

## DAFTAR PUSTAKA

- [1] V. Chamola, P. Kotesh, A. Agarwal, Naren, N. Gupta, and M. Guizani, “A Comprehensive Review of Unmanned Aerial Vehicle Attacks and Neutralization Techniques,” *Ad Hoc Networks*, vol. 111, no. September 2020, p. 102324, 2021, doi: 10.1016/j.adhoc.2020.102324.
- [2] MTS Systems Corporation, “MTS Services, Maintenance Parts and Accessories Catalog for 2020,” 2020.
- [3] K. J. Åström, “Control System Design: Chapter 6 -PID Control,” in *Control System Design*, 2002, pp. 216–251.
- [4] N. Tandan and K. K. Swarnkar, “Tuning of PID Controller Using PSO and Its Performances on Electro-Hydraulic Servo System,” pp. 233–240, 2015.
- [5] T. Samakwong and W. Assawinchaichote, “PID Controller Design for Electro-hydraulic Servo Valve System with Genetic Algorithm,” *Procedia - Procedia Comput. Sci.*, vol. 86, no. March, pp. 91–94, 2016, doi: 10.1016/j.procs.2016.05.023.
- [6] K. K. Ahn, D. Q. Truong, and Y. H. Soo, “Self Tuning Fuzzy PID Control for Hydraulic Load Simulator,” *ICCAS 2007 - Int. Conf. Control. Autom. Syst.*, pp. 345–349, 2007, doi: 10.1109/ICCAS.2007.4406935.
- [7] D. Q. Truong and K. K. Ahn, “Force Control for Press Machines Using An Online Smart Tuning Fuzzy PID based on A Robust Extended Kalman Filter,” *Expert Syst. Appl.*, vol. 38, no. 5, pp. 5879–5894, 2011, doi: 10.1016/j.eswa.2010.11.035.
- [8] Y. Xiaole, Z. Yuanliang, and Z. Wenlong, “Electro-Hydraulic Servo System Control Technology Based on Fuzzy-Multi-PID,” *2009 Int. Work. Intell. Syst. Appl. ISA 2009*, pp. 1–4, 2009, doi: 10.1109/IWISA.2009.5072846.



- [9] A. Sakalli, A. Beke, and T. Kumbasar, “Gradient Descent and Extended Kalman Filter based Self-Tuning Interval Type-2 Fuzzy PID Controllers,” *2016 IEEE Int. Conf. Fuzzy Syst. FUZZ-IEEE 2016*, pp. 1592–1598, 2016, doi: 10.1109/FUZZ-IEEE.2016.7737880.
- [10] R. R. De Maity, R. K. Mudi, and C. Dey, “Real-time Evaluation of an Interval Type-2 Fuzzy PID Controller on Servo Position Control System,” *Proc. 5th Int. Conf. Emerg. Appl. Inf. Technol. EAIT 2018*, 2018, doi: 10.1109/EAIT.2018.8470410.
- [11] T. Kumbasar and H. Hagras, “Interval Type-2 Fuzzy PID Controllers,” pp. 285–294, Jan. 2015, doi: 10.1007/978-3-662-43505-3.
- [12] N. Sheng, X. Chen, H. Ge, and D. Li, “Optimal Interval Type 2 Fuzzy PID Controller and its Application in Inverted Pendulum System,” *Proc. 2019 IEEE 2nd Int. Conf. Autom. Electron. Electr. Eng. AUTEEE 2019*, pp. 635–637, 2019, doi: 10.1109/AUTEEE48671.2019.9033265.
- [13] P. D. Pour, K. M. J. Alsayegh, and M. A. Jaradat, “Type-2 Fuzzy Adaptive PID Controller for Differential Drive Mobile Robot: A Mechatronics Approach,” *2022 Adv. Sci. Eng. Technol. Int. Conf. ASET 2022*, no. 1, 2022, doi: 10.1109/ASET53988.2022.9734882.
- [14] X. Jin, K. Chen, Y. Zhao, J. Ji, and P. Jing, “Simulation of Hydraulic Transplanting Robot Control System Based on Fuzzy PID Controller,” *Meas. J. Int. Meas. Confed.*, vol. 164, p. 108023, 2020, doi: 10.1016/j.measurement.2020.108023.
- [15] S. Kundu, R. Bhattacharjee, and S. Chaudhuri, “Evaluation of Fuzzy-Logic based Position Control Strategies for an Electrohydraulic Actuation System,” *Proc. 2021 1st Int. Conf. Adv. Electr. Comput. Commun. Sustain. Technol. ICAECT 2021*, 2021, doi: 10.1109/ICAECT49130.2021.9392479.
- [16] G. Timothy *et al.*, “Design of Self-tuning PID Controller Parameters Using



Fuzzy Logic Controller for Quad-rotor Helicopter Design of Self-tuning PID Controller Parameters Using Fuzzy Logic Controller for Quad-rotor Helicopter,” vol. 3, no. 6, pp. 95–99, 2021.

