ABSTRACT&REFERENCES

MATHEMATICS AND CYBERNETICS - FUNDAMENTAL AND APPLIED ASPECTS

APPLICATION OF BOX METHOD FOR MULTI-OBJECTIVE OPTIMIZATION (p. 4-8)

Anatolii Danilkovich, Slava Branovitskaja, Sergii Bondarenko, Olga Sanginova

The article presents a criterion of optimality in the form of a generalized additive objective function to optimize the chrome tanning of the semi-finished product. Local criteria of the objective function are normalized and reduced to dimensionless form. Weight factors are obtained on the bases of expert assessments. To solve the problem of multi-objective optimization a complex Box method was used.

The algorithm of the Box method serves as a basis for the software module, which is implemented using object-oriented programming language Visual Basic for Application.

The software module provides an opportunity to work with explicit and implicit restrictions. The developed software module was used to find the optimal values of the generalized objective function.

For low-waste technology of tanning of semi-finished product with dry chrome tanning agent we obtained its mathematical description and determined restrictions on technological parameters of the process. The problem of optimization of the process of dry chrome tanning of semi-finished product was solved and the optimal values of the parameters of the process of tanning were determined

Keywords: optimization, optimality criterion, restrictions, objective function, mathematical description, regression equation

References

1. Ostrovsky, G. M., Berezhinsky, T. A. (1984). Optimization of chemical processes. Theory and practice.Chemistry, 240.
2. Bundy, B. (1988). Methods of optimization. Introductory course [Text] Translated from English. Radio and Communications, 129.
3. Danylkovych, A. G. (2001). Features hidroksosulfatohromovyh complex interactions with collagen. Bulletin KDUTD, 1, 151-153.
4. Danylkovych, A. G., Gryschenko, I. M., Lishchuk, V.I. [et al.] (2012). Innovative technology of leather and fur materials and products: monograph. Phoenix, 344.
5. Danylkovych, A. G., Lishchuk, V. I., Plavan, V. P., Kasian E. E., Zhyhotskyy, O. H. (2011). Environmentally oriented technology of leather and fur materials to create competitive products [in Part 2]: monograph, Part I. Phoenix, 437, [3].
6. Danilkovich, A.G., Omelchenko, N. V., Shahnovsky, A. M. (2012). Optimization of composition for repelling elastic materials. News KNU, 1, 74-78.
7. Lishchuk, V.I. Voitsekhovska, T.G., Danylkovych, A.G. (2007). Use of multi-objective optimization to find a compromise area ashing process. Light Industry, 1, 37-39.
8. Danylkovych, A. G, Brayilko, A., Omelchenko, N. (2010). Improving the quality of secondary coverage by optimizing the coating composition / A.G. Danylkovych, / Bulletin of KNU, 3, 129-134.
9. Danilkovich, A. G. (2010). Basic scientific research in higher education. KNUTD, 296.
10. Danylkovych, A. G. Petran, A. G. (1999). Development of technology for dry tanning nedvoyenoyi holyny and its multicriteria optimization. Bulletin of the State Acad. Light Ind.'s Ukraine, 2, 170-173.
11. Himmelblau, D. (1975). Applied Nonlinear. Academic Press, 534.

MATHEMATICAL MODELLING OF DIFFUSION PROCESSES In THE shale gas EXTRACTING TECHNOLOGY realization (p. 9-13)

Andrij Olijnyk, Lida Shtayer, Oksana Klaposhchak

The article studies the problem of evaluation of the penetration of substances into the environment during implementation of technology of shale gas extraction, as well as the current state of research in this area.

A mathematical model of diffusion based on two-dimensional unsteady diffusion equation in Cartesian coordinate system, taking into account a variable diffusion coefficient, initial and boundary conditions that take into account features of the technology of shale gas extraction.

A numerical method of the model realization based on the method of variable directions was suggested. The stability of corresponding difference schemes using spectral characteristics of stability was studied.

The method of mathematical formalization of boundary conditions that permit to simulate various intensities and duration of emissions was suggested. A numerical algorithm for solving the problem was developed and its implementation was carried out in the form of complex applications. For the model parameters test calculations were performed that showed correspondence of simulation results with the actual physical picture of the process. The geometric characteristics of the zone of penetration of substances in the test environment were determined.

The features of filtration of substances with the variable diffusion coefficient in a region and the various intensity of substances emission were studied. The value of the zone of emission of substances in the studied model area was assessed, the directions for future research were determined

Keywords: shale gas, diffusion, equations of mathematical physics, stability of calculations, sweep method, concentration

References

1. Garilov T.G. (2006). The modeling of hydraulic fracture in poroelastic medium. Matematical modeling, 18(6), 53-69.
2. Gorodetskaja N.S. (2007) Waves in the liquid saturated poroelastic media Acoustic bulletin, – 10(2), 46-63.
3. Karev V.M., Kovalenko U.F., Odintsev V.N. (1995) Hydro-mechanical effects on the gas-impulse fractured-porous rock with hydraulic borehole. The physics and technical problems of the mineral resources development, №6, 70-83.
4. Puchkov L.A. (2002) The methane extraction from the coal seams. Moscow, Russia: Moscow State Technical University.
5. Tabachenko M.M and others. (2012) Physics and Chemistry Geotechnology. Manual – Dnipropetrovsk: National Mining University.
6. Boger C., Kieschnick I., Lewis R. E. Waters G. (2006) Production gas from its source. Oilfield Review, Autumn 2006, 36-49.
7. Zhao C., Villippan S. (1995) Finite element modeling of methane gas / Migration in coal seams, Computers and structures. 55(4), 625-629.
8. Rice J. R., Cleary M.P. (1992) Some basic stress-diffusion solutions for fluid-saturated elastic porous media with compressible constituents, Reviews of Geophysics and Space Physics, (14), 227-241.
9. Thermal diffusion problems and solution methods (editor Ljashenko V.P.) (2012). Kremenchuk : National State University named after M. Ostrogradskij.
10. Bulgakov V.K., Kodolov V.I., Lipanov A.M. (1990) The polymeric materials combustions modeling. Moscow: Chemistry.
11. Dijachenko V.F. (1997) The basic concepts of computational mathematics. Moscow: Nauka.

