

World Center of Education and Research for Trans-disciplinary Flow Dynamics

DongSeop Chris Lee

School of Aerospace, Mechanical and Mechatronic Engineering
The University of Sydney
NSW 2006, Australia

Research title: FAST EVOLUTIONARY OPTIMISATION TECHNIQUES IN AEROSPACE ENGINEERING.

Supervisor: Prof. SHIGERU OBAYASHI.

Duration: 3rd. October ~ 15th. November

My research activity in Institute of Fluid Science (IFS) is to integrate new optimisation technique Hybrid-Game on one of well known Multi-Objective Evolutionary Algorithms (MOEAs) Non-dominated Sorting Genetic Algorithms NSGA-II developed by Dr. K. Deb; NSGA-II is hybridised using the concept of Nash-Equilibrium to accelerate optimisation process or searching speed to capture a set of global non-dominated solutions.

For the applications, Automation Mission Planning System (AMPS) is addressed to provide a set of collision-free pathways for Unmanned Aerial System (UAS). The baseline terrain is generated by Matlab codes and contains 90% of obstacles in 400 nautical miles. The pathway is computed by using three dimensional Bezier-spline curves. Two test cases are conducted in terms of Multi-Objective (MO) and Robust Multi-Objective (R-MO) design optimisation.

From the results, Hybridised NSGA-II based on the concept of Hybrid-Game saves 81% and 85% computational cost for MO and R-MO problems respectively when compared to original NSGA-II. In addition, numerical results show that the solutions obtained by Hybridised NSGA-II have higher quality than NSGA-II.

Consequently, Hybrid-Game has a good comparability to be adapted to any MOEAs and also has a potential to save computational cost while generating higher quality of solutions for Aerospace MO & MDO under uncertainty.

For academic contribution, the details of this project have been presented in IFS laboratory (45 mins) and GCOE meeting (20 mins).

I would like to express my sincere gratitude to Prof. Shigeru Obayashi for the opportunity to study in IFS and also Dr. Shimoyama for the interesting discussions on future aerospace research aspects. I warmly thank to research students in IFS and staffs in GCOE program.