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Nash-Strategies and Evolutionary Algorithms for Solving Single and Multidisciplinary Design Problems

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ABSTRACT

The aim in Multi-objective (MO) and Multidisciplinary Design Optimisation (MDO) research is to develop robust and efficient optimisation techniques with high quality of solutions.
The paper investigates two different optimisation techniques for single discipline and multidisciplinary design optimisation problems. The first optimisation method is a Hierarchical Asynchronous Parallel Multi-Objective Evolutionary Algorithms (HAPMOEA). The second method combines the concepts of Nash-equilibrium, Pareto optimality and the extension of HAPMOEA to be a Hybrid game strategies algorithm (Hybrid Nash-HAPEA). The algorithm is specially designed for uncertainty based MO and MDO problems to reduce the computational expense. The Nash-HAPEA methodology is introduced as a distributed virtual game and consists of splitting the design variables - aerofoil sections/wing geometry - supervised by players optimising their own strategy.
This paper compares the performances of HAPMOEA and Hybrid Nash-HAPEA. The HAPMOEA and Nash-HAPMOEA algorithms are applied to single discipline and uncertainty based multidisciplinary design optimisation problems. Numerical results from the two approaches are compared in terms of the quality of model and computational expense. The benefits of using the distributed Nash-HAPMOEA methodology in a parallel environment is demonstrated.

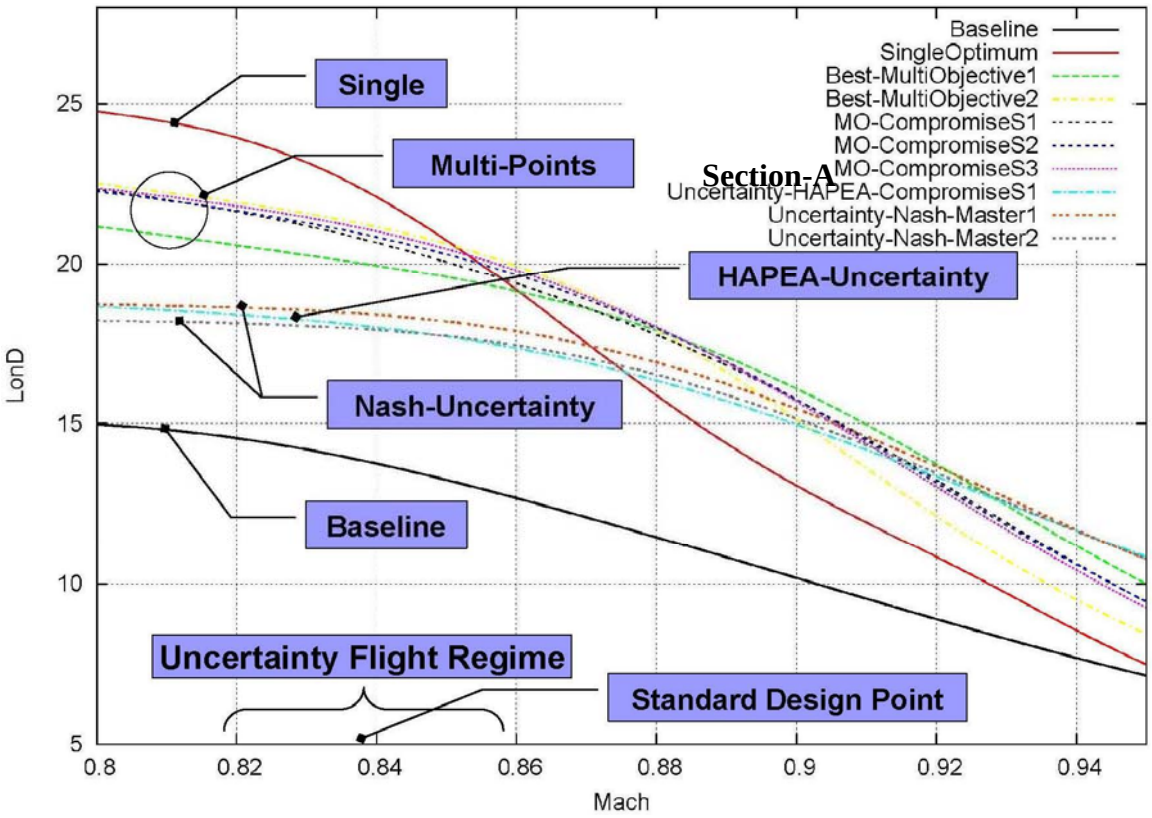

Figure 1. *L/D* vs. Mach sweep obtained by Nash-HAPMOEA and HAPMOEA.