METHOD OF PREDICTING THE WATER LEVEL IN THE RIVER DNIESTER, DEPENDING ON WEATHER CONDITIONS (p. 13-19)

Mikhail Gorbiychuk, Maryana Shufnarovich

This article describes a new method of constructing mathematical models of complex oscillatory processes with non-multiple

frequencies, based on the ideas of genetic algorithms. Compared with existing methods of creating mathematical models of complex processes considered in the works of Academician O.G.Ivakhnenko and his students, this method allows the synthesis of mathematical models of any complexity. Using the ideas of genetic algorithms to the construction of mathematical models provides an opportunity not only to choose the optimal structure of an adequate model, but also significantly reduce the number of calculations at search patterns.

Therefore, the new method can be used to predict how the physical phenomena and complex processes. Effectiveness of the developed method has been confirmed by the model of change of the water level in the river Dniester, depending on weather conditions.

The model constructed by the water level in the river Dniester gives sufficiently accurate prediction results. The author suggests that the model can be used for flood forecasting

Keywords: synthesis of mathematical models, genetic algorithm, chromosome, external criterion, aliquant frequency, harmonic series, prediction accuracy

References

1. Box G., Jenkins J. (1974) Time Series Analysis. Forecast and Control. Moscow: Word.
2. Ivakhnenko A. G. (1981) The inductive method of self-organizing models of complex systems: the monograph. Kyiv: Scientific thought.
3. Gorbiychuk M. I.. Shufnarovich M. A. (2010) Method pobudovi mathe models Folding protsesiv in ambushes genetichnih algoritmiv. Artificial intellect, 4, 50-57.
4. Wierzbicki V. M. (2002) Basics of numerical methods: a textbook for high schools. Moscow: High school.
5. Ivachnenko A. G., Kopp J. V., Stepashko V. S. and others. (1980) Reference model simulation programs. Kyiv: Tehnika.
6. Rutkovska D, Pilinsky M, Rutkowsky L. (2004) Neural networks, genetic algorithms and fuzzy systems. Moscow: Hotline – Telecom.
7. Ivakhnenko A. G., Stepashko V. S. (1985) Modeling Immunity: monograph. Kiev: Scientific thought.
8. Gorbiychuk, M. I.. Kogutyak, M. I. Zayachuk Y. I. (2008) Induktivny method pobudovi mathe-models gazoperekachuval them agregativ natural gas. Naphtha i gaseous promislovist, 5, 32-35.
9. Ermakov S. M., Zhiglyavskii A. A. (1987) Mathematical theory of optimal experiments. Moscow: Science.
10. Ivakhnenko A.G, Muller Y.A. (1985). Self-organization of predictive models. Kyiv: Tehnika.

MARKOV MODEL OF UNSTEADY FLOW ELIMINATION OF ACCIDENTS IN RESTRICTIONS ON THE PERFORMANCE OF THE OPERATOR (p. 20-23)

Igor Naumeyko, Al-Azawi Razi Jabur, Alrefai Waleed Ahmed

The actual problem of simulating the operation of the "Man-Machine-Environment" system, that is the process of the object recovery after the environmental disaster is considered, provided the recovery is made by one of its sub-systems, that include humans. The model differs significantly from the classical theory of reliability.

The work is devoted to modeling of multi-step restoration process of an arbitrary nature object with non-stationary Poisson stream of events (accidents) and exponential intensity of recovery process. It passes a fixed finite sequence of phases - the states and is described by the Kolmogorov probabilities for these states. The cases of ergodic and absorbing chains with continuous time are considered.

Some of the states in the chain indicate the efficiency of the operator in elimination the accident. It is assumed that the efficiency of the operator can not recover during the process of eliminating accidents.

According to the verbal descriptions of the object, graphs of states are drawn, and in accordance to them – the Kolmogorov equations and their stationary solutions. The resulting figures of numerical solutions allow us to determine the time of the process stabilization.

For actual input data the following resulting probabilities are obtained: for trouble-free operation of the facility, for a fatal accident and for disaster recovery

Keywords: Markov chain, Kolmogorov differential equations, the maximum entropy, ergodic, disasters, Erlang

References

1. Dzyundzyuk B.V., Naumeyko I.V. , Serduk N., Stytsenko I.E. (2007). Structure and types of system models "man-machine-environment" .Automated Control Systems and Devices - Kharkov MY. 138. P. 47-50.
2. Naumeyko I.V., Serduk N. (2005).Markov model system "man - machine - environment" . Electronics and Computer Science, Kharkov, vol. 4.
3. Naumeyko I.V., Al-Azawi R.J. (2013). Model systems "Man-Machine-Environment" with the recovery in the non-classical event streams .East European Journal of advanced technology, Kharkov, № 2 \ 10(62) ,P. 55-58.
4. Naumeyko I.V., Al-Azawi R.J. (2013). Another dynamic model of Markovian Human-Machine-Environment system that is effected by some hazard . Radio Engineering, № 172, Kharkov (in press).
5. Al-Azawi R. J. (2013). A dynamic model of Markovian Human-Machine-Environment system that is effected by some hazard . conference :Innovation Potential of Ukrainian science - the twenty-first century, Kharkiv, Vol. 20 (in press).
6. Sevastyanov B.A. (1959). Erlang formula in telephone for an arbitrary distribution law for the duration of a call . Proceedings of the III All-Union Mathematical Congress. T.IV Moscow: USSR Academy of Sciences.
7. Khinchin A.Y. (1963). work on the mathematical theory of queuing .Edited by Gnedenko. Moscow: Fizmatgiz, p. 236.
8. Ivchenko G.I., Chestnuts V.A., Kovalenko I.N. (1982). Queueing theory . High School, 256 p.
9. Beckenbach E., Bellman R. (1965). Inequalities. World.
10. Samojlenko A.M. (1989). Differential equations . High School, 383 p.

