IMPROVEMENTS IN CLASSICAL PROPORTIONAL NAVIGATION GUIDANCE USING FUZZY LOGIC

Squadron Leader Balraj Sharma
Engineering Officer at Indian Air Force (IAF) and
Former Post Graduate Student
Department of Aerospace Engineering
Defence Institute of Advanced Technology (DIAT)
Pune-411 025, India
Email : engineer.dadhich@gmail.com

Abstract

The performance of classical Proportional Navigation guidance is limited against highly maneuvering targets and in presence of measurements noise resulting into large miss distances and lower hit probability. Also, the advanced Augmented PN guidance technique requires target state estimation. In this paper, fuzzy logic has been used to implement PN guidance and Membership Functions of fuzzy logic has been tuned using genetic algorithm. The proposed Fuzzy Based PN (FBPN) guidance gives superior performance than PN and APN in terms of lower miss distance, higher hit ratio and better ability to handle measurement noise at all target attack aspects. Deterministic simulations have proved the superior performance and robustness of proposed scheme for various conditions such as step target maneuver upto 9g, weaving maneuver and presence of measurement noise. Further, Monte Carlo simulations have proved that proposed scheme enhances interception performance in realistic scenarios by improving the hit ratio upto 48% and rms miss distance upto 41%. Limitations of APN scheme in terms of target state estimation is also mitigated in the proposed guidance scheme. Finally, global asymptotic stability of fuzzy homing guidance loop is proved using circle criterion.