A slot allocation model for congested airports with stochastic modelling of operational delays

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Abstract

In many airports around the world, demand to use the airport infrastructure exceeds available capacity. Outside of the US, the dominant mechanism for managing demand is an administrative scheme called IATA Worldwide Slot Guidelines (WSG). Under the IATA WSG, airlines must be allocated time slots for the purposes of landing and take-off at the airport. A key input for the problem of how slots are allocated is the declared capacity which limits the number of slots that can be allocated over time.

The declared capacity takes into consideration physical constraints of an airport such as the runway capacity, terminal capacity (number of passengers) and the number of available apron stands. However, capacity and allocation of slots should also take into account operational delays which arise from aircrafts queueing to use the runway.

In this talk, we present a new stochastic programming model for slot allocation which explicitly considers operational queueing dynamics.

In particular, the model incorporates a stochastic queuing model where:

(i) actual aircraft arrival times are subject to random deviations;

(ii) the times of arriving and departing aircraft are explicitly coupled and not considered independently as in previous models;

(iii) the rates at which arriving and departing aircraft are serviced can be adjusted according to the airport's runway characteristics.

This model can be used to examine the trade-off between schedule efficiency (i.e. how close we schedule aircraft to requested times) and operational delays.

We present some preliminary numerical results on the use of this model.