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OPTIMIZATION OF SHORT-HAUL AIRLINE CREW PAIRING PROBLEMS USING A MULTIOBJECTIVE GENETIC ALGORITHM

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Abstract. *Airline crew pairing problems involve optimizing an overall evaluation function containing various conflicting objectives and constraints originating from cost and safety considerations. Classical approaches based on set partitioning or set covering methods separate the solution into two phases, pairing generation and pairing optimization, and evaluate the cost by a weighted-sum of objective values. This paper proposes a new multiobjective evolutionary approach to improve the classical solution flow by integrating the two-phase steps as a single step and reasoning the multiple practical objectives simultaneously.*

Furthermore, this paper also examines real-life daily pairing problems in a Taiwanese short-haul airline as case studies. Compared to man-made pairing plans, the positive experimental results demonstrate the more appropriate and effective crew pairing plans explored according to practical considerations. These considerations include objectives such as duty connection, transition time, layover, pairing number, aircraft changing times, flying time, and duty period.

Keywords: Crew pairing, Multiobjective genetic algorithm, Short-haul airline

1. **Introduction.** Airline crew scheduling is one of the most important operations in airline companies, since it is a major determinant of crew costs, second only to fuel costs. Crew costs easily exceed one billion US dollars annually for larger airlines [1]. Due to the potential for considerable cost savings, this topic has long been the focus of academic attention. Crew scheduling is separated into two sub-problems, crew pairing and crew rostering. Crew pairing combines the flight legs into several groups, and assigns crew members to these groups through crew rostering to obtain the final crew schedule. This paper focuses on the optimization solution for airline crew pairing problems.

Crew pairing involves optimizing an overall evaluation function, composed of various conflicting objectives and constraints originating from limitations imposed by safety regulations, union contract agreements, and other complex working rules and management policies. Previous researches have discussed and surveyed the details of these criteria with regard to safety and costs [1-4]. Due to its complexity, this problem is classically modeled as a set partitioning problem or a set-covering problem solved by a two-phase approach [5]. In the first phase, or pairing generation, planners generate a group of possible pairing