ISSN 2312-4997

Automatics & Software Enginery

2015 N 3(13)

© Automatics & Software Enginery. 2015, №3(13)

UDK 681.2; 681.3; 681.5; 681.7

Automatics & Software Enginery. № 2(12), 2015
ISSN 2312-4997.
The Journal “Automatics & Software Enginery” has been found in June 2012.

Founder of the Journal:

Novosibirsk Institute of Program Systems
Web site of the organization: www.nips.ru

Registration certificate ПИ № ФС77-55079

Mailing Address of the editorship:

630090, Russia, Novosibirsk, Str. Prospect Akademika Lavrentieva, h. 6/1,
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Journal has been signed to publication on the 21 October 2015

Content

Control of Object with Distributed Parameters **8**

Control of Object with Feedback Loop Using Imperfect Position and Acceleration Sensors **10**

Implementation of Software for Digital Holography in Software CUDA **12**

Accelerating methods of the fabric products assembly **14**

Correct Identification and Control of Object with Time-Delay Link **15**

Unit playback of audio signals JQ6500-16P **16**

Comparison of the Contribution of Quantization Error in Level and in Time into the Result of Analog-to-Digital Conversion **17**

Reverse Overshootings Suppression in Aautomation Systems **18**

Embedded Control Systems. The Specifics of Specialist Training **19**

Information Approach to the Problems of Metrology and Physics **20**

Content of Full-Version in Russian **21**

Control of Object with Distributed Parameters

Boris Pyakillya, Vadim Zhmud

Abstract. Objects with distributed parameters differ from dynamic objects with distributed parameters by the fact that their mathematical model is much more complex. These models instead differential equations are partial differential equations. These objects are found in a variety of processes in industry, transport, science and technology. Design of control systems for such objects is based on the principle of negative feedback, as well as for objects with distributed parameters, consist in three steps. These steps are the identification of the object, selection of structure of the regulator and the calculation of the parameters for it. Methods of analytical calculation of regulators parameters may be extremely difficult to apply due to the complexity of the object model. Recently, one of the widely used methods of analysis and synthesis of regulators is a numerical optimization. It is carried out in the mathematical modeling of the system [1]. In a series of papers [1-10] a number of measures have been developed to create a target (cost) function to optimize control. These measures allow an effective search for the PID coefficients. At that, recommendations are developed about ways how to modify the cost function to increase the stability margin in the system, to reduce the static error, to reduce overshoot, to eliminate or reduce the reverse overshoot and so on, including resource saving. All these measures have been tried for controller optimization, solving the problem of the control of object with distributed parameters, but the best result is characterized by overshooting about 22%, that for many practical problems may be too large. This paper proposes a new method of control, which is a special modification of a cost function. This method reduced the overshooting to a value of about 11%, which may be preferred for some applications, even despite the fact that the duration of the transient system increased. The proposed method adds an arsenal of techniques of control of complex dynamic objects.

Key words: regulation, delay, object with distributed parameters, control, modeling, simulation

REFERENCES

[1] Zhmud V. A. Modelirovanie, issledovanie i optimizacija zamknutyh sistem avtomaticheskogo upravlenija. Monografija. Novosibirsk, Izd-vo NGTU, 2012. – 335 s. (Zhmud V.A. Simulation study and optimization of locked systems of automatic control. Monograph. Novosibirsk, Publishing House of the NSTU, 2012. - 335 p.)

[2] Zhmud V.A., Zavorin A.N. Struktura modeli dlja optimizacii sistemy s obratnoj svjaz'ju. Patent RF RU 2554291 C1. Opubl. 27.06.2015. Bjull. № 18.

[3] V. A. Zhmud. The Use of the Feedback Control Systems in Laser Physics Researching Experiments. // Proceedings of RFBR and DST Sponsored “The 2-nd Russian-Indian Joint Workshop on Computational Intelligence and Modern Heuristics in Automation and Robotics”, 10–13 September, 2011, Additional volume, pp.40–43.

