ABSTRACT AND REFERENCES

INFORMATION AND CONTROLLING SYSTEM

CALCULATION ACCURACY EVALUATION OF QUANTITATIVE PARAMETERS OF OVERALL PERFUSION ASSESSMENT (p. 4-9)

Svitlana Alkhimova

The problem of compliance of quantitative parameters of overall perfusion assessment according to tomographic studies with the real values of human hemodynamic parameters was considered. The existing software-algorithmic approaches to calculating the overall perfusion parameters by discretely presented time-concentration curves were analyzed. The effect of calculated parameters on the results of the obtained values of other parameters was investigated, the scheme of interdependence in the calculation of such parameters was formalized. The calculation accuracy evaluation of quantitative parameters of overall perfusion assessment by the reference values of the main hemodynamic parameters of ghost images was carried out. According to the correlation and linear regression analyses, the algorithm for the quantitative calculation of overall perfusion assessment with achieving maximum accuracy in the values of the obtained parameters under the computer and magnetic resonance tomography was formalized. The research results show the possibility of using the parameters of overall perfusion assessment on the same level with characteristics, based on physiological models and interpolated curves of dependence of contrast agent concentration on time.

Keywords: accuracy evaluation of perfusion characteristics, overall perfusion assessment, tomography.

References

1. Fieselmann, A., Kowarschik, M., Ganguly, A., Hornegger, J., Fahrig, R. (2011). Deconvolution-Based CT and MR Brain Perfusion Measurement: Theoretical Model Revisited and Practical Implementation Details. International Journal of Biomedical Imaging, 2011, 20. doi: 10.1155/2011/467563
2. Jahng, G.-H., Li, K.-L., Ostergaard, L., Calamante, F. (2014). Perfusion Magnetic Resonance Imaging: A Comprehensive Update on Principles and Techniques. Korean Journal of Radiology, 15 (5), 554–577. doi: 10.3348/kjr.2014.15.5.554
3. Willats, L., Calamante, F. (2013). The 39 steps: evading error and deciphering the secrets for accurate dynamic susceptibility contrast MRI. NMR Biomedicine, 26 (8), 913–931. doi: 10.1002/nbm.2833
4. Nagata, K., Asano, T. (1990). Functional image of dynamic computed tomography for the evaluation of cerebral hemodynamics. Stroke, 21 (6), 882–889. doi: 10.1161/01.STR.21.6.882
5. Bjørnerud, A., Emblem, K. E. (2010). A fully automated method for quantitative cerebral hemodynamic analysis using DSC–MRI. Journal of Cerebral Blood Flow and Metabolism, 30 (5), 1066–1078. doi: 10.1038/jcbfm.2010.4
6. Kudo, K., Christensen, S., Sasaki, M., Østergaard, L., Shirato, H., Ogasawara, K. et al. (2013). Accuracy and Reliability Assessment of CT and MR Perfusion Analysis Software Using a Digital Phantom. Radiology, 267 (1), 201–211. doi: 10.1148/radiol.12112618
7. Kudo, K., Sasaki, M., Ostergaard, L., Christensen, S., Uwano, I., Suzuki, M. et. al. (2011). Susceptibility of Tmax to tracer delay on perfusion analysis: quantitative evaluation of various deconvolution algorithms using digital phantoms. Journal of Cerebral Blood Flow and Metabolism, 31 (3), 908–912. doi: 10.1038/jcbfm.2010.169
8. Alhimova, S. M., Ivanov, O. K. (2014). Informatyvnist' kryvyh zalezhnosti koncentracii' kontrastnoi' rechovyny vid chasu v perfuzijnij tomografii'. Sovremennye problemy i puti ih reshenija v nauke, transporte, proizvodstve i obrazovanii '2014. Odessa, 2 (7), 90–92.
9. Alhimova, S. M., Zhjeljezna, V. S. (2015). Vyznachennja pershogo prohodu kontrastnoi' rechovyny za danymy dynamichnoi' kontrastnoi' magnitno-rezonansnoi' tomografii'. Sovremennye napravlenija teoreticheskih i prikladnyh issledovanij '2015. Odessa, 1 (5), 4–7.
10. Gall, P., Mader, I., Kiselev, V. G. (2009). Extraction of the first bolus passage in dynamic susceptibility contrast perfusion measurements. Magnetic Resonance Materials in Physics, Biology and Medicine, 22 (4), 241–249. doi: 10.1007/s10334-009-0170-6
11. Patil, V., Johnson, G. (2011). An improved model for describing the contrast bolus in perfusion MRI. Medical Physics, 38 (12), 6380–6383. doi: 10.1118/1.3658570

IMPROVING THE EFFICIENCY OF AUTOMATIC CONTROL SYSTEMS OF POWER QUALITY OF STAND-ALONE POWER SYSTEMS (p. 10-16)

Anton Zhilenkov

The urgent problem of improving the efficiency of active filter-compensating devices used in stand-alone electric power systems of offshore drilling platforms and water transport facilities is considered.