FUZZY DISTANCES AND THEIR APPLICATIONS ON FUZZY SCHEDULING (p. 23-30)

Hanan A. Cheachan, Hussam A.A. Mohammed, Faria A. Cheachan

The aim of this paper is to develop a fuzzy scheduling problem for solving a multi-objective functions on single machine scheduling problems when processing time and due date are a triangular fuzzy numbers.

We are used fuzzy distance function concepts which introduced by Lam and Cai.

The objective is to minimize the maximum fuzzy lateness and maximum fuzzy completion time. In this paper we compare and test different local search methods (Threshold accepted (TA), Tabu search (TS), and Memetic algorithm (MA)) computational experience 1000 jobs with reasonable time. For comprise results we use probability and cost considerations in project scheduling

Keywords: fuzzy scheduling problem, single machine scheduling ,local search methods (Threshold accepted (TA), Tabu search (TS), and Memetic algorithm (MA))

References

1. Brucker P. (2007). "Scheduling Algorithms", Springer Berlin Heidelberg New York, Fifth Edition.
2. Chanas, S., Kasperski, A. (2001). "Minimizing maximum lateness in a single machine scheduling problem with fuzzy processing times and fuzzy due dates", Engineering Application of Artificial Intelligence, 14, 377-386.
3. Chanas, S., Kasperski, A. (2003). "On two single machine scheduling problems with fuzzy processing times and fuzzy due dates", European Journal of Operational Research, 147, 281-296.
4. Dubois, D., Prade H. (1980). "Fuzzy sets and systems: theory and applications", Academic press, Inc.

5. França P. M. (1999). Mendes A. and Moscato P., "A memetic algorithm for the total tardiness single machine scheduling problem" European Journal of OR.
6. Glover F. (1994). "A user's guide to tabu search", Annals of Operations Research, 41, 3-28.
7. Goguen J. (1973). "The Fuzzy Tychonoff Theorem", J. Math. Anal. Appl, 43, 734-742.
8. Han, S., Ishii, H., Fujii, S. (1994). "One machine scheduling problem with fuzzy due dates", European Journal Operation. Research, 79, 1-12.
9. Heilpern, S. (1997). "Representation and application of fuzzy numbers", Fuzzy Sets and Systems, 91, 259-268.
10. Hussam, A., Faria, A., Hanan, A. and Fathalh, A. "On Fuzzy Distances and their Applications on Cost Function $\tilde{L}_{max}\left(\tilde{C}_j,\tilde{D}_j\right)$, to appear.
11. Ishii, H., Tada, M. (1995). "Single machine scheduling problem with fuzzy precedence relation", European Journal of Operational Research, 87, 284-288.
12. Kaufmann, A., Gupta, M. (1991). " Introduction to fuzzy arithmetic theory and applications", Van Nostrand Reinhold.
13. Lam, S., Cai X. (1999). "Distance measures of fuzzy numbers computational intelligence and applications", Springer, Berlin, 207-214.
14. Lam, S., Cai, X. (2002). "Single machine scheduling with nonlinear lateness cost functions and fuzzy due dates nonlinear analysis ", Real World Application, 3333, 307-31.
15. Moscato, P. (1989). "On evolution, search, optimization, genetic algorithm and martial arts: toward memetic algorithms", Caltech Concurrent Computation Program c3p Technical Report, California, 826.
16. Nachammai, A. (2012). "Solving fuzzy linear Fractional programming problem using Metric distance Ranking", Applied Mathematical Sciences, 6, 1275-1285.
17. Tanaka, K., Vlach, M. (1997). "Single machine scheduling with fuzzy due dates", Seventh IFSA World Congress Prague, 195-199.
18. Zadeh, L. (1965). "Fuzzy sets" Information and Control, 8, 338-353.

THE TREATMENT OF CHARACTERISTICS OF GROUNDWATER LEVEL CHANGING VIA THE MATHEMATICAL MODELING (p. 30-35)

Olena Strelnikova, Olena Sierikova

To calculate the uniform rise of ground waters level throughout Kharkov and to determine a year of flooding of the urban areas a mathematical model has been developed. It takes into account the following components of the water balance: additional infiltration into ground waters, precipitation, infiltrating into ground waters, transpiration, evaporation, water taking from ground waters. To calculate the time after which the water level will reach the norm of drainage it is sufficient in this model to take as a point of reference a specific depth of the groundwater level at a particular area and set the size of the investigated area.

The developed approach permits to apply numerical methods of assessment to predict the changing of the groundwater level in urban areas, taking into account various natural and anthropogenic factors

