## Testing as a Method of Remote Learning in Connection with the COVID-19 Pandemic: Effective Feedback on the Level of Students' Knowledge

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Abstract. In the context of self-isolation announced in connection with the COVID-19 pandemic, the ability of teachers to contact teaching methods has changed significantly, including lecturing, conducting practical exercises and laboratory work. Only the possibilities of assigning assignments that students can do on their own have not been affected, since nothing prevents you from assigning assignments and checking the results using any of the communication technologies, starting with email, ending with any means of communication, including conferences and webinars. Methods involving direct dialogs are currently not effective enough, because providing all teachers and students with stable Internet connection in our country still remains a problem. Many systems work stably only with a relatively small number of active interlocutors. In this situation, testing, which, as a rule, teachers actively object, becomes a fairly effective teaching method, providing feedback on the level of students' knowledge. This article informs readers about the experience of applying testing in the subject "Modeling of control systems".

Key words: automation, mathematical modeling, numerical optimization, cybernetics, distance education, network education, testing, automatic control, control in technical systems, higher technical education

## REFERENCES

- [1] Zhmud V., Prokhorenko E., Liapidevskiy A. The design of the feedback systems by means of the modeling and optimization in the program VisSim 5.0/6. В сборнике: proceedings of the IASTED international conference on modelling, identification and control 30th IASTED conference on modelling, identification, and control, ASIAMIC 2010. Cep. "Proceedings of the 30th IASTED conference on Modelling, Identification, And Control, Asiamic 2010" Phuket, 2010. C. 27-32.
- [2] Zhmud V.A. Modeling, research and optimization of closed systems. Monograph / Novosibirsk State Technical University. Novosibirsk, 2012. (in Russian).
- [3] Zhmud V.A., Zavorin A.N. Metodi di ottimizzazione del controllo numerico su una modelli troncati. Italian Science Review. 2014. № 4 (13). C. 686-689.
- [4] Voevoda A.A., Zhmud V.A., Ishimtsev R.Y., Semibalamut V.M. The modeling tests of the new pidregulators structures. In: Proceedings of the IASTED International Conference on Applied Simulation and Modelling, ASM 2009 18th IASTED International Conference on Applied Simulation and Modelling, ASM 2009. Palma de Mallorca, 2009. C. 165-168.
- [5] Voevoda A.A., Zhmud V.A. Convergence of controller optimization algorithms for an object with a limiter and with a delay. Scientific Bulletin of the Novosibirsk State Technical University. 2007. No. 4 (29). S. 179-184. (in Russian).
- [6] Zhmud V., Yadrishnikov O., Poloshchuk A., Zavorin A. Modern key techologies in automatics: structures and numerical optimization of regulators. В сборнике: Proceedings 2012 7th International Forum on Strategic Technology, IFOST 2012 2012. C. 6357804.
- [7] Vasiliev V.A., Voevoda A.A., Zhmud V.A., Hassuoneh V.A. Digital controllers: target settings, selection of integration method, hardware implementation. Collection of scientific papers of Novosibirsk State Technical University. 2006. No. 4 (46). S. 3-10. (in Russian).

- [8] Zhmud VA, Yadryshnikov O. Numerical optimization of pid-regulators using the detector of the correctness of motion in the target function. Automation and software engineering. 2013. No. 1 (3). S. 24-29. (in Russian).
- [9] Zhmud V., Dimitrov L., Yadrishnikov O. Calculation of regulators for the problems of mechatronics by means of the numerical optimization method. В сборнике: 2014 12th International Conference on Actual Problems of Electronic Instrument Engineering APEIE 2014 Proceedings. 2014. C. 739-744.
- [10] Zhmud V., Vostrikov A., Semibalamut V. Feedback systems with pseudo local loops. В сборнике: Testing and Measurement: Techniques and Applications Proceedings of the 2015 International Conference on Testing and Measurement: Techniques and Applications, TMTA 2015 2015. C. 411-417.
- [11] Voevoda A.A., Zhmud V.A. Astatic control of objects with non-stationary matrix transfer functions by the method of approximate inversion of functional complex matrices. Scientific Bulletin of the Novosibirsk State Technical University. 2006. No. 2 (23). S. 3-8. (in Russian).
- [12] Zhmud V., Zavorin A. The design of the control system for object with delay and interval-given parameters. В сборнике: 2015 International Siberian Conference on Control and Communications, SIBCON 2015 Proceedings 2015. C. 7147060.
- [13] Zhmud V.A., Zavorin A.N. A method for designing energy-saving controllers for complex objects with a partially unknown model. In the collection: Problems of control and modeling in complex systems. Proceedings of the XVI International Conference. Institute for Management of Complex Systems, Samara Scientific Center of the Russian Academy of Sciences; Edited by: E.A. Fedosova, N.A. Kuznetsova, V.A. Wittich. 2014.S. 557-567. (in Russian).
- [14] Zhmud V.A., Goncharenko A.M. Modern problems of high-precision measurements of the phase differences.
  В сборнике: Труды XIII Международной Научно-Технической Конференции Актуальные Проблемы Электронного Приборостроения. Proceedings: in 12 volumes. 2016. C. 314-318.

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- [15] Zhmud V.A., Frantsuzova G.A., Vostrikov A.S. Dynamics of mechatronic systems. Textbook / Novosibirsk, 2014. (in Russian).
- [16] Zhmud V.A., Zavorin A.N., Yadryshnikov O.D. Non-analytical methods for calculating PID controllers (in Russian). Textbook / Novosibirsk, 2013.



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