The simulation results showed that the developed system allows to improve the efficiency of the AFCD by increasing the identification accuracy of the compensated components of the current signals and mains voltage. Static variation did not exceed 0.5 %, in dynamics, the time to adapt to changes in the analyzed signal did not exceed one period of the fundamental harmonic of the mains voltage that is at least 3–4 times better than the performance of identification systems with the fast Fourier transform. The maximum error in transient conditions did not exceed 10 %. The upgraded model of the automatic control system of the active filter uses an observing device for recovering the network signals unavailable for measurement and performs a harmonic synthesis of non-sinusoidal currents and voltages using the adaptive approximation algorithms. The simulation results of the system under consideration are presented.

The research proved the high efficiency of the proposed method and technique for identification of the target harmonics of the analyzed signals.

Keywords: stand-alone power systems, adaptive filtering, signal observers, load, fluctuations, generator.

References

1. Mikajeljan, Je. A., Mikajeljan, R. Je., Dorohin, V. P. (1998). Perspektiva primenenija gazoturbinnyh agregatov v neftegazovoj promyshlennosti. Neftjanoe hozjajstvo, 6, 49–52.
2. Jelektricheskaja jenergija. Sovmestimost' tehnicheskih sredstv jelektromagnitnaja. Normy kachestva jelektricheskoj jenergii v sistemah jelektrosnabzhenija obshhego naznachenija (1998). GOST 13109–97. Moscow: Mezhgosudarstvennyj Sovet po standartizacii, metrologii i sertifikacii, 58.
3. Mocohejn, B. I., Parfenov, B. M., Shpilevoj, V. M. (1999). Jelektroprivod, jelektrooborudovanie i jelektrosnabzhenie burovyh ustanovok. Tjumen', 263.
4. Rejnike, M. Trenel, K., Herbst, Je. (1989). Puti povyshenija jekonomicheskoj jeffektivnosti operacij na staryh neftjanyh mestorozhdenijah. Neft', gaz i neftehimija za rubezhom, 7, 21–26.
5. Chernyj, S. G., Zhilenkov, A. A. (2015). Ocenka nadezhnosti funkcionirovanija morskih burovyh platform. Avtomatizacija, telemehanizacija i svjaz' v neftjanoj promyshlennosti, 1, 30–36.
6. CNW Research. Data showing the increasing consumer consideration of diesel and hybrid vehicles provided by CNW Research. Available at: http://www.cnwmarketingresearch.com/
7. Chernyi, S., Zhilenkov, A. (2015). Analysis of complex structures of marine systems with attraction methods of neural systems. Metallurgical and Mining Industry, 1, 37–44.
8. National Oilwell Varco. Available at: https://www.nov.com/ProductIndex.aspx
9. Can You Afford the Risk? The Case for Collaboration on Risk Mitigation for High-Specification Offshore Assets. Available at: http://www.osp.ru/os/2010/08/13005222/
10. Mocohejn, B. I. (1977). Jelektroprivod zarubezhnyh ustanovok dlja morskogo burenija. Obzor zarubezhnoj literatury. Moscow: VNIIOJeNG, 76.
11. Mocohejn, B. I. (1991). Jelektrotehnicheskie kompleksy burovyh ustanovok. Moscow: Nedra, 253.
12. Zhilenkov, A. A., Chernyi, S. G. (2015). Povyshenie jeffektivnosti sistem avtomaticheskogo upravlenija avtonomnymi burovymi ustanovkami za schet razrabotki metodov obespechenija ih sovmesti-

mosti i integracii. Avtomatizacija, telemehanizacija i svjaz' v neftjanoj promyshlennosti, 4, 9–18.
13. Zhilenkov, A., Chernyi, S. (2015). Investigation performance of marine equipment with specialized information technology. Energy Procedia, 100, 1247–1252. doi: 10.1016/j.proeng.2015.01.490
14. Polonskij, V. I., Hajkin, A. B. (1976). Avtomatizirovannye grebnye jelektricheskie ustanovki. Moscow: Transport, 432.

