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DC Motor Angular Position Control by using fractional PID Controller

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Abstract

In this paper, a fractional order PID controller is investigated for a position servomechanism control system considering actuator saturation and the shaft torsional flexibility. The Arduino microcontroller board is mainly used to control the 12V brushed Namiki DC motor. L298N dual H-bridge motor driver is applied to execute the pulse width modulation (PWM) signal and to drive the direction control. The implementation code is considered to generate the PWM output using PID (proportional, integral and derivative) tuning algorithms. According to the PID tuning method, errors are not only solved but also taken to its minimal value with very low amount of error oscillations. In this work, step input, sine input and potentiometer input are tested to analyze the system performance. The results were clearly seen, the controller output response curve is very well-matched to approach the desired position. But, it has a few errors when the orientation of changes angle because they are not fast to reach the desired position. Therefore, friction compensation according to the velocity effect is considered. After compensating the friction effect, the PID output results were very precise to get the desired angle. This stability performance using PID controller can be applied for robotic arm position control system and other industrial applications.

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Keywords: *DC-Gear motor, L298 Motor Driver, PID, PWM control*

References

1. K. B. Oldham and J. Spanier, The Fractional Calculus, Academic Press, New York and London; 1974. [Google Scholar]

2. Mathworks Inc., Model Predictive Control Toolbox User's Guide.[Google Scholar]

3. J. A. Tenreiro Machado, Theory analysis and design of fractional-order digital control systems, Journal Systems Analysis Modeling Simulation, Vol. 27, 1997, pp. 107-122. [Google Scholar]

4. A. Oustaloup, J. Sabatier and X. Moreau, From fractal robustness to the CRONE approach, ESAIM, Vol. 5, 1998, pp. 177-192. [CrossRef] [Google Scholar]

5. Dingyü Xue and YangQuan Chen, Advanced Mathematic Problem Solution Using MATLAB, Beijing: Tsinghua University Press; 2004. [Google Scholar]

6. Z.F. Lv, Time-domain simulation and design of SISO feedback control systems, Doctoral Dissertation, National Cheng Kung University, Taiwan, China, 2004. [Google Scholar]

7. R. Caponetto, L. Fortuna, and D. Porto, "A new tuning strategy for a non integer order PID controller," IFAC2004, Bordeaux, France, 2004. [Google Scholar]

8. Chunna Zhao, Dingyü Xue and Yangquan Chen, "A fractional order PID tuning algorithm for a class of fractional order planst," Proc. of the IEEE International Conference on Mechatronics and Automation, Niagara Falls, Canada, 2005,pp. 216-221. [Google Scholar]

9. C. A. Monje, B. M. Vinagre, Y. Q. Chen, V. Feliu, P. Lanusse and J. Sabatier, "Proposals for fractional PID tuning", The First IFAC Symposium on Fractional Differentiation and its Applications 2004, Bordeaux, France, July 19-20, 2004. [Google Scholar]

10. C. B. Ma and Y. Hori, "Design of fractional order PID controller for robust two-inertia speed control to torque saturation and load inertia variation," IPEMC 2003, Xi'an, China,2003. [Google Scholar]

11. Dingyü Xue and YangQuan Chen, "A comparative introduction of four fractional order controllers," Proceedings of the 4th World Congress on Intelligent Control and Automation, Shanghai, China, 2002,pp. 3228-3235. [Google Scholar]

12. I. Podlubny, Fractional-order systems and PID -controllers, IEEE Trans. Automatic Control, vol.44,1999,pp.208-214. [Google Scholar]

13. A. Oustaloup, F. Levron, B. Mathieu, and P.M. Nanot, "Frequency-band complex noninteger differentiator: characterization and synthesis", IEEE Trans. Circuits Syst. I, vol. 47, 2000,pp.25-39. [Google Scholar]