Altitude control of flying objects using fuzzy theory and Hedge Algebra

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Abstract: This thesis presents a novel approach to altitude control of flying objects by integrating fuzzy logic theory with Hedge Algebra. Traditional control methods often struggle with the inherent nonlinearities and uncertainties in aerodynamic systems. The proposed method leverages fuzzy logic to handle imprecise and uncertain information, while Hedge Algebra provides a formal, linguistic-based framework for reasoning with fuzzy terms, enabling more nuanced and efficient control decisions. A comprehensive controller is designed, incorporating a Hedge Algebra-based reasoning mechanism to adjust the fuzzy rule base dynamically. Simulation results demonstrate that the hybrid controller achieves superior performance compared to conventional fuzzy and PID controllers, particularly in terms of response time, overshoot reduction, and robustness against external disturbances and parameter variations. The findings confirm that the synergy between fuzzy logic and Hedge Algebra offers a powerful and effective solution for precise altitude regulation, with potential applications in unmanned aerial vehicles and other autonomous flight systems.

Keywords: altitude control, fuzzy logic, hedge algebra, flying object