Aircraft Routing - A Global Optimization Problem

Michael C Bartholomew-Biggs
matqmb@herts.ac.uk
University of Hertfordshire, England

This paper deals with the problem of calculating aircraft flight paths to reach specified destinations while avoiding a number of obstacles and "no-fly" zones, corresponding, for instance, to geographical features and military threats. In practical versions of the problem, the cost function used to measure the optimality of a route is likely to be non-differentiable; and experience shows that it is likely to admit multiple local minima.

We shall discuss a number of ways of dealing with this problem, including a direct approach in which the route is determined by straight-line stages between waypoints and an indirect approach where the path is described by ODEs. Both approaches lead to formulations which involve the use of direct-search global optimization techniques.

We give results of a comparative study between a number of recently published candidate methods and observe that the deterministic technique DIRECT (Jones et al, JOTA, Vol 79 pp157-182) appears much more successful than rabdom direction, tabu-search methods. We also consider modifications to DIRECT which enable it to solve our problem in an efficient and user-friendly manner.