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Autoren	L. Walter
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Abstract

One key element of future Air Traffic Management concepts are automated support tools that help to separate aircraft from one another in a tactical environment. This work investigates the possibilities of a centralized approach to separation or conflict management, based on optimal control theory and its applications. Therefore we will present an optimization framework that generates conflict-free trajectories for all aircraft within a regarded airspace. The optimization process is based on the direct solution method and uses multiple shooting features with a SQP method to solve the resulting nonlinear problem. Numerical computations were performed with the MUSCOD-II software from the IWR at University of Heidelberg, Germany. The principle advantage of a centralized approach is that the optimization framework has full information of the traffic situation in a sector, so it may generate solutions that incorporate information of all airspace users. This will prevent solutions that could otherwise yield even more severe traffic situations later in time. As an optimality measure we used a function that aims to assess the deviation from a nominal flight path and flight time. This work focuses on en-route traffic scenarios, so we will present some numerical examples of solutions provided by the framework for two-dimensional traffic situations. Numerical use cases will show that the method delivers very promising results — with subsequent research yielding the possibility of further improvement. These results will be validated with realtime simulations at the DFS R&D department in November 2011.