessornoiu sistemoiu. *Patent Ukraini № 65505. Biul 3*.
6. Borodavka, V. P., Dashkovsk'kii, O. A., Vorobiov, S. S., Primis'kii, V. P. and others. (2004). Ekoloho-tekhnolohichnii hazoanalitichnii kompleks. *Patent Ukraini № 64586. Biul 2*.
7. Bezruk, Z. D., Primis'kii, V. P. (2004). Ekoloho-tekhnolohichnii monitorinh pererobki vidkhodiv. *Sbornik materialov Piatoi nauchno-tekhnicheskoi konferentsii «Sovremennye informatsionnye i elektronnye tekhnolohii»*. Odessa, 100.
8. Vizniuk, A. A., Bezruk, Z. D., Primis'kii, V. P. (2004). Sozdanie sistem tekhnoloho-ekolohicheskoho monitorinha ulitizatsii promyshlennykh otkhodov. *Materialy Mezhdunarodnoi konf. Katsiveli, ARK. Materialy i pokrytiia v ekstremal'nykh usloviiakh: issledovanniia, primenenie, ekolohicheskie chistyie tekhnolohii proizvodstva i ulitizatsii izdelii*. Krym, 563–564.
9. Movchan, N. M., Bezruk, Z. D., Dashkovskii, A. A., Primiskii, V. F. and others. (2005). Instrumental'nyi kontrol' vybrosov v atmosferu kievskoho musoroszhihatel'noho zavoda «Enerhiia». *Materialy II nauch.-prakt. konf. s mezhdunar. uchastiem. Sotrudnichestvo dlia resheniia problemy otkhodov*. Khar'kov, 250.
10. Bezruk, Z. D., Movchan, N. M., Dashkovsk'kii, O. A. (2005). Hazoanalitichni sistemi promislavoho monitorinh. *Materialy z shostoii mizhnarodnoi nauch.-prakt. konf. Suchasni informatsiini i elektronni tekhnolohii*. Odessa, 391.

#### MAXIMUM VALUES OF TOTAL DIFFERENTIALS AND LINEAR HULLS OF BLOCK SYMMETRIC CIPHERS

page 47–52

The approach to obtaining the estimates of provable block symmetric ciphers security against differential and linear cryptanalysis attacks, represented by the maximum values of differential and linear probabilities of multi-cycle enciphering transformations is proposed in the paper. The main objective of the research is to obtain the design ratios to calculate these indicators. As it is known, today these indicators are represented as estimated values, significantly differing

from true that was determined using the new methodology for estimating the indicators of provable block symmetric ciphers security against differential and linear cryptanalysis attacks, developed recently. The basic mathematical apparatus of the random permutation theory is described, and the calculation results of provable security indicators, obtained using this mathematical apparatus for ciphers with 128-bit input, and in particular for the cipher Rijndael and ciphers, presented at the recent Ukrainian competition are given in the paper. The obtained results allow to obtain more objective data on ciphers security indicators, which can be used for improving the quality of expert solutions and conclusions on the improvement degree of the projects, submitted to the contest, as well as for selecting new promising solutions and developments on building ciphers. It is concluded that all these ciphers have the same parameters both for the differential and linear properties, almost equal to  $2^{-121}$ .

**Keywords:** random permutation, block symmetric ciphers, provable security indicators.

#### References

1. Lysytska, I. V. (2011). Methodology for assessing resistance block symmetric ciphers. *Automatic control systems and automation devices*, № 163, 123–133.
2. Lysytska, I. V. (2012). A comparison of the effectiveness of superblocks some modern ciphers. *Radioelektronika. Informatika. Upravlinnya*, 1(26), 37–43.
3. Gorbenko, I. D., Dolgov, V. I., Lysytska, I. V., Olejnikov, R. V. (2010). The new ideology evaluate resistance block symmetric ciphers to differential attacks and linear cryptanalysis. *Applied electronics*, T. 9, № 3, 212–320.
4. Lysytska, I. (2012). *Methodology for assessing resistance block symmetric kriptopreobrazovany based on reduced models*, 284–293.
5. Baignoires, T., Vaudenay, S. (2004). *Proving the Security of AES Substitution-Permutation Network*, 16. Available: <http://lasecwww.epfl.ch>
6. Keliher, L. (2007). Toward Provable Security Against Differential and Linear Cryptanalysis for Camellia and Related Ciphers. *International Journal of Network Security*, Vol. 5, No. 2, 167–175.
7. Keliher, L., Meier, H., Tavares, S. (2001). New method for upper bounding the maximum average linear hull probability for SPNs. *Advances in Cryptology. EUROCRYPT 2001, LNCS 2045*. Springer-Verlag, 420–436.
8. Keliher, L., Meijer, H., Tavares, S.; In: Vaudenay, S., Youssef, A. M. (2001). Improving the upper bound on the maximum average linear hull probability for Rijndael. *Advances in Cryptology, Selected Areas in Cryptography '01, LNCS 2259*. Springer-Verlag, 112–128.
9. Alekseychuk, A. N., Kovalchuk, L. V., Skrypnyk, E. V., Shevtsov, A. S. (2008). Evaluate the feasibility of resistance block cipher «Kalina» relative difference methods, linear cryptanalysis, and with respect to algebraic attacks based on homomorphisms. *Applied electronics*, V. 7, № 3, 203–209.
10. Sano, F., Ohkuma, K., Shimizu, H., Kawamura, S. (2003). On the Security of Nested SPN Cipher against the Differential and Linear Cryptanalysis. *IEICE Trans. Fundamentals*, E86-A, No. 1, 37–46.
11. Oleinikov, R. V., Oleshko, O. I., Lisitskiy, K. E., Teviashev, A. D. (2010). Differential properties of substitutions. *Applied electronics*, T. 9, № 3, 326–333.
12. Dolgov, V. I., Lysytska, I. V., Oleshko, O. I. (2010). Properties of linear approximation tables of random permutations. *Applied electronics*, T. 9, № 3, 334–340.
13. O'Connor, L. J.; In: Helleseht, T. (1994). On the Distribution of Characteristics in Bijective Mappings. *Advances in Cryptology. EUROCRYPT 93, Lecture Notes in Computer Science*, Vol. 795. Springer-Verlag, 360–370.
14. O'Connor, L. (1995). Properties of Linear Approximation Tables. *Fast Software Encryption Lecture Notes in Computer Science*, Vol. 1008, 131–136.
15. Lysytska, I. V. (2011). Property distribution laws XOR tables and tables of linear approximations of random permutations. *News Harkivskogo natsionalnogo universitetu imeni V. N. Karazina*, № 960, Vip. 16, 196–206.
16. Daemen, J., Rijmen, V. (2006). *Probability distributions of Correlation and Differentials in Block Ciphers*, 1-38. Available: <http://eprint.iacr.org/2005/212.pdf>