

**Thesis subject:**

*Automatic crew scheduling involving high-level modeling of the regulations and use of parallel/distributed processing.*

**Doctoral dissertation abstract**

In the doctorate thesis the airline crew scheduling problem was examined and two basic issues were confronted: the inadequate performance of the applied solution methodology, especially with respect to the increasing demands of the airlines, and the lack of an effective and unified management policy regarding scheduling regulations in the distributed application environment of an airline enterprise. The approach that was taken in order to cope with these problems involves on the one hand the development of a generic modeling system related to the management of the regulations and on the other hand the development of more efficient algorithms as well as the use of parallel processing on a network of workstations, which improve the performance of the solution process.

In particular, a generic modeling system was designed and developed in order to effectively manage the complex set of problem regulations. The system encounters the dynamic nature of the regulations in a flexible way and allows the smooth adaptation of the solution process to the heterogeneous environment of different airlines as well as the unified representation and management of the regulations in the distributed application environment of an airline. A special purpose programming language was designed and the corresponding compiler was implemented. The performance of the solution process was significantly improved by using parallel processing on a network of workstations (NOW), while eliminating problems related to the NOW computation environment (e.g., fault tolerance, load balancing, local user priority and dynamic resource management). Due to the improved performance either larger problems can be solved (more realistic scheduling periods) or the problem solution quality can be improved by relaxing the control parameters of the solution process. Furthermore, the reduction of the solution time gives the marketing department the opportunity to handle the market requirements more efficiently and decreases the necessity for rescheduling. Finally, solving some of the largest crew scheduling problems of Lufthansa German Airlines in significantly reduced computation times did the validation of the developed systems.