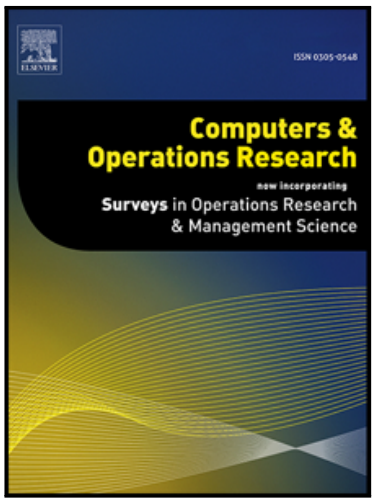

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An integrated flight scheduling and fleet assignment problem under uncertainty

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Abstract

Flight scheduling and fleet assignment are the two most prominent decisions in airline planning as they contribute towards a majority of the costs and revenues of an airline company. Moreover, these decisions have to be made 10-12 weeks prior to the flight date as mandated by labor unions in order to accommodate cabin crew scheduling requirements. Since demand and fares are highly uncertain, a two-stage stochastic programming model was developed for flight scheduling and fleet assignment where the fleet family assigned to each scheduled flight leg is decided at the first-stage. Then, the fleet type to assign to each flight leg is decided at the second-stage based on demand and fare realization. Sample average approximation (SAA) algorithm is then used to solve the problem and provide information on the quality of the solution. To the extent of our knowledge, this work is the first to apply the SAA algorithm to the airline industry. Experiments conducted on a case study based on an flight network of a legacy airline company show that modeling the stochastic problem with 100 scenarios is sufficient to capture the effect of demand and fare uncertainty and to provide a solution with an optimality gap less than 1% within a reasonable computational time. A sensitivity analysis on different parameters of the model was also carried out and points out the applicability of the proposed model and solution in practice.

Keywords: flight scheduling, fleet assignment, stochastic demand, stochastic fares, sample average approximation

1. Introduction

The airline industry is a highly competitive one, and coupling this with the recent economic crisis, the demand for airline tickets has dramatically decreased. With competition between different airline companies being extremely fierce, it has become clear that immediate changes are needed. In order to tackle these challenges properly, airline companies

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