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presented the Poster face-to-face

“A Mathematical Modeling and Passive Sliding Mode FTC Method of a Manipulator Arm”

at

“Computer Science and Technology”

Session during the 9th International Conference of Mathematical Sciences (ICMS 2025)

held in Maltepe University, Istanbul Turkey on 03- 07 September 2025



Prof. Dr. Hüseyin ÇAKALLI
Chairman of the Organizing Committee

A Mathematical Modeling and Passive Sliding Mode FTC Method of a Manipulator Arm

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Abstract

The objective of this paper is the application of the passive sliding mode fault tolerant control (PSMFTC) of a manipulator arm with two degrees of freedom based on the control with sliding mode. we start by mathematical modeling of this system with state space and presenting the idea of this non-linear control. We presented the theory of the variable structure, in order to use in the PSMFTC method. This last technique is applied to the mathematical model of manipulator arm with 2DOF system using MATLAB/ SIMULINK, their performance results are compared with a PID controller in order to discover who these approaches preserve system performance and ensure stability and trajectory tracking. The results of the study prove the higher performance of the PSMFTC when compared with the PID technique.

Keywords: Manipulator arm with 2DOF, Passive sliding mode FTC, PID control, State space system, Mathematical modeling.

2020 Mathematics Subject Classification Numbers: First, Second, Third.

References

- [1] M. Bhawe, S. Janardhanan, L. Dewan , Configuration Control of Planar Underactuated Robotic Manipulator using Terminal Sliding Mode, *IFAC-PapersOnLine*, 49(1), 148-153 (2016).
- [2] T. N. Truong, A. T. Vo, H. J. Kang, M. Van, A Novel Active Fault-Tolerant Tracking Control for Robot Manipulators with Finite-Time Stability , *Sensors*, 21(23), 8101 (2021).
- [3] C. Chen , Z. Peng, C. Zou, K. Shi, R. Huang, H. Cheng, Event-Triggered Robust Optimal Control for Robotic Manipulators with Input Constraints via Adaptive Dynamic Programming, *IFAC-PapersOnLine*, 56(2), 841-846 (2023).
- [4] A. Milecki, P. Nowak , Review of Fault-Tolerant Control Systems Used in Robotic Manipulators, *Applied Sciences*, 13(4), 2675 (2023).
- [5] S. M. Hussain, A. Brunetti, G. Lucarelli, R. Memeo, V. Bevilacqua, D. Buongiorno, Deep Learning Based Image Processing for Robot Assisted Surgery: A Systematic Literature Survey, *IEEE Access*, 10, 122627-122657 (2022).