ANALYSIS OF EXISTING APPROACHES TO SETTING THE INTELLIGENT MANAGEMENT SYSTEMS OF TRANSPORT UNDERTAKINGS (p. 17-22)

Denys Zubenko, Andriy Kovalenko, Oleksandr Kuznetsov

The problem of designing intelligent management systems (IMS) of dynamically variable objects (DO), operating under significant a priori uncertainty is considered. The analysis of existing approaches to developing DO IMS, methods, models and algorithms of their construction based on the integration of classical methods of management theory and artificial intelligence methods was presented. As examples of DO, rolling stock (TU) of the multi-mode enterprises is examined. The range of unresolved problems is identified, the purpose and objectives for the solution are formulated.

Currently, the problem of designing the automatic management systems of dynamically variable objects is characterized by the transition from the paradigm of adaptive management to the paradigm of intelligent management. This is caused by a continuous complication of management objects and conditions of their operation, the emergence of new classes of computing means (in particular, distributed computing systems), high-performance telecommunications channels, and a sharp increase in the reliability and efficiency requirements for management processes under significant a priori and a posteriori uncertainty. Accounting of these factors is possible only on the basis of transition from "hard" algorithms of parametric and structural adaptation to the anthropomorphic principle of management formation.

Keywords: intelligent systems, dynamically variable objects, transport undertakings.

References

1. Artsybashev, A. Y., Nikitin, R. Yu. (2014). Diagnosing drive vehicles based on neural networks. Acta Facultatis forestalis Zvolen, 56 (1), 201–208.
2. Kostin, N. S. (2013). Mesto modul'nyh nejronnyh setej v klassifikacii iskusstvennyh nejronnyh setej. Intellektual'nyj potencial HHI veka: stupeni poznanija, 19, 91–95.
3. Sinchuk, O. N., Bojko, S. N. (2014). Nejronnye seti i upravlenie processom upravlenija jelektrosnabzheniem obektov ot kombinirovannyh jelektricheskih setej. Tehnichna elektrodinamika, 5, 53–55.
4. Manzhula, V. G., Fedjashov, D. S. (2011). Nejronnye seti Kohonena i nechetkie nejronnye seti v intellektual'nom analize dannyh. Fundamental'nye issledovanija, 4, 108–114.
5. Tarkov, M. S. (2013). Otobrazhenie parallel'nyh programm na mnogojadernyh komp'juterah s rekurrentnymi nejronnymi setjami. Prikladnaja diskretnaja matematika, 2 (20), 50–58.
6. Kolbasin, V. A. (2011). Parallel processing of data flow by artificial neural networks on the cuda platform. Eastern-European Journal of Enterprise Technologies, 3 (3 (51)), 54–57. Available at: http://journals.uran.ua/eejet/article/view/1560/1458
7. Gorbacheev, S. V., Syrjamkin, V. I. (2014). Nejro–nechetkie metody v intellektual'nyh sistemah obrabotki i analiza mnogomernoj informacii. Tomsk: Izd–vo Tomskogo un–ta, 441.
8. Semenov, A. M. (2014). Intellektual'nye sistemy. Orenburg: OGU, 236.
9. Vasil'ev, A. N., Tarhov, D. A. (2014). Nejrosetevye metody i algoritmy matematicheskogo modelirovanija. St. Peterburg: Izd–vo Politehn. un–ta, 581.
10. Jeshbi, U. R. (2014). Vvedenie v kibernetiku. Moscow: URSS: LENAND, 432.
11. Andrejchikov, A. V., Andrejchikova, O. N. (2014). Sistemnyj analiz i sintez strategicheskih reshenij v innovatike. Moscow: URSS, 304.
12. Guljaev, V. A. (1993). Tehnicheskaja diagnostika upravljajushhih sistem. Kyiv: Naukova dumka, 208.
13. Denisov, A. A., Kolesnikov, D. M. (1982). Teorija bol'shih sistem upravlenija. Leningrad: Jenergoizdat, 288.
14. Komarcova, L. G., Maksimov, A. V. (2002). Pejrokomp'jutery. Moscow: MGTU im. Baumana, 320.
15. Kuzovkov, P. T. (1976). Modal'noe upravlenie i nabljudajushhie ustrojstva. Moscow: Mashinostroenie, 184.
16. Sadovskii, M. G. (Ed.) (2014). Nejroinformatika, ejo prilozhenija i analiz dannjah. Krasnojarsk: IVM SO RAN, 195.
17. Molchanov, I. N. (1987). Mashinnye metody reshenija prikladnyh zadach. Algebra, priblizhenie funkcij. Kyiv: Naukova dumka, 288.
18. Mashkina, I. V. (1989). Reguljator peremennoj struktury chastoty vrashhenija rotora gazoturbinnogo dvigatelja v sisteme upravlenija reaktivnym soplom. Ufa: UAI, 21.
19. Melsa, D., Dzhons, S. (1981). Programmy v pomoshh' izuchajushhim teoriju linejnyh sistem upravlenija. Moscow: Mashinostroenie, 199.
20. Neterson, D. (1984). Teorija setej Netri i modelirovanie sistem. Moscow: Mir, 264.
21. Gregor, D., Toral, S., Ariza, T., Barrero, F., Gregor, R., Rodas, J., Arzamendia, M. (2015). A methodology for structured ontology construction applied to intelligent transportation systems. Computer Standards & Interfaces. doi: 10.1016/j.csi.2015.10.002
22. Larue, G. S., Rakotonirainy, A., Haworth, N. L., Darvell, M. (2015). Assessing driver acceptance of Intelligent Transport Systems in the context of railway level crossings. Transportation Research. Part F: Traffic Psychology and Behaviour, 30, 1–13. doi: 10.1016/j.trf.2015.02.003
23. Satunin, S., Babkin, E. (2014). A multi–agent approach to Intelligent Transportation Systems modeling with combinatorial auctions. Expert Systems with Applications, 41 (15), 6622–6633. doi: 10.1016/j.eswa.2014.05.015
24. Demin, D. A. (2012). Synthesis of optimal temperature regulator of electroarc holding furnace bath. Scientific Bulletin of National Mining University, 6, 52–58.
25. Mendes, J., Araújo, R., Sousa, P., Apóstolo, F., Alves, L. (2011). An architecture for adaptive fuzzy control in industrial environments. Computers in Industry, 62 (3), 364–373. doi: 10.1016/j.compind.2010.11.001
26. Wai, R.-J., Chen, M.-W., Yao, J.-X. (2015). Observer–based adaptive fuzzy–neural–network control for hybrid maglev transportation system. Neurocomputing, 175, 10–24. doi: 10.1016/j.neucom.2015.10.006