[4] Zhmud V.A., Zavorin A.N. Method of designing energy-efficient regulators for complex objects with partially unknown model. Proc.: The control and modeling in complex systems. Proceedings of the XVI International Conference June 30-July 3, 2014, Samara. Russia. p. 557-567.

[5] The modeling tests of the new PID-regulators structures. Voevoda, A.A., Zhmud, V.A., Ishimtsev, R.Y., Semibalamut, V.M. 2009. Proceedings of the IASTED International Conference on Applied Simulation and Modelling, ASM 2009. P.165 – 168.

[6] Modern key technologies in automatics: Structures and numerical optimization of regulators. Zhmud, V., Yadrishnikov, O., Poloshchuk, A., Zavorin, A. 2012. Proceedings - 2012 7th International Forum on Strategic Technology, IFOST 2012.

[7] The design of the feedback systems by means of the modeling and optimization in the program VisSim 5.0/6. Zhmud, V., Liapidevskiy, A., Prokhorenko, E. 2010. Proceedings of the IASTED International Conference on Modelling, Identification and Control. PP. 27–32.

[8] V. Zhmud, O. Yadrishnikov. Numerical optimization of PID-regulators using the improper moving detector in cost function. Proceedings of the 8-th International Forum on Strategic Technology 2013 (IFOST-2013), vol. II, 28 June – 1 July. Mongolian University of Science and Technology, Ulaanbaator, Mongolia. IEEE organized. 2013. P. 265 – 270. http://www.must.edu.mn/IFOST2013/

[9] V. Zhmud, A. Polishchuk, A. Voevoda, R. V. Rao. The Tuning of the PID-Regulator for Automatic Control System of Thermo Energetic Equipment // Proceedings of the Fifth International Conference on Advances in Mechanical Engineering (ICAME-2011), June 06-08, 2011. Surat – 395 007, Gujarat, India. pp. 254-263.

[10] Zhmud V.A., Zavorin A.N. Metodi di ottimizzazione del controllo numerico su una modelli troncati. Italian Science Review. 2014; 4(13). PP. 686-689. Available at URL: http://www.ias-journal.org/archive/2014/april/Zhmud.pdf and http://www.ias-journal.org/archives/april-2014

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Control of Object with Feedback Loop Using Imperfect Position and Acceleration Sensors

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Abstract. The paper discusses the problem of balancing robot control loop with negative feedback. The controller (regulator) can be calculated by numerical optimization. Sensors of the controlled value are imperfect. Orientation angle sensor (gyroscope) has a limited speed, as well as binary quantization noise. An acceleration sensor (accelerometer) has the average drift value and Gaussian noise. None of these sensors is not sufficient to stabilize balancing robot effectively, but using of them both in a single control loop can achieve the required accuracy of control in static and dynamic. Method of sharing the two sensors to determine more accurately the single value, previously developed in theory, has been tested with simulation. Furthermore, the results are confirmed with their practical use with good effect.

Key words: automation, control, transient process, stability, quality of control, closed-loop system, the accuracy of the sensors, balancing robot, gyroscope, accelerometer

REFERENCES

[1] Zhmud V. A. Modelirovanie, issledovanie i optimizacija zamknutyh sistem avtomaticheskogo upravlenija. Monografija. Novosibirsk, Izd-vo NGTU, 2012. – 335 s. (Zhmud V.A. Simulation study and optimization of locked systems of automatic control. Monograph. Novosibirsk, Publishing House of the NSTU, 2012. - 335 p.)

[2] Zhmud V.A., Zavorin A.N. Struktura modeli dlja optimizacii sistemy s obratnoj svjaz'ju. Patent RF RU 2554291 C1. Opubl. 27.06.2015. Bjull. № 18.

[3] V. A. Zhmud. The Use of the Feedback Control Systems in Laser Physics Researching Experiments. // Proceedings of RFBR and DST Sponsored "The 2-nd Russian-Indian Joint Workshop on Computational Intelligence and Modern Heuristics in Automation and Robotics", 10–13 September, 2011, Additional volume, pp.40–43.

