
A study on the robust flight level assignment problem

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Résumé

Data published by Eurocontrol report the traffic growth over summer 2011 to be around 2%. In these conditions alleviating delays caused by airspace congestion is, and will continue to be, critical to the operation of the European air traffic control system. In the origin of delays are several factors, an important one being the congestions. We will focus on congestion in the airspace rather than at airports, both problems can be treated separately. Here we are interested in reducing the en-route congestion and the induced cost, and we study flight level optimization with respect to a given traffic demand and given routes. We typically consider here the total cost due to en-route conflict resolution. With respect to the FLA (Flight Level Assignment) problem, we restrict ourselves to only three possible levels for each flight, called preferred levels (the one in the middle being the most preferred). Despite this restriction, the problem remains highly combinatorial due to the large number of simultaneous flights. We prove formally that the flight level assignment problem is NP-complete in the strong sense even for an airspace with only three flight levels, which makes it hard to solve at optimum even for reduced size instances. The problem becomes rather more difficult when involving the uncertainties in ATM (Air Traffic Management). More precisely, an important question that we raise in this paper is how to include the potential en-route conflicts associated with each aircraft in the flight level assignment model and take into account the uncertainties related to it. All this leads to the robust flight level assignment problem and the associated mathematical model, which is the main focus of this work.

Mots-Clés: air traffic management, level assignment, robust optimisation

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