Keywords: additional infiltration, flooding of urban areas, mathematical model

Referenses

1. Strigelchik, G., Sokolov, Y., Goldfeld, I., Chebanov, A., Nikolenko, N. (2003) Podtoplenie v naselennih punktah Kharkovskoi oblasti (Underflooding at the urban settlements of Kharkiv region), Kharkiv. 160 p.
2. Sierikova, E.N., Yakovlev, V.V. (2012) Rol upravlencheskih metodov v predotvrashenii podtopleniya gorodov (The Role of Manage Techniques in the Cities Flooding Prevention), Kharkiv, Building Univ, 68, 382-387.
3. Polubarinova-Kochina, P.Ya. (2003) Razvitie issledovanij po teorii filtratsii v SSSR (1917-1967) (Development of Research in the Theory of Filtration in the USSR(1917-1967), Moscow, 546 p.
4. Averyanov, S.F. (1956) Filtratsiya iz kanalov I ee vliyanie na regim gruntovih vod (Infiltration from the Channels and its Impacting on the Groundwater Regime), Moscow, 85-447.
5. Averyanov, S.F. (1982) Filtratsiya iz kanalov I ee vliyanie na regim gruntovih vod (Infiltration from the Channels and its Impacting on the Groundwater Regime), Moscow, 238 p.
6. Sierikova, E.N. (2012) Matematicheskoe modelirovanie povisheniya urovnya gruntovih vod pod vozdeistviem dopolnitelnoi infiltratsii (Mathematical Modeling of the Groundwater Level Rising Under the Influence of Additional Infiltration), Easten-European Jornal of Enterprise technologies №6/4 (60). Kharkiv, 26-33.
7. Sierikova, E.N., Yakovlev, V.V. (2011) Dopolnitelnya infiltratsiya v podzemnie void na territorii krupnih gorodov (na primere g. Kharkova) (Additional Infiltration to Underground Waters of Big Cities Territory (for Example Kharkiv Regione), Kharkiv, KNAME, 344-348.
8. Shestopalov, V.M. (1989) Vodoobmen v gidrogeologicheskih strukturah Ukraini (Water Exchange in the Hydrogeological Structures of Ukraine), Institute of Geological Sciences of the Ukrainian SSR, Kiev, 286 p.
9. (1962) Transpiratsia i ee znachenie v gizni rastenij (Transpiration and Its Importance in the Life of Plants), Leningrad.
10. Sleicher, R. (1970) Vodnij regim rastenij (Water Treatment Plants) Moskow, 368 p.
11. Rubin, B. (1971) Kurs fiziologii rastenij (Course of Plant Physiology) 3rd ed Moskow, 672 p.
12. Postanova KMU "Pro zatverdgennya poryadku vedennya dergavnogo vodnogo kadastru" (CMU Resolution "On approval of the management of the state water cadastre") 08.04.1996 N 413.

MATHEMATICAL MODELING OF THE SEASONAL CHANGES OF PHYTOPLANKTON DEVELOPMENT IN THE WATER „VIDSICHNE" THE RIVER TETERIV (p. 36-39)

Ella Arystarkhova, Igor Pilkevych

Despite the wide application of mathematical modeling to determine the characteristics of phytoplankton growth in basins, until now there had not been created sound mathematical models that would take into account the diversity of groups of planktonic algae for the basins of the river Teterev. Based on the research conducted in 2006-2008 the article approximates the growth of six groups of phytoplankton of water intake "Vidsichne" using the polynomial of the 6th degree and the basic criteria of the adequacy of mathematical models.

The method of consolidation of intervals and replacement of the original number by medium-range intervals was applied in the research.

To construct mathematical models the smoothing using moving average was carried out.

As a result of processing of the data the major pathogens of "bloom" of water among groups of planktonic algae were revealed and the most dangerous periods of water pollution with their metabolites were identified.

The research provided mathematical models that describe the dynamics of the growth of phytoplankton in the water intake, and multiple correlation coefficients, indicating the adequacy of these models

Keywords: phytoplankton, seasonal changes, anthropogenic eutrophication, "bloom" of water, mathematical model

References

1. Topachevsky, A.V., Masiuk, N.P. (1984). Freshwater algae of the Ukrainian Soviet Socialist Republic, Kiev: Vyssha shkola, Head of publishing house, 336 p.
2. Shcherbak, V.I. (1999). Phytoplancton as a Model Object of Evaluating the Influence of Power Complexes on Water Ecosystems. Engineering Simulation, Vol. 16, P. 513-519.
3. Romanenko, V.D. (2004). The fundamentals of hydro-ecology [Heat transfer], Kiev: Heneza, 664 p.
4. Masiuk, N.P., Kostikov, I.Yu. (2002). Algae in the system of the organic world [monograph], Kiev: Academic periodicals, 178 p.
5. Khoruzhaia, T.A., Nikanorov, A.M. (2003). Global ecology [Manual], Moscow: Publishing House „Kniga servis", 288 p.
6. Ken, O. (1987). Buesseler Chernobyl: Oceanographic Studies in the Black Sea. Oceanus, 30, № 3, P. 23-30.

7. Yerkhard, Zh.P., Sezhen, Zh. (1984). Plankton. Composition, ecology, pollution [Translation from French], Leningrad: Gidrometeoizdat, 256 p.
8. Herasimenko, S.S., Holovach, A.V., Yerina, A.M. (2000). Statistics [Tutorial], Kiev: KNEU, 467 p.
9. Ovchinikov, P.P., Bondarchuk, Ye.V., Kostrytsia, Yu.Yu., Onishchenko, L.P. (2004). Higher mathematics. In 2 hours. Part 2: Differential equations. Operational calculus. Series and their application. The stability of the Lyapunov. The equations of mathematical physics. Optimization and control. The theory of probability. Numerical methods [Tutorial], Kiev: Technique, 792 p.
10. Hryhorkiv, V.S. (2007). Modelling of ecological and economical interaction [Tutorial], Chernivtsi: Ruta, 84 p.

ADDITION AND MULTIPLICATION PROBABILISTIC ARITHMETIC OPERATION EXECUTION ERROR ESTIMATION (p. 40-42)

Nikolay Sapoznikov, Dmitrii Moiseev, Peter Beyner, Nadezhda Beyner

The most important efficiency component characteristics of information-measuring systems used in nuclear engineering for radiation and gas monitoring, environmental protection and ecological monitoring are survivability, reliability, accuracy while the original information presentation, ability to operate in real time mode, equipment cost, designing cost, production and operation costs.

Probabilistic information representation form corresponds to all these characteristics.