[4] Zhmud V.A., Zavorin A.N. Method of designing energy-efficient regulators for complex objects with partially unknown model. Proc.: The control and modeling in complex systems. Proceedings of the XVI International Conference June 30-July 3, 2014, Samara. Russia. p. 557-567.

[5] The modeling tests of the new PID-regulators structures. Voevoda, A.A., Zhmud, V.A., Ishimtsev, R.Y., Semibalamut, V.M. 2009. Proceedings of the IASTED International Conference on Applied Simulation and Modelling, ASM 2009. P.165 – 168.

[6] Modern key technologies in automatics: Structures and numerical optimization of regulators. Zhmud, V., Yadrishnikov, O., Poloshchuk, A., Zavorin, A. 2012. Proceedings - 2012 7th International Forum on Strategic Technology, IFOST 2012.

[7] The design of the feedback systems by means of the modeling and optimization in the program VisSim 5.0/6. Zhmud, V., Liapidevskiy, A., Prokhorenko, E. 2010. Proceedings of the IASTED International Conference on Modelling, Identification and Control. PP. 27–32.

[8] V. Zhmud, O. Yadrishnikov. Numerical optimization of PID-regulators using the improper moving detector in cost function. Proceedings of the 8-th International Forum on Strategic Technology 2013 (IFOST-2013), vol. II, 28 June – 1 July. Mongolian University of Science and Technology, Ulaanbaator, Mongolia. IEEE organized. 2013. P. 265 – 270. http://www.must.edu.mn/IFOST2013/

[9] V. Zhmud, A. Polishchuk, A. Voevoda, R. V. Rao. The Tuning of the PID-Regulator for Automatic Control System of Thermo Energetic Equipment // Proceedings of the Fifth International Conference on Advances in Mechanical Engineering (ICAME-2011), June 06-08, 2011. Surat – 395 007, Gujarat, India. pp. 254-263.

[10] Zhmud V.A., Zavorin A.N. Metodi di ottimizzazione del controllo numerico su una modelli troncati. Italian Science Review. 2014; 4(13). PP. 686-689. Available at URL: http://www.ias-journal.org/archive/2014/april/Zhmud.pdf and http://www.ias-journal.org/archives/april-2014

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Implementation of Software for Digital Holography in Software CUDA

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Abstract: This article examines the development of software for digital holography CUDA environment optimized by the criterion of the execution time.

Key words: digital holographic interferometry, GPGPU, CUDA, algorithm parallelization of digital holographic interferometry, digital conversion Fresnel suppression of DC component, removing speckle noise.

