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MODELING, SIMULATION AND CONTROL OF PROPELLER DRIVEN SEESAW SYSTEM WITH ASYMMETRIC GEOMETRY USING PID CONTROLLER

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ABSTRACT

Various algorithms are used to control modern unmanned aerial systems. However, thanks to the simplicity of application, the most commonly used control algorithm for aircraft but also for other dynamic systems in various industries is the PID (Proportional, Integral, Derivative) controller. For the proper response of the system and fast stabilization during the action of certain disturbances during its operation, it is necessary to precisely adjust the parameters of the PID controller. This paper presents a mathematical model of a seesaw system for which a PID control simulation was performed for different asymmetric geometries. Asymmetric geometry implies different positions of the rotor relative to the axis of system rotation, as well as when the rotor disks do not lie in the same plane, which simulates the influence of inaccuracy in the construction of multi-rotor UAVs. The control simulation shows the possibility of compensating for the mentioned geometric irregularities to ensure the appropriate behavior of the system. The limit values of this influence are also shown, at which the PID control algorithm cannot adequately perform the correction and ensure the correct response of the system. The obtained simulation results would be verified by making an adequate physical model and obtaining experimental results for the same input parameters, which may be the subject of future research work.

REFERENCES

[1] Tengis, T., Uurtsaikh, L., & Batminkh, A. (2020). Balancing a seesaw with reinforcement learning, *International Journal of Advanced Culture Technology*, *8*(4), 51-57.
[2] Idrissi, M., Salami, M., & Annaz, F. (2021). Modelling, simulation and control of a novel structure varying quadrotor. *Aerospace Science and Technology*, *119*, 107093.
[3] Nemati, A., & Kumar, M. (2014, June). Modeling and control of a single axis tilting quadcopter. In *2014 American Control Conference* (pp. 3077-3082). IEEE.
[4] Romero, L. E., Pozo, D. F., & Rosales, J. A. (2014). Quadcopter stabilization by using PID controllers. *Maskana*, *5*, 175-186.
[5] Leal, I. S., Abeykoon, C., & Perera, Y. S. (2021). Design, Simulation, Analysis and Optimization of PID and Fuzzy Based Control Systems for a Quadcopter. *Electronics*, *10*(18), 2218.
[6] Garcia, R. A., Rubio, F. R., & Ortega, M. G. (2012). Robust PID control of the quadrotor helicopter. *IFAC Proceedings Volumes*, *45*(3), 229-234.
[7] Bolandi, H., Rezaei, M., Mohsenipour, R., Nemati, H., & Smailzadeh, S. M. (2013). Attitude control of a quadrotor with optimized PID controller.