It is necessary to ensure the implementation of the reforms within the permitted tolerances. This article is devoted to the addition and multiplication probabilistic calculation theoretical errors estimation.

The main value of the paper is providing the ground to the choice of the number of statistical tests, which determines the maximum value of the absolute error.

The article reveals the factors influencing the accuracy of addition and multiplication probabilistic arithmetic calculations, the number of statistical tests, distribution law of auxiliary random signals, position of converted values within the dynamic range and probabilistic conversion method being among these factors

Keywords: probabilistic form of representation, arithmetic operations, accuracy, error

References

1. Gladkiy, V. S. (1973) Probabilistic computing models. - Moscov.: The science, 300.
2. Sapozhnikov, N. E., Khaykov, V. l. (1992). Mathematical modeling of probabilistic processors with a computer: - Sevastopol. 24 –28.
3. Moiseev, D. V., Sapozhnikov, N. E. (2010) About the method of high precision probabilistic spectrometer constructing. - Sevastopol: SNUNEI, 2010. - № 2(34), 209-215.
4. Sapozhnikov, N. E. (1983). To the question of probabilistic information conversion. Engineering. . – Issue 34.31-38.
5. Sapozhnikov, N. E. (1991). To the question of addition operations on the probability transformed signals. Materials of the All-Union school-seminar “Transfer, processing and display of information”. - Teberda - Kharkov. 25 - 28.
6. Sapozhnikov, N. E. (1992). Probabilistic adder. Approaches in improving the professional development of high school graduates - Sevastopol. 53 - 54.
7. Sapozhnikov, N. E. (1997). Comparative evaluation of methods of probabilistic information conversion. Vestnik SevNTU. Computer science, electronics, and communications. - Sevastopol: SevNTU. - № 5. 37 - 41.
8. Sapozhnikov, N. E. (1993). About the error nature when multiplying the nonlinear converted values. Combat effectiveness increase, tactical and weapon technical characteristics and navy equipment efficiency increase: - Sevastopol. 130 - 133.
9. Sapozhnikov, N. E. (1992). Probabilistic adder. Approaches to the high school graduates professional skill improvement. - Sevastopol. 47 - 49.
10. Sapozhnikov, N. E. (1997) Comparative evaluation of probabilistic converted signals addition methods. SevGTU, Mechanics, power engineering, ecology.- N6, 89-95.

MATHEMATICAL INTERPRETATION OF THE MASS TRANSFER PROCESS IN ANAEROBIC BIOREACTORS (p. 43-48)

Ludmila Ruzhinska, Anastasiya Fomenkova

The article considers the methanogenesis in bioreactors with immobilized microflora on fixed media. The processes of decomposition of organic pollution of the wastewater and the formation of metabolic products are analyzed.

t the same time, the decomposition of organic pollution is considered from the standpoint of a two-stage process. As the first stage, the hydrolysis and acid production is considered, as the second - methanogenesis.

On the basis of this process the spatial distribution of acid and methanogenic microorganisms in the anaerobic bioreactor has been suggested, and a model of mass transfer in a bioreactor has been built.

As a calculated model, the motion of the fluid in the channel formed by sheets of biofilm carrier was taken.

At the two-dimensional motion of a fluid in a channel, 2 types of the main substances mass transfer are considered, which are involved in the process of anaerobic digestion: by the convective diffusion in the core of the flow and by the molecular diffusion in the boundary wall layer and biofilm

Keywords: biogas, immobilized microflora, bioreactor, mathematical model, mass transfer

References

1. Ruzhinskaia L.I., Fomenkova A.A. (2012) Polymeric microflora supports in anaerobic biofilter VI International Scientific and Technical web-conference «Composite Materials», p.
5. Ruzhinskaia L.I. Baranova I.G. (2006). Anaerobic digestion model in bioreactor with immobile microflora support. Vol №2. pp.84-87.
6. Kasatkin A.G. (1971). General processes and apparatus of chemical technologie 784 p.
7. IWA Task Group on Biofilm Modelling, Hermann Eberl (2006) Mathematical Modeling of Biofilms, 179 p.
5. R. Moletta , D. Verrier, G. Albagnac (1986). Dynamic modeling of anaerobic digestion. Water Research, Vol. 20-4, pp. 427-434.
6. G. Kiely , G. Tayfur , C. Dolan, K. Tanjf (1997). Physical and mathematical modelling of anaerobic digestion of organic wastes. Water Research, Vol. 31-3. – pp. 534-540.
7. Misak I.C., Gnatishin Ya. M., Shumskii T.B. (2003). Technologies anaerobic digestion of organic wastes review. The problem of saving energy, pp. 188-189.
8. Semenenko I. V. (1996). Biogaz installation projecting. 347p.
9. Victor Alcaraz Gonzalez (2001). Estimation et commande robuste non-lineaires des procedes biologiques de depollution des eaux usees : application a la digestion anaerobie. 270 p.
10. Kaluzhnii S.V. (2004). High-intensity anaerobic technology for industrial wastewater treatment. Catalysis in Industry Vol. 6, pp. 42-50.
11. Hansruedi Siegrist , Dea Vogt , Jaimel Garcia-Heras , Willig Ujer (2002). Mathematical model for meso- and thermophilic anaerobic sewage sludge digestion. Environ. Sci. Technol. Vol.36, p. 1113-1123.
12. Denis Dochain, Peter Vanrolleghem (2001). Dynamical Modelling and Estimation in Wastewater Treatment Processes, 342p.
13. Anaerobic Digestion Model No.1 (ADM1) / Task Group for Mathematical Modelling of Anaerobic Digestion Processes - IWA Publishing, 2002 – 80p.