DEVELOPMENT OF THE INFORMATION TECHNOLOGY FOR PROCESSING ANOMALOUS MEASUREMENTS OF STRAIN-GAUGE SYSTEMS (p. 22-27)

Nikolai Kopytchuk, Peter Tishyn, Igor Kopytchuk

The aim of the research is the development of the information technology for processing anomalous measurements of strain-gauge systems to improve the accuracy of estimating the mass of an object with a limited time of weighing.

With this, the main problem is the need to describe anomalous situations that may occur on a variety of sensors under uncertainty. This task required the development of an appropriate mathematical approach based on the theory of fuzzy time series, as well as new approaches in determining the degree of comparison of fuzzy situations.

In practice, the search for anomalies is proposed to carry out with the help of the algorithms using the specially-designed standard bases, describing the fuzzy situations. It is assumed that the standard bases are formed of a large set of real situations.

Experimental results show that using this information technology in processing the signals from a plurality of strain gauges increases the estimation accuracy of the sensor readings by several times.

Keywords: linguistic variable, fuzzy time series, fuzzy situations, degree of comparison of fuzzy situations.

References

1. Zadeh, L. A. (1965). Fuzzy sets. Information and Control, 8 (3), 338–353. doi: 10.1016/s0019-9958(65)90241-x
2. Kruglov, V. V., Dli, M. I., Golunov, R. Ju. (2001). Nechetkaja logika i iskusstvennye nejronnye seti. Moscow: Fizmatlit, 224.
3. Shtovba, S. D. (2007). Proektirovanie nechetkih sistem sredstvami MATLAB. Moscow: Gorjachaja linija – Telekom, 288.
4. Borisov, V. V., Kruglov, V. V., Fedulov, A. S. (2007). Nechetkie modeli i seti. Moscow: Gorjachaja linija – Telekom, 284.