REFERENCES

[1] http://supercomputingblog.com/cuda/cuda-tutorial-3-thread-communication/
[2] https://msdn.microsoft.com/en-us/magazine/cc337887.aspx
[3] Разработка системы неразрушающего контроля на основе методов цифровой голографической интерферометрии
[4] http://docs.nvidia.com/cuda/cuda-c-programming-guide/
[5] https://developer.nvidia.com/cuFFT
[6] http://stackoverflow.com/questions/3606636/cuda-model-what-is-warp-size
[7] http://stackoverflow.com/questions/16986770/cuda-cores-vs-thread-count
[8] http://stackoverflow.com/questions/10934240/blocks-threads-warpsize
[9] http://cuda-programming.blogspot.ru/2013/01/what-is-constant-memory-in-cuda.html
[10] http://developer.download.nvidia.com/compute/cuda/CUDA_Occupancy_calculator.xls
[11] Рефакторинг. Улучшение существующего кода
[12] Optimizing software in C++ An optimization guide for Windows, Linux and Mac platforms http://www.agner.org/optimize/optimizing_cpp.pdf
[13] http://web.archive.org/web/20080729033434/http://www.abarnett.demon.co.uk/tutorial.html
[14] https://www.sharcnet.ca/help/index.php/CUDA_tips_and_tricks
[15] http://stackoverflow.com/questions/16119923/using-constants-with-cuda
[16] Kreis, T. Suppression of the dc term in digital holography [Text] / T. Kreis, W. Juptner // Optical Engineering. – 1997. – Vol. 36. – P. 2357-2360.
[17] Madrigal R., Acebal P. , Blaya S., Carretero L, Fimia A., Serrano F. GPU-based calculations in digital holography // Holography: Advances and Modern Trends III. – 2013. - Vol. 8776.
[18] S. Lee, H. C. Wey, D. K. Nam and D. S. Park. GPU implementation of wave field translation method for fast hologram generation // Optics and Photonics for Information Processing VIII. – 2014. - Vol. 9216.
[19] Koki Murano1, Tomoyoshi Shimobaba1,, Atsushi Sugiyama1, Naoki Takada1, Takashi Kakue1, Minoru Oikawa1, Tomoyoshi Ito. Fast computation of computer-generated hologram using Xeon Phi coprocessor // Computer Physics Communications. – 2014.
[20] N. Múnera Ortiz, C. A. Trujillo and J. García-Sucerquia. Digital holographic interferometry accelerated with GPU: application in mechanical micro-deformation measurement operating at video rate // 8th Iberoamerican Optics Meeting and 11th Latin American Meeting on Optics, Lasers, and Applications. – 2013. - Vol. 8785
[21] Yasuyuki Ichihashi, Ryutaro Oi, Takanori Senoh, Hisayuki Sasaki, KokiWakunami, and Kenji Yamamoto. A real-time 3D system using electronic holography // SPIE. – 2014.
[22] Mert Dogar, Hazar A. Ilhan, and Meric Ozcan. Real-time reconstruction of digital holograms with GPU // Practical Holography XXVII. – 2013. - Vol. 8644
[23] Koki Muranoa, Tomoyoshi Shimobabaa, Atsushi Sugiyamaa, Naoki Takadab, Takashi Kakuea, Minoru Oikawaa, Tomoyoshi Itoa. Fast computation of computer-generated hologram using Xeon Phi coprocessor // Preprint submitted to Computer Physics Communications. – 2013.
[24] R.V. Uskov. O nekotoryh osobennostjah primenenija tehnologii CUDA dlja modelirovanija perenosa izluchenija // Vestnik MGTU im. N.Je. Baumana. Ser. “Estestvennye nauki”. 2011. № 3
[25] Guzhov V.I. Ispol'zovanie golograficheskoj i spekl-interferometrii pri kontrole promyshlennyh izdelij// Pjataja mezhdunarodnaja nauchno-tehnicheskaja konferencija "Opticheskie metody issledovanija potokov". - Moskva: MJeI.- 1999.- C.107-108.
[26] Cifrovaja golograficheskaja sistema real'nogo vremeni. / Guzhov V.I., Il'inyh S.P., Hajdukov D.S., Kabak E.S. // Sbornik nauchnyh trudov Novosibirskogo gosudarstvennogo tehnicheskogo universiteta, Novosibirsk , – 2014.-№4(78) – S. 97 – 112.
[27] Algoritm rasshifrovki interferencionnyh kartin so sluchajnym fazovym sdvigom. / Guzhov V.I., Il'inyh S.P., Hajdukov D.S. // Sbornik nauchnyh trudov Novosibirskogo gosudarstvennogo tehnicheskogo universiteta, Novosibirsk , – 2014.-№4(78) – S. 79 – 96.

[28] Guzhov V.I., Pod#jakov A.E., Solodkin Ju.N., Shtejngol'c Z.I. Vosstanovlenie fazy volnovogo fronta na osnove odnomernogo preobrazovanija Fur'e// Avtometrija.- 1992.- №6.- C.21-24.

