

Reverse Overshootings Suppression in Automation 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 programnaja inzhenerija. 2013. № 1 (3). p.24–29. URL: <http://www.nips.ru/images/stories/zjournal-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 perehnogo processa pri upravlenii sklonnymi k kolebanijam ob'ektami. Avtomatika i programnaja 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. Yadryshnikov. 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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