Application of game theory and evolutionary algorithm to the regional turboprop aircraft wing optimization

Pierluigi Della Vecchia, Luca Stingo, Fabrizio Nicolosi, Agostino De Marco, Elia Daniele, Egidio D'Amato

Abstract Nash equilibrium and evolutionary algorithm are used to optimize a wing of a regional turboprop aircraft, with the aim to compare different optimization strategies in the aircraft design field. Since the aircraft design field is very complex in terms of number of involved variables and space of analysis, it is not possible to perform an optimization process accounting for all possible parameters. This leads to the need to reduce the number of the variables to the most significant ones. A multi-objective optimization approach is here performed, paying attention to the variables which mainly influence the objective functions. Results of Nash-Genetic algorithm are compared against those of both a typical Pareto front and a scalarization, showing that the proposed approach locates almost all solutions on the Pareto front, while the scalarization results are confined only in a zone of this front. The optimization elapsed time for a single optimization point is less than 32% of an entire Pareto front, but the designer must initially choose the players' cards assignment.

1 Introduction

Nowadays multi-objective optimization problems are usually solved via Pareto Genetic Algorothms (GAs), to find a wide range of solutions for a given problem,

Pierluigi Della Vecchia, Luca Stingo, Fabrizio Nicolosi, Agostino De Marco
University of Naples Federico II, Department of Industrial Engineering, Aerospace Division, 80125, Naples, Italy, e-mail: pierluigi.dellavecchia@unina.it

Elia Daniele
Fraunhofer IWES, Küpkersweg 70, 26129 Oldenburg, Germany e-mail: elia.daniele@iwes.fraunhofer.de

Egidio D'amato
Università degli Studi della Campania "Luigi Vanvitelli", Via Roma 29, 81031 Aversa, Italy e-mail: egidio.damato@unina2.it