[29] Cifrovaja golograficheskaja interferometrija real'nogo vremeni dlja jeksperimental'nogo issledovanija naprjazhenno-deformirovannogo sosotojanija dinamicheskih ob#ektov. / Guzhov V.I., Il'inyh S.P., Kuznecov R.A., Kabak E.S. // Omskij nauchnyj vestnik, Omsk , – 2015.-№1(137) – S. 158 – 162.
[30] http://fap.sbras.ru/node/4141.

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Accelerating methods of the fabric products assembly

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Abstract: Using of the parallel processing methods during the simulation of the fabric material products on the solid plane–bounded object's surface to accelerate the simulation process is considered in the paper. The algorithms for paralleling the calculations on the central processing unit and on the graphics processor of the video display adapter are presented.

Keywords: the parallel processing methods, simulation of the fabric materials, particle method, leapfrog scheme.

REFERENCES

[1] Hockney W., Eastwood J., Computer Simulation Using Particles. McGraw-Hill, New York, 1981.
[2] Breen D., House D. A physically based model of woven cloth. The Visual Computer, 8(5-6):264–277, June 1992.
[3] Kawabata S. The standardisation and analysis of hand evaluation. Technical report, The textile machinery society of Japan, Osaka, July 1980.
[4] Landovsky V.V., Frolovsky V.D. Issledovanie metodov integrirovanija differencial'nyh uravnenij v zadache modelirovanija povedenija tkani na osnove metoda chastic [Investigation of the techniques of the difference equation integration in the problem of the simulation of the fabric materials behavior by particle method]. Sibirskij zhurnal vychislitel'noj matematiki. - Siberian Journal of Numerical Mathematics. 2006. vol. 9. pp. 287-298.
[5] Hughes C., Hughes T. Parallel'noe i raspredelennoe programmirovanie na C++.: Per. s angl. [Parallel and distributed programming using C++] – M.: Izdatel'skij dom «Vilyams», 2004. – 672 p.
[6] Sanders J., Kandrot E. Tekhnologiya CUDA v primerakh: vvedenie v programmirovanie graficheskikh protsessorov: Per. s angl. [CUDA by example. An introduction to general-purpose GPU programming] – M.: DMK Press, 2011. – 232 p.

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Correct Identification and Control of Object with Time-Delay Link

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Abstract. The relevance of control of objects with delay is beyond doubt; rising number of publications proves this, in particular [1]. However, the theoretical calculation results are often very far from practical results obtained using the controller (regulator) to control these objects. We can assume that the most common reason for this is too fundamental simplification of the model in the result of the identification. It can be named uncorrecrt identification. This paper usee the example object from [1] to test its adequacy of the model and its admissibility of simplifying in relation to the task the control design with the helps of negative feedback loop. The correct identification mean usability of the result for the calculation of the regulator for the object by means of any possible method, including numerical optimization. The paper resolves the stated problem of the identification based in the comparison of the resulting transient processes from the experiment and from the simulation. In addition, it gives the results of the regulator calculation by means of numerical optimization on the base of the mathematical modeling (simulation) in program *VisSim*.

Key words: regulation, time-delay, object identification, configuration of control, modeling, simulation, simulation correctness.

REFERENCES

[1] V.V. Kurganov, A.V. Cavnin. Upravlenie ob#ektom s zapazdyvaniem. FGBOU VO NI TPU (Tomsk, Rossija). Avtomatika i programmnaja inzhenerija. 2015. № 2 (12). S. 9–13.
[2] Zhmud' V. A. Modelirovanie, issledovanie i optimizacija zamknutyh sistem avtomaticheskogo upravlenija. Monografija. Novosibirsk, Izd-vo NGTU, 2012. – 335 s.
[3] Zhmud' V.A., Zavorin A.N. Struktura modeli dlja optimizacii sistemy s obratnoj svjaz'ju. Patent RF RU 2554291 C1. Opubl. 27.06.2015. Bjull. № 18.