- [17] A. T. Negara, I. Ardiyanto, and O. Wahyunggoro, “Tuning of Fractional-Order PID Controller for Electro-Hydraulic Servo Valve System,” *2019 Int. Conf. Inf. Commun. Technol.*, pp. 659–662, 2019.
- [18] G. Yang and J. Yao, “Output Feedback Control of Electro-Hydraulic Servo Actuators with Matched and Mismatched Disturbances Rejection,” vol. 356, pp. 9152–9179, 2019, doi: 10.1016/j.jfranklin.2019.07.032.
- [19] E. Dyah Atsari and A. Halim, “Design of a Fractional Order PID Controller for Electric Hydraulic Actuator,” *Kinet. Game Technol. Inf. Syst. Comput. Network, Comput. Electron. Control*, vol. 4, pp. 59–68, 2021, doi: 10.22219/kinetik.v6i1.1151.
- [20] D. Zhao, F. Meng, Z. Zhang, L. Wang, Q. Liu, and C. Liu, “Research on Active Disturbance Rejection Control Based on Position Disturbance Electro-hydraulic Servo Force,” *Chinese Control Conf. CCC*, vol. 2020-July, pp. 3544–3549, 2020, doi: 10.23919/CCC50068.2020.9188655.
- [21] X. Ma, X. Zhang, W. Wang, and Z. Su, “Sliding Mode Variable Structure Control for Servo System of Valve Controlled Hydraulic Actuator,” *2018 IEEE 8th Int. Conf. Underw. Syst. Technol. Theory Appl.*, no. 2, pp. 1–5, 2018, doi: 10.1109/USYS.2018.8779232.
- [22] Moog, “Electro-Hydraulic Valves – a Technical Look,” *Moog*, pp. 1–36, 2016, [Online]. Available: [http://www.moogvalves.com/Global/FileLib/EH/Moog-ServoValves-Techn\\_Look-Overview-en.pdf](http://www.moogvalves.com/Global/FileLib/EH/Moog-ServoValves-Techn_Look-Overview-en.pdf).
- [23] “Servo Valves Pilot Operated Flow Control Valve with Analog Interface G761/761 Series, Size 04.” Accessed: Dec. 07, 2020. [Online]. Available:

[www.moog.com/literature/disclaimers](http://www.moog.com/literature/disclaimers).

- [24] M. G. Rabie, *FLUID POWER ENGINEERING*. The McGraw-Hill Companies, Inc., 2009.
- [25] “How Does a Strain Gauge Load Cell Work? | Load Cell Central | Load Cell Central.” <https://www.800loadcel.com/load-cell-and-strain-gauge-basics.html> (accessed Apr. 13, 2023).
- [26] MTS, “661.20 Force Transducer,” 2008. <https://manualzz.com/doc/12295843/661.20-force-transducer>.
- [27] “Linear Variable Differential Transformer (LVDT) Basics | TE Connectivity.” <https://www.te.com/usa-en/products/sensors/position-sensors/intersection/lvdt-tutorial.html> (accessed Apr. 14, 2023).
- [28] E. D. Atsari, “Perancangan Pengendali PID Orde Fraksi pada Aktuator Hidrolik Elektrik,” Universitas Indonesia, 2022.
- [29] “Aktuator - Definisi, Fungsi, Jenis dan Kelebihan Kekurangan.” <https://wira.co.id/aktuator/> (accessed Apr. 14, 2023).
- [30] K. J. Åström and T. Hägglund, *PID Controllers: Theory, Design, and Tuning*, vol. 2. North Carolina: Instrument Society of America, 1995.
- [31] T. Y. Wu, Y. Z. Jiang, Y. Z. Su, and W. C. Yeh, “Using Simplified Swarm Optimization on Multiloop Fuzzy PID Controller Tuning Design for Flow and Temperature Control System,” *Appl. Sci.*, vol. 10, no. 23, pp. 1–23, 2020, doi: 10.3390/app10238472.
- [32] L. A. Zadeh, “Fuzzy Sets,” *Inf. Control* 8, pp. 338–353, 1965, doi: 10.1061/9780784413616.194.
- [33] Q. Liang and J. M. Mendel, “Introduction to type-2 TSK fuzzy logic systems,” *IEEE Int. Conf. Fuzzy Syst.*, vol. 3, pp. 915–920, 1999.



