

Master Thesis Proposal

Integrated Crew Scheduling

To organize daily operations, airlines have 4 planning stages to distribute the available resources such as aircraft and crews to activities such as flights and maintenance events. The last step is usually the Airline Crew Scheduling Problem, in which crew members are assigned to specific flights in a planning period with the objective to have the cost minimizing solution. This problem has received much attention due to the high savings potential of crew cost; generally, it is solved in two sequential steps called crew pairing and crew assignment to better manage complexity and following the process of first minimizing the schedule costs and then satisfying crew members. Similar processes can be found for railways and other transport industries.

Integrated crew scheduling is the idea of combining both crew scheduling problems again to achieve a lower overall cost and to consider employee preferences earlier. These models are challenged by the large problem size due to the combinatorial nature of the problem; multiple solution techniques have been identified such as improvements of column generation, colony ant optimization or genetic algorithms to name a few.

Aim of the master thesis should be to,

- introduce the crew scheduling problem and the disadvantage of the sequential approach,
- summarize integrated crew scheduling models
- to discuss a specific integrated crew scheduling in detail,
- to create an academical example with a small network in AMPL or another modelling language; here the model should be the focus and as solution procedure a state-of-the-art solver may be used,
- to provide open research gaps and future trends.

Recommended basic literature:

Barnhart, C., Cohn, A. M., Johnson, E. L., Klabjan, D., Nemhauser, G. L., & Vance, P. H. (2003): Airline crew scheduling. In *Handbook of transportation science* (pp. 517-560). Springer, Boston, MA.

Kasirzadeh, A., Saddoune, M., & Soumis, F. (2017): Airline crew scheduling: models, algorithms, and data sets. *EURO Journal on Transportation and Logistics*, 6(2), 111-137.

Lin, D. Y., & Tsai, M. R. (2019): Integrated crew scheduling and roster problem for trainmasters of passenger railway transportation. *IEEE Access*, 7, 27362-27375.

Saddoune, M., Desaulniers, G., Elhallaoui, I., & Soumis, F. (2012): Integrated airline crew pairing and crew assignment by dynamic constraint aggregation. *Transportation Science*, 46(1), 39-55.

Zeighami, V., & Soumis, F. (2019): Combining Benders' Decomposition and Column Generation for Integrated Crew Pairing and Personalized Crew Assignment Problems. *Transportation Science*, 53(5), 1479-1499.