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Unit playback of audio signals JQ6500-16P

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Abstract: The paper deals with offline playback sounds, music, voice playback using the sounds module JQ6500-16P. The paper gives scheme of connectivity for stand-alone regime, and for work with computer. The paper resolves the problem of transfer of audio-files from computer to modules without specialized software. In addition, the paper discovers the way to control the module using the buttons and serial interface. It allows controlling the module with the helps of computer of on any microcontroller. The minimum number of external components is required for the operation of the module. It is the additional significant advantage. All this allows quickly creating of devices and systems capable of reproducing audio signals.

Key words: JQ6500, JQ6500-16P, MP3, play audio, RS-232, USART, UART, Terminal.

REFERENCES

[1] URL: http://www.ebay.com/sch/i.html?_odkw=JQ6500-16P&_osacat=0&_from=R40&_trksid=p2045573.m570.l1313.TR0.TRC0.H0.XJQ6500+mp3.TRS0&_nkw=JQ6500+mp3&_sacat=0. (Date: 22.06.2015)URL: http://saber.patagoniatecnology.com/wp-content/uploads/2014/09/JQ6500-voice-Module.pdf (Date: 22.06.2015)

[2] V.A. Zhmud, I.V. Trubin, M.V. Trubin. Exchange of Data between the Computer and the Microcontroller STM32F100 by Serial Communication Interface RS-232. Automatics & Software Enginery. 2015. №1(11). С. 45–51. http://www.jurnal.nips.ru/sites/default/files/A%26SE-1-2015-6.pdf

[3] URL: http://jurnal.nips.ru/sites/default/files/%D0%90%D0%98%D0%9F%D0%98-1-2015-6.pdf (Date: 22.06.2015)

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Comparison of the Contribution of Quantization Error in Level and in Time into the Result of Analog-to-Digital Conversion

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Abstract: Choice of analog-digital converters (ADC) for converting of signals is based on a compromise between speed and accuracy, even if the price of ADC can be not taken into consideration. Obviously, the accuracy of ADC is connected with the number of digits, though not only this limits it. Nyquist theorem (Nyquist-Shannon sampling theorem) states that at sufficiently high accuracy of samples taking it is enough to take them with a frequency of more than twice of the maximum frequency of the spectrum of the converted signal. This requirement sets the limits of applicability of digital conversion, and if, under the terms of the pure theory, the signal is infinite in time and the samples are taken from the zero error and the upper limit of the frequency band of signal is known. Under these conditions, such readings gives the opportunity to restore the original signal without loss. On this basis, many practitioners, engineers, teachers, and researchers believe that the accuracy of the conversion has the highest priority, and the frequency of conversion can be not too high, it is enough to provide the required conditions of the theorem. However, in practice, the signals are limited in time, the accuracy of the conversion is also limited, and the restoration of the original signal not uses the best algorithms for calculating it. The proof of this theorem does not take into account such situation. The question of the criteria for selecting the ADC is relevant, espessially if it is noe possible at the same time to provide a higher precision and higher performance. It is important to know, which of these parameters should be considered as the most important one, and what parameter you can donate. This paper explores this question by modeling.

Key words: data collection and data processing, ADC, sampling, quantization of the time, quantization of the level

REFERENCES

[1] https://ru.wikipedia.org/wiki/Теорема_Котельникова.
[2] V.A. Zhmud Simulation study and optimization of locked systems of automatic control. Monograph. Novosibirsk, Publishing House of the NSTU, 2012. - 335 p.

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Reverse Overshootings Suppression in Aautomation Systems

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Abstract. The task of control of objects prone to oscillation is extremely difficult. Analytical methods in the case of a complex object models are inferior in features methods based on numerical optimization controllers. Tools of this method is a set of structures regulators, set of objective functions and tools for modeling and optimization. A number of works of the author is devoted to the author's methods of constructing of the objective functions, their advantages and disadvantages, as well as the rationale for the choice of program VisSim for the simulation and optimization [1-6]. The most commonly used control structure - is a serial PID-controller (PID-regulator, PID) which contains proportional, integrating and derivative links. In some cases spetial measures for the choice of the target (cost) functions allow to suppress oscillations in the system, however, in some cases, even these measures are not effective enough. This paper discusses one of the structural methods of suppression of oscillations in systems for control of objects prone to oscillatory instability. This method is in the use of more complicated structure than conventional PID-controllers, in particular, double-loop regulator. Mathematical modeling has tested the proposed method. Transients illustrate the paper confirming the effectiveness of this method.

