2022 International Conference and Exposition on Electrical and Power Engineering

20-22 October 2022, Iasi, Romania, eISBN 978-16-65489-94-2

Modified polynomial method to synthesize a control algorithm for a system with second-order inertia and time delay

Bartolomeu IZVOREANU, Adrian SECRIERU, Irina COJUHARI, Ion FIODOROV, Dumitru MORARU, Mihail POTLOG

https://doi.org/10.1109/EPE56121.2022.9959867

Abstract

The paper presents the procedure for tuning the PID controller to the object model with second-order inertia and time delay according to the method of the maximum degree of stability with iterations and the modified polynomial method. In industrial process automation, mathematical models attached to slow and very slow processes are approximated by mathematical model with second-order inertia and time delay. The modified polynomial method of tuning the PID algorithm to the control object model with first-order inertia and time delay is developed, which presents a simple procedure. To compare the obtained results, the method of the maximum degree of stability with iterations, the Ziegler-Nichols method of tuning the PID controller to the object model with second-order inertia and time delay is applied. Examples are examined and the results obtained when varying the parameters of the object model are analyzed. The advantages of the maximum degree of stability method with iterations and modified polynomial method are highlighted.

Keywords: *tuning methods, maximum degree of stability, method with iterations, polynomial method, performance, robustness*

References:

1. *Automatica/ Ioan Dumitrache (in romanian), Bucharest:Romanian Academy Publishing House, vol. 1, 2009.* Google Scholar
2. *I. Dumitrache, Control engineering (in romanian), Bucharest:Politehnica P, vol. 1, 2016.* Google Scholar
3. *V. A. Lukas, Automatic control theory (in russian), Moskva:Nedra, 1990.* Google Scholar
4. *E. Iu. Vorontzov, V. G. Lisenko and N. N. Ponamarev, "The study of tuning the PID*

contollers based on the example of modeling the control object with inertia and time delay (in russian)", Proceeding of the Conference Heat Engineering and Computer Science in Education Science and Production, pp. 37-41, 2013. Google Scholar

5. *A. V. Polishuk, "Tuning the PID controller for the control objects with heat power equipments (in russian)", Journal Technical Sciences Informatics Computer Engineering and Automatics, 2012.* Google Scholar
6. *A. A. Sidorova, "Determination of the most effective tuning method of the PID controller (in russian)", Prob. inform., vol. 5, no. 18, pp. 143-150, 2012.* Google Scholar
7. *N. I. Smirnov, V. P. Sabinin and A. I. Repin, "Optimization of the one contour automatic control systems with multiparametric controller (in russian)", Prom. ASU i kontollery, vol. 7, pp. 24-28, 2005.* Google Scholar
8. *V. A. Jmudi, "About PID tuning metods (in russian)", Journal Automatics and Software Engineering, no. 2(4), pp. 118-124, 2013.* Google Scholar
9. *A.P. Prokopiev, V.I. Ivanchura and R.T, "Emelyanov Synthesis PID Controller for Objects Second Order with Regard to the Location Poles", Journal of Siberian Federal University. Engineering & Technologies, vol. 9, no. 1, pp. 50-60, 2016.* CrossRef Google Scholar
10. *G. I. Zagarii and A. M. Shubladze, The Synthesis of the Control System According to the Maximum Stability Degree (in russian), Moskva:Energoatomizdat, 1988.* Google Scholar
11. *B. Izvoreanu, I. Cojuhari, I. Fiodorov, D. Moraru and A. Secrieru, "Tuning the PID Controller to the Model of Object with Inertia Second Order According to the Maximum Stability Degree Method with Iteration", Annals of the University of Craiova Electrical Engineering series, no. 43, pp. 79-85, 2019.* Google Scholar
12. *B. Izvoreanu, I. Fiodorov and M. Pisarenco, "Comparative Analysis of Regulators Tuning Methods to Models of Objects with Inertia", Buletinul Institutului Politehnic din Iaşi Tomul L(LIV) Fasc. 5A Electrotehnică Energetică Electronică, pp. 63-68, 2004.* Google Scholar