METHOD OF IDENTIFICATION OF DEDICATED COMPUTER NETWORKS FOR COMPUTER SYSTEMS OF OBJECTS OF OIL AND GAS COMPLEX (p. 48-51)

Sergiy Babchuk

For many years the automation systems used to be constructed on the basis of analogue devices. However, in the conditions of rap-

idly growing production of micro processing systems, multiple nodes dedicated computer networks that digitally exchange data emerged as an alternative solution.

Nowadays, the companies of the world use more than hundred different dedicated computer networks. During modernization period the companies need to choose optimal decisions for specific technological areas. However, at present time, methodological background for effective solution of mentioned problem practically does not exist. There has been done research of the existing dedicated computer networks. \

We have developed classification of dedicated computer networks that can be used on the objects of oil and gas complex. Also, there was created selection algorithm of dedicated computer network for computer systems of the objects of oil and gas complex. We have developed method of identification of dedicated computer networks for computer systems of objects of oil and gas complex.

Thus, we have created a methodological background that will assist enterprises in their choice of optimal decisions for specific technological areas

Keywords: dedicated computer networks, method, classification, algorithm, oil and gas complex

References

1. Sakhniuk, A. (2004). Industrial networks. Advanced Technologies and Technical Solutions, 2, 6-8.
2. Satynarayana, S., Sailaja, M. (2012). Performance of H1 network ing wind turbine generator with Foundation Fieldbus. International Journal of Engineering Science and Technology, 4, 27-32.
3. Zhu, S. (2009). Study of practical DNC system based on CAN Fieldbus. Journal of Dalian Jiaotong University, 30, 9-12.
4. Swider, Z., Mikluszka, W., & Rzonca, D. (2005). The integration of CAN and Modbus protocols in a distributed control system. PAK, 1, 21-24.
5. Chauhan, A., Mahajan, A. (2011). Designing of Modbus for continues process control. International Journal of Advanced Engineering Science and Technology, 3, 24-28.
6. Vaijapurkar, S., Kate, S. (2012). Implementation strategy for optical fiber Modbus-TCP based nuclear radiation detection instrument for nuclear emergency. International Journal of Engineering Trends and Technology, 3, 462-465.
7. Peng, J., Shu, Z., & Ying Q. (2009). Application of IEEE 802.1P in Industrial Ethernet. Journal of Nanchang University Engineering & Technology, 31, 49-52.
8. Kruhliak, K. (2002). Industrial networks: objectives and means. Modern technologies of automation, 4, 6-17.
9. Sakhniuk, A. (2004). Internetwork interrelation in industrial networks. Advanced technologies and technical solutions, 3, 6-11.
10. Sementsov, H. (1999). Automation of the process of well drilling: study guide. IFSTUOG, 300 P.
11. Babchuk, S. (2009). Classification of industrial computer networks. Eastern-European Journal of Enterprise Technologies, 4, 14-17.

NON-ADDITIVE MODEL OF THE H-MEASURES (p. 51-57)

Vladimir Kasyanov

The article suggests a model of a non-additive H-measure, where uncertainty is related to the entropy of preference or subjective probabilities.

The model of the H-measure is well linked with the Jaynes principle of maximum of entropy, as well as with the principle of maximum of subjective entropy.

It is proposed to use the H-measure in tasks of subjective analysis, which studies the genesis of the distributions of preferences, and is its natural development. In the article we propose the model of the non-additive measure similar to the measure of Sugeno, but as it seems to the author, more natural, as it is directly related to the measure of uncertainty in the distribution of preferences, namely, the entropy of preferences.

In addition, this measure (called H-measure) is well linked with the Jaynes principle of maximum of entropy, originally formulated for probability distributions, therefore, in the frameworks of the theory of the additive probability measure. The measure of Sugeno seems rather artificial. You never know how the additional term reflects the uncertainty of the situation. On the other hand, the measure of uncertainty is the entropy, in this case the entropy of preferences, which is called the subjective entropy of preferences, and the corresponding variation principle – the principle of maximum of subjective entropy. In the fuzzy set theory there is uncertainty in the choice of fuzzy distributions. The theory does not give direct selection algorithms of these distributions, which are of heuristic nature

Keywords: H-measure, measure of Sugeno, non-additive measure, subjective entropy, Jaynes maximum entropy principle, principle of maximum of subjective entropy, subjective analysis

References

1. Kolmogorov A., Fomin S. (1976). Elements of the theory of functions and functional analysis, 542.
2. Sugeno M. (1975). Fuzzy Measure and Fuzzy Integral. Transaction of the Society of Instrument and Control Engineers, 2, 85 – 90.
3. Sugeno M. (1975). Fuzzy Measure and Fuzzy Integral. Transaction of the Society of Instrument and Control Engineers, 6, 218 – 226.
4. Pospelov D. (1986). Fuzzy sets in the equation models and artificial intelligence, 396.
5. Jager R. (1986). Fuzzy sets and possibility theory. Recent advances, 408.
6. Bocharnikov V. (2001). Fuzzy-technology: Mathematical Foundations. practice of modeling in economics, 328.
7. Karkishchenko A., Bronevich A., & Lepskiy A. (2005). Non-additive measures: application to the processing of information with high uncertainty. Bulletin of the Southern Scientific Center, Russian Academy of Sciences,3, 90 – 95.
8. Denneberg D. (1997). Non-additive measure and integral.
9. Choquet G. (1954). Theory of capacities. 131 – 295.
10. Kasyanov V. (2003). The elements of subjective analysis, 224.
11. Kasyanov V. (2007). Subjective analysis, 512.
12. Kasyanov V. (2013). Subjective entropy of preferences,460.
13. Kasyanov V., Goncharenko A. (2012). Light and shadow, proportion of the shadow economy, the entropy approach, 75.
14. Jaynes E. (1957). Information theory and statistical mechanics. Phys. Rev, 1,171 – 190.
15. Jaynes E. (1957). Information theory and statistical mechanics. Phys. Rev, 1, 620 – 630.
16. Martyushev L. (2006), The principle of maximum entropy production in physics and related fields, 83.