Key words: controller, regulatorl, automation, feedback, speed, accuracy, control, transients, numerical optimization

REFERENCES

[1] Zhmud V.A., Yadryshnikov O.D. Chislennaja optimizacija PID-reguljatorov s ispol'zovaniem detektora pravil'nosti dvizhenija v celevoj funkcii. Avtomatika i programmnaja inzhenerija. 2013. № 1 (3). p.24–29. URL: http://www.nips.ru/images/stories/zhournal-AIPI/3/Paper-2013-1-4.pdf (Automatics & Software Engineering, URL: http://jurnal.nips.ru/en/node/58)

[2] V.A. Zhmud, O.D. Yadryshnikov. Povyshenie kachestva perehodnogo processa pri upravlenii sklonnymi k kolebanijam ob'ektami. Avtomatika i programmnaja inzhenerija. 2013. № 3 (5). p. 12–17. URL: http://jurnal.nips.ru/sites/default/files/AIPI-3-2013-2.pdf

[3] V.A. Zhmud. Simulation study and optimization of closed systems of automatic control. Novosibirsk, Publishing House of the NSTU, 2012. 335 p.

[4] V.A. Zhmud, G.A. Frantsuzova, A.S. Vostrikov. Dynamics of mechatronic systems: Proc. Manual. Novosibirsk: Publishing House of the NSTU, 2014. - 176 p. ISBN 978-5-7782-2415-5.

[5] V.A. Zhmud, O.D. Yadrishnikov. Numerical optimization of PID-regulators using the improper moving detector in cost function. Proceedings of the 8-th International Forum on Strategic Technology 2013 (IFOST-2013), vol. II, 28 June – 1 July. Mongolian University of Science and Technology, Ulaanbaator, Mongolia. IEEE organized. 2013. P. 265 – 270. http://www.must.edu.mn/IFOST2013/

[6] V.A. Zhmud, A.N. Zavorin. Method of designing energy-efficient controllers for complex objects with partially unknown model. Proc.: The control and modeling in complex systems. Proceedings of the XVI International Conference June 30 - July 3, 2014, Samara. Russia. p. 557-567. V.A. Zhmud V., L.V. Dimitrov. The providing of the power saving control of one output value with two controlling channels having different effectiveness and cost of the controlling resource. International journal for science, technics and innovations for the industry. 2015. IX Issue 9. ISSN 1313-0226 / Machines, Technologies, Materials. P. 50 –54.URL: http://mech-ing.com/journal/Archive/2015/9-2015.pdf

[7] Nusret Tan, Derek P. Atherton. Design of PI and PID controllers. International Journal of Systems Science. Vol.37, No. 8, June 2006. p. 543–554.

[8] Жмудь В.А., Трубин М.В. Регулятор с разделением «правильных» и «неправильных» движений. Автоматика и программная инженерия. 2015. № 1 (11). С. 57–62.

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Embedded Control Systems. The Specifics of Specialist Training

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Abstract: Modern embedded systems include are relevant. The area of application includes: automatic control systems and many other areas. Design of these systems is a complex task. It requires the participation of experts in many fields. The task is complicated by the fact that for them, as a rule, there are strict limitations on computational resources, reliability, cost and development time. The article discusses ways of teaching students the development of such systems.

Key words: higher education, software systems, information technology, embedded system

REFERENCES

[1] MDD – Total review and concept of the development, controlled models. – URL: http://www.ibm.com/developerworks/ru/library/mdd/ch1/ch1.html.