UNIVERSITAS  
GADJAH MADA

**Implementasi Pengendali Fuzzy Interval Tipe 2 PID untuk Mengurangi Dampak Derau pada Sistem Elektro Hidrolik Servo Valve Mesin Uji Kekuatan Struktur MALE UAV (Medium Altitude Long Endurance Unmanned Aerial Vehicle)**

JAWAHIR AL KALAMUL HAQ, Ir. Oyas Wahyunggoro, MT., Ph.D.; Ir. Eka Firmansyah, S.T., M.Eng., Ph.D., IPM.  
Universitas Gadjah Mada, 2024 | Diunduh dari <http://etd.repository.ugm.ac.id/>

- [34] Guanrong Chen and T. T. Pham, *Introduction to Fuzzy Sets, Fuzzy Logic, and Fuzzy Control Systems*, vol. 4, no. 1. 2000.
- [35] P. Ponce-cruz, A. Molina, and B. MacCleery, *Fuzzy Logic Type 1 and Type 2 Based on LabVIEW™ FPGA*. Warsaw: Springer International Publishing, 2016.
- [36] I. Iancu, *A Mamdani Type Fuzzy Logic Controller*. 2012.
- [37] “Mamdani and Sugeno Fuzzy Inference Systems - MATLAB & Simulink.” <https://www.mathworks.com/help/fuzzy/types-of-fuzzy-inference-systems.html> (accessed May 04, 2023).
- [38] Q. Liang and J. M. Mendel, “Interval Type-2 Fuzzy Logic Systems: Theory and Design,” *IEEE Trans. Fuzzy Syst.*, vol. 8, no. 5, pp. 535–550, 2000, doi: 10.1109/91.873577.
- [39] “Add membership function to fuzzy variable - MATLAB addMF.” <https://www.mathworks.com/help/fuzzy/mamfis.addmf.html> (accessed May 04, 2023).
- [40] C. C. Lee, “Fuzzy Logic in Control Systems: Fuzzy Logic Controller, Part I,” *IEEE Trans. Syst. Man Cybern.*, vol. 20, no. 2, pp. 419–435, 1990, doi: 10.1109/21.52552.
- [41] T. Kumbasar and H. Hagras, “Interval Type-2 Fuzzy PID Controllers,” *Springer Handb. Comput. Intell.*, no. June, pp. 285–294, 2015, doi: 10.1007/978-3-662-43505-3.
- [42] B. Feng, G. Gong, and H. Yang, “Self-Tuning-Parameter Fuzzy PID Temperature Control in a Large Hydraulic System,” in *2009 IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, 2009, pp. 1418–1422.
- [43] I. I. and M. Society, “IEEE Standard for Transitions , Pulses , and Related



UNIVERSITAS  
GADJAH MADA

**Implementasi Pengendali Fuzzy Interval Tipe 2 PID untuk Mengurangi Dampak Derau pada Sistem Elektro Hidrolik Servo Valve Mesin Uji Kekuatan Struktur MALE UAV (Medium Altitude Long Endurance Unmanned Aerial Vehicle)**

JAWAHIR AL KALAMUL HAQ, Ir. Oyas Wahyunggoro, MT., Ph.D.; Ir. Eka Firmansyah, S.T., M.Eng., Ph.D., IPM.  
Universitas Gadjah Mada, 2024 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Waveforms IEEE Instrumentation and Measurement Society,” *IEEE Std 181:2011*, vol. 2011, no. September. 2011.

- [44] A. Khuriati, “Identifikasi dan Perancangan Pengendali PID Menggunakan Penduga ARX Terhadap Sistem Pemanas Udara dengan Kriteria ISE, IAE, ITSE, dan ITAE,” *Berk. Fis.*, vol. 15, no. 4, pp. 111–116, 2012.