INDUSTRIAL ENTERPRISES MATHEMATICAL OPERATION MODELING AND FINANCIAL FLOWS FORMALIZATIONS (p. 57-60)

Bohdan Mysnyk

Industrial enterprise (IE) is influenced by many factors such as environment, operation factors and dynamics. One cannot take in account of all such factors quantity, since the value of many of them is error determined, so a great amount of considered factors make serious miscalculations.

Such particularities show the urgency to apply new methods approach to the process modeling of industrial enterprises functioning. The results of previous analysis show that amongst all the evolutionary paradigms the idea of "Artificial Life" is the best to correspond the task of complex artificial systems modeling. The suggested model includes the foundations of modern economical mathematics models functioning, with changes made to integrate the principles of "artificial life" idea.

The set of investigated enterprise operation factors is the result of modeling. Prediction is the aim of the certain set of enterprises work modeling. This gives us an opportunity to investigate a new enterprise life or to glance to the horizon to see the prospect of existent industrial enterprises on condition of competition

Keywords: artificial life, neuron nets, evolution modeling, artificial systems

References

1. Samarskiy A.A., Michajlov A.P. (1997) Mathematical Modeling: Ideas. Methods. Examples., Moscow, Science, 320.
2. Yemalianov V.V., Curejchyk V.V., Curejchyk V.M. (2003) Evolutionary Modeling Theory and Practice, Moscow, Physmathlit, 432.

3. Snytiuk V.Y. (2009) Decision Taking Evolutionary Technologies on Caundition of Uncertainty, Kyiv, 305.
4. Bedau M.A. (2003) Artificial Life: organization, adaptation and complexity from the bottom up, Trends in cognitive science, Vol. 7, № 11, 505-512.
5. Vasylenko V. O. (2005) Crises-proof Enterprise Operating: Workbook; 2nd enlarged and corrected edition, Kyiv, ELC, 501.
6. Barro, Robert J. (1989). "New Classicals and Keynesians, or the Good Guys and the Bad Guys". Swiss Journal of Economics and Statistics 125 (3): 263–273.
7. Kirman, Alan P. (1992). "Whom or What does the Representative Individual Represent?". Journal of Economic Perspectives 6 (2): 117–136.
8. Shevchenko O.O. (2012) Economic Hystory and Thought: Modern Economic Theories: Workbook, Kyiv, ELC, 280.
9. Vitlinsky V.V. (2003) Economic Modeling: Workbook, Kyiv, KNEU, 408.
10. Moshek H.Y. (2002) Enterprise Management: Textbook, Kyiv, KNTEU, 371.

DISTRIBUTION OF UNBRANCHED FLOWS WITH SELF-SIMILARITY EFFECT (p. 60-63)

Dmytro Ageyev

An important stage in the design and operation of telecommunication systems is the choice of routes and finding of the intensity of flows along these routes.

This problem is known as the problem of the distribution of flows. The existing methods of solution are based on simple flow models, which lost their adequacy for the modern multiservice traffic.

The studies have shown that the models of self-similar processes describe more precisely the properties of the traffic. Despite the large number of publications on the self-similar traffic study there is a significant lack of works on the application of these models in the synthesis of telecommunications systems.

The article suggests a modification of the previously known method of deflection of unbranched flows taking into account the effect of self-similarity. As a result, in the basic method of calculation we have changed a number of expressions that provide the finding of the parameters of aggregated flows and the average delay in the network.

The proposed method can be used when designing large balanced telecommunication systems, where a flow has little influence on the quality parameters of service of the whole network

Keywords: flow, distribution, effect of self-similarity, Hurst parameter, deflection of the flow, network, delay

References

1. Leland W.E., Taqqu M.S., Willinger W., Wilson D.V. (1994). On the Self-Similar Nature of Ethernet Traffic (Extended Version) IEEE/ACM Trans, on Networking, Vol. 2, Issue 1, 1-15.
2. Paxson V., Floyd S. (1994). Wide-Area Traffic: The Failure of Poisson Modeling. Proc. ACM Sigcomm, London, UK, 257-268.
3. Simonina O., Yanovskiy G. (2004). Kharakteristiki trafika v setyakh IP [Characteristics of traffic in IP networks]. Trudy uchebnykh zavedeniy svyazi, 177, 8-14.
4. Norros I. (1994). A Storage Model with Self-Similar Input. Queueing Systems, Vol. 16, No 3-4, 387-396.
5. Shubin Ye. (2005). PhD Thesis, Kharkov.
6. Taqqu M.S. Proof of a Fundamental Result in Self-Similar Traffic Modeling / M.S. Taqqu, W. Willinger, R. Sherman // SIGCOMM Comput. Commun. Rev. - 1997. - Vol. 27, Issue 2. - P. 5-23.
7. Ageytv D., Ignatenko A., Kopyliov A. (2011). Metodika opredeleniya parametrov potokov na raznykh uchastkakh mul'tiservisnoy telekommunikatsionnoy seti s uchetom effekta samopodobiya [Method for determination of flow parameters in different parts of multiservice telecommunications network, taking into account the effect of self-similarity] Problemi telekomunikacij, 3 (5), 18 - 37.
8. Zaychenko U. Gonta U. (1986). Strukturnaya optimizatsiya setey EVM [Structural optimization of computer networks], Kiev. USSR: Tekhnika.

THE METHOD OF THE JOINT APPROXIMATION FOR SOLVING THE MULTI-DIMENSIONAL QUASI-LINEAR HYPERBOLIC EQUATIONS (p. 64-67)

Valeriy Bucharskyi

In present paper the method of the joint approximation for constructing high order of accuracy finite difference schemes is extended on the case of multidimensional quasi-linear hyperbolic equations. The new two-step cost-effective way for constructing compact cost-effective finite difference schemes with unlimited order of accuracy is suggested.