5. Rotshtejn, A. P. (1999). Intellektual'nye tehnologii identifikacii: nechetkaja logika, geneticheskie algoritmy, nejronnye seti. Vinnica: UNIVERSUM-Vinnica, 320.
6. Jarushkina, N. G. (2008). Nechetkie sistemy: obzor itogov i tendencij razvitija. Iskusstvennyj intellekt i prinjatie reshenij, 4, 26–38.
7. Afanas'eva, T. V., Namestnikov, A. M., Perfil'eva, I. G., Romanov, A. A., Jarushkina, N. G. (2014). Prognozirovanie vremennyh rjadov: nechetkie modeli. Ul'janovsk: UlGTU, 145.
8. Graves, D., Pedrycz, W. (2009). Multivariate Segmtntation of Time Series with Differential Evolution. International Fuzzy Systems Association World – European Society for Fuzzy Logic and Technology Conference (IFSA-EUSFLAT 2009). Lisbon, Portugal, 1108–1113.
9. Giove, S. (1999). Fuzzy logic and Clustering methods for time series analisys. ESIT'99. Workshop on Finance, Trade and Services. Chania, 7. Available at: http://www.erudit.de/erudit/events/esit99/12600_p.pdf
10. Herbst, G., Bocklish, S. F. (2009). Online Recognition of fuzzy time series patterns. International Fuzzy Systems Association World – European Society for Fuzzy Logic and Technology Conference (IFSA-EUSFLAT 2009). Lisbon, Portugal, 974–979.
11. Kacprzyk, J., Wilbik, A. (2009). Using Fuzzy Linguistic summaries for the comparison of time series. International Fuzzy Systems Association World – European Society for Fuzzy Logic and Technology Conference (IFSA-EUSFLAT 2009). Lisbon, Portugal, 1321–1326.
12. Chandola, V., Banerjee, A., Kumar, V. (2009). Anomaly Detection: A Survey. ACM Computing Surveys, 41 (3), 1–58. doi: 10.1145/1541880.1541882
13. Cheboli, D. (2010). Anomaly Detection of Time Series. Minnesota, 75. Available at: http://conservancy.umn.edu/handle/11299/92985
14. Afanas'eva, T. V. (2013). Modelirovanie nechetkih tendencij vremennyh rjadov. Ul'janovsk: UlGTU, 215.
15. Kopytchuk, N. B., Tishin, P. M., Kopytchuk, I. N., Milejko, I. G. (2015). Algoritm opredelenija anomal'nyh situacij dlja tenzometricheskih sistem Visnyk Nacional'nogo tehnichnogo universytetu "KhPI". Serija: Mehaniko-tehnologichni systemy ta kompleksy, 21 (1130), 37–45.
16. Kopytchuk, N. B., Tishin, P. M., Kopytchuk, I. N., Milejko, I. G. (2015). Construction of set of standards to improve the accuracy of expert assessments. ScienceRise, 4/2 (9), 72–76. doi: 10.15587/2313-8416.2015.41579
17. Kopytchuk, N. B., Tishin, P. M., Kopytchuk, I. N., Milejko, I. G. (2014). Postroenie aproksimmirujushhej nechetkoj zavisimosti, dlja opredelenija parametrov klassifikacii anomalij. Innovacii v nauke. Novosibirsk, 8 (33), 14–22.

DESIGNING A MOBILE SYSTEM OF ROBUST NOISE MONITORING OF CHANGES IN THE HEART ACTIVITY (p. 28-36)

Narmin Eldar Rzayeva

Since nowadays the number of cases of heart disease progressively increases, the article presents the algorithms for robust noise monitoring of the changes in the cardiovascular system and the concept of the monitoring system.

It is found that the use of the technologies proposed in the article allows a reliable monitoring of changes in the cardiovascular system online. The latter is ensured by the robust noise characteristics of the heart murmurs that are used to make up a plurality of informative signs.

The creation of the robust noise monitoring system would minimize the number of unwarranted visits to doctors and, consequently, facilitate their work.

The study has also proved that the above purpose is compatible with the use of notebooks and smart phones. We have considered the concept of the heart monitoring system via a laptop and a smart phone.

The system can be implemented in two ways: (1) for the mass use – for healthy people who want to control the functioning of their heart, and (2) for patients suffering from cardiovascular diseases.

In either case, the system can be: (A) a Lithmann 3200 electronic stethoscope that listens to heart murmurs at regular intervals and sends the information wirelessly to a laptop for its subsequent processing, and (B) a system that does not imply any additional equipment. Listening to the heart murmurs takes place via the microphone of a smart phone with a mode of increased sensitivity of the microphone.

Keywords: interference, heart murmur, correlation function, cardiovascular system, laptop, smart phone.

