

Optimization in Airline Scheduling: Network Design and Fleet Assignment

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In this thesis we investigate the optimization process in the airline scheduling. We develop efficient algorithms for solving the underlying optimization problems and analyze the performance of the algorithms. The results of this work are in use in decision support systems, improve the quality of the solutions, and contribute in this way to cost reduction in airlines.

In the first part of the thesis the network design problem is considered. The goal is to design an airline network in the way that the forecasted traffic demand is served as cost-efficient as possible. The underlying mixed-integer linear optimization problem has a very high complexity. To solve the problem we develop and implement the relax-and-cut algorithm. The algorithm is based on the Lagrangian relaxation and uses additional valid inequalities (cuts) for the network design problem to improve the efficiency. The developed optimization system contains several exact and heuristic methods for solving the network design problem.

The second part of the thesis investigates the fleet assignment problem. Fleet assignment is one of the most important planning tasks in an airline. Main properties of the airline schedule are defined in this step and determine the operating costs and revenues for the schedule. Better solutions of the fleet assignment problem can improve the overall profitability of the schedule. The tasks of market modeling and revenue management are closely connected with the fleet assignment problem. We consider the interdependencies between these planning tasks and develop three integration strategies. These strategies lead us to the integrated optimization of the tasks. As a result the quality of the solutions is improved significantly.