This approach is based on the method of the joint approximation and one property of the hyperbolic partial derivatives equations. Finite difference schemes up to seventh order of temporal and spatial accuracy for the two-dimensional linear transport equation and the two-dimensional Burgers equation are presented. Results of the solution of the used widely test cases are presented also. The data of the calculations confirm the theoretical results

Keywords: Method of the joint approximation; finite difference scheme; high order of accuracy

References

1. Encyclopedia of Computational Mechanics Volume 1 Fundamentals (2004): WILEY.
2. Drikakis D. Rider W. (2005). High-Resolution Methods for Incompressible and Low-Speed Flows. Springer-Verlag Berlin Heidelberg.
3. Samarskyi A.A. (1980) The theory of difference schemes. Moskow, USSR: Nauka.
4. Bucharskyi, V.L. (2007) The method of joint approximation for constructing the finite difference schemes for solving partial derivative equations Tehnicheskaya mekhanika, 1, 50 – 57.
5. Bucharskyi V.L., Kalinchuk E.M. (2011) Symmetrical difference schemes of the joint approximation for solving the linear transport equations Matematychni mashyny i sistemy, 4, 161-165.
6. Bucharskyi, V.L. (2013) Two-step finite difference schemes of the method of the joint approximation for solving the quasi-linear one-dimensional hyperbolic equations. Eastern-European Journal of Enterprise Technologies, 2/4 (62), 34-38.
7. Akivis, M. A., Goldberg V.V. (2003) Tensor Calculus. Moskow: FIZMATLIT.
8. Shokin Y.I. (1983) The Method of Differential Approximation. Springer-Verlag Berlin And Heidelberg Gmbh & Co.
9. Shu C.-W., Osher S. (1988) Efficient implementation of essentially non-oscillatory shock capturing schemes J. Comp. Phys., 77, 439-471.
10. Qiu J., Shu C.-W. (2003) Finite-difference WENO schemes with Lax-Wendroff-type time discretizations SIAM J.Sci.Comput, 24(6), 2185-2198.
11. Qiu J. (2007) Hermite WENO schemes with Lax-Wendroff type time discretizations for Hamilton-Jacobi equations Journal of Computational Mathematics, 25, 131-144.

EVOLUTION OF COMPLEX SYSTEMS WITH HYPERBOLIC DISTRIBUTION (p. 67-73)

Nikolai Delas

Most complex, hard-formalized systems with a large number of elements can be viewed as objects on a finite set of "carriers" of which a limited set of "resources" is distributed. The hyperbolic distribution is characteristic for systems where "resources" are more dynamic than "carriers", i.e. the relaxation time of "resources" τ_R is much less than the relaxation time of "carriers."

The application of the principle of maximum entropy permits to obtain expressions for the maximum hyperbolic distribution law (11), which at certain values of its parameters asymptotically approaches to the hyperbolic.

The evolution of a complex object in time is expressed in a change of its distribution curve. The process of evolution looks like a quasi-equilibrium motion of the system to a state of complete equilibrium, when the maximum is reached not only by the entropy of "resources" H_E, but also by the entropy of "carriers" H_N. The pa-

rameter ϕ, being an important characteristic of the system, reflects the evolution of the process.

The systems close to a purely hyperbolic distribution (with $\phi \approx 0$) are young systems.

They have reached a quasi-equilibrium distribution of "resources", but are far from the state of total equilibrium due to slower settling of "carriers."

With increase of the age of the system, the parameter ϕ increases, and the distribution curves $n_i=f(\varepsilon_i)$ change as shown at the fig. 4. An algorithm for determining $n_i=f(\varepsilon_i)$ for different time values in the range $\tau_R \le t \le \tau_C$ was described

Keywords: hyperbolic distribution, non-Gaussian distribution, power-series distribution, hyperbolic distribution law

References

1. Botvina, L. R., Barenblatt, G. I. (1985). Avtomodel'nost' nakoplenija povrezhdaemosti. Problemy prochnosti, №12, 17–24.
2. Golicin, G. S., Mohov, I. I., Akperov, M. G., Bardin, M. Ju. (2007). Funkcii raspredelenija verojatnostej dlja ciklonov i anticiklonov. Dokl. RAN, T. 413, №2, 254–256.
3. Andersen, K. (2008). Dlinnyj hvost. Novaja model' vedenija biznesa. Translation from English. M.: Vershina. 272p.
4. Hajbullov, R. A. (2009). Rangovyj analiz kosmicheskih sistem. Izvestija glavnoj astronomicheskoj observatorii v Pulkove, Vyp.3, №219, 95–104.
5. Orlov, Ju. K. (1980). Nevidimaja garmonija. Chislo i misl', Vyp.3, 70–105.
6. Gurina, R. V. (2006). Rangovyj analiz pedagogicheskih sistem (cenologicheskij podhod). Metodicheskie rekomendacii dlja rabotnikov obrazovanija. M.: Tehnetika. 40p.
7. Nikitina, E. Ju., Guzev, M. A. (2009). Primenenie matematicheskih metodov pri issledovanii kriminologicheskih dannyh (na primere Japonii). Rossija i ATR. №2, 77–85.
8. Delas, N. I., Kas'janov, V. A. (2012). Nongauss distribution as a property of complex systemes that are organized by type of cenoses. Eastern-European Journal Of Enterprise Technologies, 3(4(57)), 27-32.
9. Vil'son, A. (1978). Dzh. Jentropijnye metody modelirovanija slozhnyh sistem. M.: Nauka. 248p.
10. Delas, N. I., Kas'janov, V. A. (2012). Extremely hyperbolic law of self-organized distribution systems. Eastern-European Journal Of Enterprise Technologies, 4(4(58)), 13-18.