References

1. Aliev, T. A., Alizade, T. A., Rzayeva, N. E. (2012). Noise control of heart by means of a smartphone. Lambert Academic Publishing, 156.
2. Aerotel Medical Systems. Available at: http://www.aerotel.com
3. Cardiocode. Available at: http://www.cardiocode.eu
4. EB Neuro. Available at: http://www.ebneuro.biz
5. Custo med. Sicherheit in der diagnostik. Available at: http://www.customed.de
6. Ericsson. Available at: http://www.ericsson.com
7. Imec. Available at: http://www.imec.be
8. Kardi.ru. Available at: http://www.kardi.ru/en/aboutcardiovisor
9. Lifewatch. Available at: http://www.lifewatch.com
10. Nihon Kohden. Available at: http://www.nihonkohden.com.com
11. Aliev, T. A., Zabirova, A. K., Mamedov, I. D. (1983). Certificate of authorship 999064. Ustrojstvo dlja diagnostiki zabolevanij. 3265368/18-24; declared 09.07.81, № 7.
12. Böhm, C., Khuri, S., Lhotská, L., Pisanti, N. (2011). Information Technology in Bio- and Medical Informatics. Second International Conference, ITBAM 2011. Toulouse, France: Springer. doi: 10.1007/978-3-642-23208-4
13. Krizmaric, M., Verlic, M., Stiglic, G., Grmec, S., Kokol, P. (2009). Intelligent analysis in predicting outcome of out-of-hospital cardiac arrest. Computer methods and programs in biomedicine, 95 (2), 22–32. doi: 10.1016/j.cmpb.2009.02.013
14. Kannathal, N., Acharya, U. R., Ng, E. Y. K., Krishnan, S. M., Min, L. C., Laxminarayan, S. (2006). Cardiac health diagnosis using data fusion of cardiovascular and haemodynamic signals. Computer methods and programs in biomedicine, 82 (2), 87–96. doi: 10.1016/j.cmpb.2006.01.009
15. Maglogiannis, I., Loukis, E., Zafiropoulos, E., Stasis, A. (2009). Support vectors machine-based identification of heart valve diseases using heart sounds. Computer methods and programs in biomedicine, 95 (1), 47–61. doi: 10.1016/j.cmpb.2009.01.003
16. Das, R., Turkoglu, I., Sengu, A. (2009). Diagnosis of valvular heart disease through neural networks ensembles. Computer methods and programs in biomedicine, 93 (2), 185–191. doi: 10.1016/j.cmpb.2008.09.005
17. Musayeva, N. E., Sattarova, U. E., Rzayeva, N. E. (2011). Tehnologija monitoringa nachalo patofiziologicheskih processov v serdechno-sosudistoj sisteme. Izvestija Nacional'noj Akademii Nauk Azerbajdzhana, XXXI (6), 162–167.
18. Aliev, T. A. (2003). Robust technology with analysis of interference in signal. New York: Processing. Kluwer Academic/Plenum Publishers, 213. doi: 10.1007/978-1-4615-0093-3
19. Aliev, T. A., Guluyev, G. A., Pashayev, F. H., Sadygov, A. B. (2012). Noise monitoring technology for objects in transition to the emergency state. Mechanical Systems and Signal Processing, 27, 755–762. doi: 10.1016/j.ymssp.2011.09.005
20. Aliev, T. A., Rzayeva, N. E. (2014). Noise analysis of heart and lungs sounds by means of laptops and smartphones. Transactions of Azerbaijan National academy of Sciences, XXXIV (3), 25–36.
21. Bendat, J. S., Piersol, A. G. (2000). Random Data: Analysis & Measurement Processing. New York: John Wiley and Sons.

DEVELOPMENT OF TELEMEDICINE SYSTEM FOR REMOTE MONITORING OF HEART ACTIVITY BASED ON FASEGRAPHY METHOD (p. 37-46)

Leonid Fainzilberg, Tetiana Soroka

A client-server system telemedicine for remote processing of electrocardiograms was proposed. In contrast to the known, the system allows to simplify the heart activity monitoring procedure using the original ECG sensor with finger electrodes and the innovative method of ECG processing in the phase space (fasegraphy method).

It is shown that the fasegraphy method allows to improve the estimation accuracy of the reference ECG cycle in the time domain, more clearly display traditional diagnostic indicators in the phase space and introduce a system of additional diagnostic features.

The peculiarity of the system lies also in using the original method of economical signal encoding, which provides a high degree

of signal compression on the client side and accurate information reproduction on the server side.

The proposed telemedicine system allows a family doctor to remotely monitor the patient, based on the analysis of the current measurement by the fasegraphy method and personalized norms of a particular patient, which is automatically calculated based on the accumulated data array.

Keywords: telemedicine system, remote ECG analysis, fasegraphy method, ECG compression methods.

