Aerospace Europe Conference 2023
Joint 10th EUCASS – 9th CEAS Conference

Abstract #XXX *(to be filled by the organizers)*
Preferred Topics: AEROFLIPHY/ *(3 maximum from the list of topics)*
Corresponding author: **BĘBEN Karol**
e-mail of corresponding author: **karol.beben@ilot.lukasiewicz.gov.pl**
Type: Oral / **Poster** *(select)*
Status or corresponding author: Regular / **Student** *(select)*
For student corresponding author: student member of one of the following:
3AF / AAAR / AIAE / AIDAA / CzAeS / DGLR / FTF / NVvL / PSAA / RAeS / SVFW / EUROAVIA

Title

Comparison of evolutionary algorithms for optimizing the flight path of a Unmanned Aerial Vehicles swarm

Authors

Karol BĘBEN [1], Robert GŁĘBOCKI [2],*

** Corresponding author*
[1] Łukasiewicz Research Network – Institute of Aviation, Poland, karol.beben@ilot.lukasiewicz.gov.pl
[2] Warsaw University of Technology, Faculty of Power and Aeronautical Engineering, robert.glebocki@pw.edu.pl

Abstract

The paper presents research and analysis of the application of selected genetic algorithms to optimize the flight trajectory of Unmanned Aerial Vehicle swarm. The optimization of the flight path of a swarm of unmanned aerial vehicles (UAVs) is a challenging problem due to the high number of vehicles and the complex interactions between them. One way to solve this problem is to use evolutionary algorithms, which are optimization methods inspired by natural selection and genetics.

In this paper, we compare the performance of three methods for optimizing the flight path of a swarm of UAVs: genetic algorithm, particle swarm optimization, and differential evolution. To compare the performance of these algorithms, we created a simulation of a swarm of UAVs flying in a specified area. The objective was to optimize the flight path of the swarm so that it covers the entire area while minimizing the various factors (for e.g.: total distance traveled) by the UAVs.

We ran experiments with different swarm sizes and evaluated the performance of the algorithms based on the average fitness of the solutions and the time taken to converge to the optimal solution. We also analyzed the robustness of the algorithms by introducing noise in the fitness function and testing their ability to handle it.

The purpose of the work is to show which algorithm is the most effective for optimizing the flight path of a swarm of UAVs. However, the choice of algorithm may depend on the specific application and the trade-off between convergence speed and solution quality.

References

[1] Yang, Y.; Xiong, X.; Yan, Y. UAV Formation Trajectory Planning Algorithms: A Review. Drones 2023, 7, 62. https://doi.org/10.3390/drones7010062

[2] Manikandan, K.; Sriramulu, R. Optimized Path Planning Strategy to Enhance Security under Swarm of Unmanned Aerial Vehicles. Drones 2022, 6, 336. https://doi.org/10.3390/drones6110336

[3] Mesquita, R.; Gaspar, P.D. A Novel Path Planning Optimization Algorithm Based on Particle Swarm Optimization for UAVs for Bird Monitoring and Repelling. Processes 2022, 10, 62. https://doi.org/10.3390/pr10010062

[4] Chu, H.; Yi, J.; Yang, F. Chaos Particle Swarm Optimization Enhancement Algorithm for UAV Safe Path Planning. Appl. Sci. 2022, 12, 8977. https://doi.org/10.3390/app12188977

[5] Dziwiński,P.,Bartczuk,Ł. & Paszkowski,J.(2020).A New Auto Adaptive Fuzzy Hybrid Particle Swarm Optimization and Genetic Algorithm. Journal of Artificial Intelligence and Soft Computing Research,10(2) 95-111. https://doi.org/10.2478/jaiscr-2020-0007

[6] Zixuan Xie, Xueyu Huang, Wenwen Liu et al. Coding-Elite Particle Swarm Optimization Searching of Moving Targets by UAVs, 06 July 2022, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-1793804/v1]