[2] Embedded control System. A Platunov: Control Engineering, Russia, February-2013. URL: http://www.controlengrussia.com/programmnye-sredstva/vstraivaemy-e-sistemy-upravleniya

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Information Approach to the Problems of Metrology and Physics

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Abstract: This paper discusses the necessity of presence of sources of error in all measurements cases. On this basis the paper proposes measurement philosophy. Dan excursion into some fizichekoy theory [1-13] did not take into account the fact that any measurement error is instrumental, as well as the method of error. In the proposed method of philosophical error are easy to take into consideration, even in the case where they are unavoidable. If this approach would be considered, perhaps, these theories would have been quite different, or does not exist.

Key words: measurements, physics, philosophy, the theory of relativity, computer science

REFERENCES

[1] Dzh. Trigg. Reshajushhie jeksperimenty v sovremennoj fizike. M. Mir. 1974. 160 s.
[2] S.N. Arteha. Kritika osnov teorii otnositel'nosti. M. Editorial URSS. 2004. 224 s. BBK 22.313.
[3] Dzh. Veber. Obshhaja teorija otnositel'nosti i gravitacionnye volny. M. Izd-vo Inostrannoj literatury. 1962. 272 s.
[4] V. Kurganov. Vvedenie v teoriju otnositel'nosti. M. Mir. 1968 g. 180 s.
[5] L. Brilljujen. Novyj vzgljad na teoriju otnositel'nosti. M. Mir. 1972. 144 s.
[6] Djevid Bom. Special'naja teorija otnositel'nosti. M. Mir. 1967. 288 s.
[7] Kliment D'jurell. Azbuka teorii otnositel'nosti. M. Mir. 1964. 164 s.
[8] Sekerin V.I. Teorija otnositel'nosti – mistifikacija veka. Novosibirsk. 1991.
[9] Ju.B. Rumer, M.S. Ryvkin. Teorija otnositel'nosti. M. Uchpedgiz. 1960. 212 s.
[10] I.D. Novikov. Kak vzorvalas' vselennaja. M. Nauka. 1988. 176 s. ISSN 5-02-012881-9
[11] D. Shama. Sovremennaja kosmologija. M. Mir. 1973. Per. s angl. 254 s.
[12] http://universe-tss.su/
[13] S. Hoking, L. Mlodinov. Neulovimaja edinaja teorija vsego. V mire nauki. 2010. № 11 – 12 (nojabr' – dekabr'), s. 6–9.

Content of Full-Version in Russian

I. Automation. Automated Systems **7**

Control of Object with Distributed Parameters. Boris Pyakillya, Vadim Zhmud 9

Control of Object with Feedback Loop Using Imperfect Position and Acceleration Sensors. Vadim Zhmud, Vladimir Semibalamut, Oleg Yadrishnikov, Vitaly Trubin 17

II. Robotics. Software and Systems. Telemechanics and Telemetry **27**

Implementation of Software for Digital Holography in Software CUDA. V.I. Guzhov, S.P. Ilyinikh, P.S. Ryzhov 29

III. Innovative Technologies. Promising Technologies. Simulation of Systems. Numerical optimization **38**

Accelerating methods of the fabric products assembly. I.E. LANDOVSKAYA, V.D. FROLOVSKY, V.V. LANDOVSKY 41

IV. Measuring Means and Systems. Identification **49**

Correct Identification and Control of Object with Time-Delay Link. Boris Pyakillya, Vadim Zhmud 51

V. Popular Papers. Intriduction into Spesialities **64**

Comparison of the Contribution of Quantization Error in Level and in Time into the Result of Analog-to-Digital Conversion. VADIM ZHMUD 66

Reverse Overshootings Suppression in Aautomation Systems. VADIM ZHMUD 71

VI. Discussions. Forum. Information for Authors **76**

Embedded Control Dystems. The Specifics of Specialist Training. L.V. Tyunina 78

Information Approach to the Problems of Metrology and Physics. V.A. Zhmud 80

Requirements for Publication in Scientific Electronic Journal "Automation and Software Engineering" 110

ISSN 2312-4997