References

1. Hozhenko A., Kulbida M., Kochet O. (2011). Profilaktychna stratehiia medychnoi nauky – shliakh do pidvyshchennia efektyvnosti okhorony zdorovia. Visnyk NAN Ukrainy, 12, 64–69.
2. Goernig, M., Kwetkat, A., Brehm, B., Fidorra, K., Roth, A., Figulla, H. R., Leder, U. (2009). Feasibility and effectiveness of home care telemedicine in patients with heart failure in Thuringia. World Congress on Medical Physics and Biomedical Engineering. Munich, Germany, 79–81. doi: 10.1007/978-3-642-03904-1_21
3. Zugck, C., Frankenstein, L., Nelles, M., Froehlich, H., Schellberg, D., Cebola, R. et al. (2008). Telemedicine reduces hospitalisation rates in patients with chronic heart failure - results of the randomized HiTel trial. European Journal of Heart Failure Supplements, 7, 9. doi: 10.1016/s1567-4215(08)60024-7
4. Molinari, G., Reboa, G., Frascio, M., Leoncini, M., Rolandi, A., Balzan, C. et al. (2002). The role of telecardiology in supporting the decision-making process of general practitioners during the management of patients with suspected cardiac events. Journal of Telemedicine and Telecare, 8 (2), 97–101. doi: 10.1258/1357633021937541
5. Pentti, M. R., Calhoun, H. P., Chaitman, B. R. (2011). NOVA CODE serial ECG classification system for clinical trials and epidemiologic studies. International Journal of Electronic Engineering Research, 9, 179–187.
6. Antoshkin S. A. (2006). Programmno-algoritmicheskoe obespechenie szhatija i vosstanovlenija signalov v sistemah obrabotki informacii pri znachitel'nyh ogranichenijah na resursy na primere obrabotki kardiosignala. Moskovskij aviacionnyj institut. Moscow, 121.
7. Saini, I. (2013). Analysis ECG data compression techniques- a survey approach. International Journal of Emerging Technology and Advanced Engineering Certified Journal, 2, 544–548.
8. Cox, J. R., Nolle, F. M., Fozzard, H. A., Oliver, G. C. (1968). AZTEC, a preprocessing program for real-time ECG rhythm analysis. IEEE Transactions on Biomedical Engineering, BME-15 (2), 128–129. doi: 10.1109/tbme.1968.4502549
9. Abenstein, J. P., Tompkins, W. J. (1982). New data-reduction algorithm for real-time ECG analysis. IEEE Transactions on Biomedical Engineering, BME-29 (1), 43–48. doi: 10.1109/tbme.1982.324962
10. Sklansky, J., Gonalez, V. (1980). Fast polygonal approximation of digitized curves. Pattern Recognition, 12 (5), 327–331. doi: 10.1016/0031-3203(80)90031-x
11. Tai, S. C. (1991). SLOPE- A real time ECG data compressor. Medical and Biological Engineering and Computing, 29 (2), 175–179. doi: 10.1007/bf02447104
12. Stewart, D., Dower, G. E., Suranyi, O. (1973). An ECG compression code. Journal of Electrocardiology, 6 (2), 175–176. doi: 10.1016/s0022-0736(73)80013-5
13. Kuklinski, W. S. (1983). Fast Walsh transform data-compression algorithm; ECG applications. Medical and Biological Engineering and Computing, 21 (4), 465–472. doi: 10.1007/bf02442635
14. Nave, G., Cohen, A. (1993). ECG compression using long-term prediction. IEEE Transactions on Biomedical Engineering, 40 (9), 877–885. doi: 10.1109/10.245608
15. Reddy, B. R. S., Murthy, I. S. N. (1986). ECG data compression using Fourier descriptors. IEEE Transactions on Biomedical Engineering, BME-33 (4), 428–434. doi: 10.1109/tbme.1986.325799
16. Lu, Z., Kim, D. Y., Pearlman, W. A. (2000). Wavelet compression of ECG signals by the set partitioning in hierarchical trees (SPIHT) algorithm. IEEE Transactions on Biomedical Engineering, 47 (7), 849–856. doi: 10.1109/10.846678
17. Khudiakova, L. A., Shuliak, V. A. (2009). Primenenie standartov peredachi medicinskih dannyh v telemedicinskih sistemah. Jelektronika i svjaz'. Tematicheskij vypusk «Jelektronika i nanotehnologii», 2, 203–205.
18. Plotnikov, A., Priluckij, D., Selishhev, S. (1999). Standart SCP-ECG dlja obmena cifrovymi JeKG. Medicinskaja tehnika, 3, 19–26.
19. Lourenço, A., Silva, H., Fred, A. (2011). Unveiling the Biometrical Potential of Finger-Based ECG Signals. Computational Intelligence and Neuroscience, 2011, 1–8. doi: 10.1155/2011/720971
20. Fainzilberg, L. (2013). Komp'juternaja diagnostika po fazovomu portretu jelektrokardiogrammy. Kyiv: Osvita Ukrainy, 191.
21. Fainzilberg, L. (2008). Informacionnye tehnologii obrabotki signalov slozhnoj formy. Teorija i praktika. Kyiv: Naukova Dumka, 333.
22. Fainzilberg, L. (2010). FAZAGRAF® – jeffektivnaja informacionnaja tehnologija obrabotki JeKG v zadache skrininga ishemicheskoj bolezni serdca. Klinicheskaja informatika i telemedicina, 6 (7), 22–30.
23. Fainzilberg, L. (2015). Obobshhennyj metod obrabotki ciklicheskih signalov slozhnoj formy v mnogomernom prostranstve parametrov. Problemy upravlenija i informatiki, 2, 58–71.

