Arrival Sequencing and Scheduling using an Evolutionary Approach in a 4D Environment

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Abstract

The aim of this article is to use an Evolutionary Algorithm (EA) to solve the Aircraft Landing Problem (ALP) in an Air Traffic Flow Management (ATFM) environment. The ALP addresses the function of generating optimal or near-optimal landing sequences and time intervals between arrivals to provide runway capacity increase and reduce air delay. Problems of the ALP type in a dynamic environment such as Air Traffic Control (ATC) are considered Non-Polynomial (NP) complete. We simulated three different models. In the first model, the algorithm was applied when there was a schedule conflict between aircraft and separation measures where used to ensure safety. On the second and third models,we scheduled the flights in hourly batches. In the third model, a Maximum Constrained Shift (MCS) restriction was introduced to simulate more realistic conditions. To test the effectiveness of our study, we used actual data from Guarulhos International Airport. Results showed a capacity gain of 12 aircraft and a delay decrease of five percent when compared to the airport current sequencing operations. Introducing this technique represents a shift from the current arrival sequence model to a Trajectory-Based Operations (TBO) model, balancing air traffic demand with airspace capacity to ensure the most efficient use of the airspace system.

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