THE EFFECT OF WEAR OF A CUTTING TOOL WITH A CONTROLLED DEPTH OF CUT ON THE ACOUSTIC EMISSION (p. 47-50)

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Control over the depth of cut when the composite-material tool wears is an important task in providing the desired size of the manufactured products. The task is solvable due to research that uses the method of acoustic emission. We have modeled the acoustic emission signals in the process of machining a composite material at a controlled depth of cut with regard to the machining tool deterioration. It is determined that an increasing wear of the machining tool at a constant cutting depth expands the acoustic emission amplitude. However, the increase in the average level of the signal amplitude of the acoustic emission is ahead of the increase in its standard deviation and variance. The findings indicate that analysis of the average amplitude rate of the acoustic emission signal can be used in methods of control over the machining of composite materials and the depth of cut with regard to the wear of the machining tool.

Keywords: acoustic emission, composite material, signal amplitude, tooling, statistical characteristics, depth of cut.

References

1. Qin, F., Hu, J., Chou, Y. K., Thompson, R. G. (2009). Delamination wear of nano–diamond coated cutting tools in composite machining. Wear, 267 (5-8), 991–995. doi: 10.1016/j.wear.2008.12.065
2. Lu, P. (2013). An investigation into interface behavior and delamination wear for diamond–coated cutting tools. Alabama, 155.
3. Fadare, D. A, Sales, W. F., Bonney, J., Ezugwu, E. O. (2012). Influence of cutting parameters and tool wear on acoustic emission signal in high–speed turning of Ti–6Al–4V Alloy. Journal of Emerging Trends in Engineering and Applied Sciences, 3 (3), 547–555. Available at: http://jeteas.scholarlinkresearch.com/articles/Influence%20of%20Cutting%20Parameters%20and%20Tool%20Wear.pdf
4. Ren, Q., Balazinski, M., Baron, L. (2012). High–order interval type–2 Takagi–Sugeno–Kang fuzzy logic system and its application in acoustic emission signal modeling in turning process. International Journal of Advanced Manufacturing Technology, 63 (9-12), 1057–1063. doi: 10.1007/s00170-012-3956-z
5. Mukhopadhyay, C. K., Jayakumar, T., Raj, B., Venugopal S. (2012). Statistical Analysis of Acoustic Emission Signals Generated During Turning of a Metal Matrix Composite. Journal of the Brazilian Society of Mechanical Sciences and Engineering, 34 (2), 145–154. doi: 10.1590/s1678-58782012000200006
6. Giriraj, B., Raja, V. P., Gandhinadhan, R., Ganeshkumar, R. (2006). Prediction of tool wear in high speed machining using acoustic emission technique and neural tenwork. Indian Journal of Engineering and Materials Sciences, 13, 275–280.
7. Sundaram, S, Senthilkumar, P, Kumaravel, A, Manoharan N. (2008). Study of flank wear in single point cutting tool using acoustic emission sensor techniques. ARPN Journal of Engineering and Applied Sciences, 3 (4), 32–36. Available at: http://www.arpnjournals.com/jeas/research_papers/rp_2008/jeas_0808_112.pdf
8. Prakash, M., Kanthababu, M., Gowri, S., Balasubramaniam, R., Jegaraj, J. R. (2014). Tool condition monitoring using multiple sensors approach in the microendmilling of aluminium alloy (AA1100). 5th International & 26th All India Manufacturing Technology, Design and Research Conference (AIMTDR 2014). Guwahati, Assam, India, 394-1–394-6.
9. Filonenko, S. F. (2015). Influencing processed composite material properties on acoustic emission. Eastern European Journal of Enterprise Technologies, 2/5 (74), 60–64. doi: 10.15587/1729-4061.2015.40191
10. Filonenko, S. F., Kosmach, O. P. (2014). Acoustic emission in composite materials friction. Aviation, 18 (2), 57–63. doi: 10.3846/16487788.2014.926640