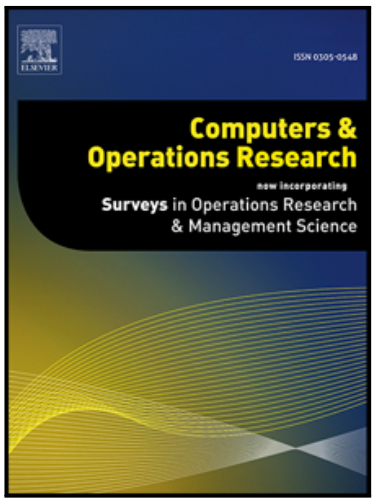

Robust Optimization: Lessons Learned from Aircraft Routing

Lavanya Marla, Vikrant Vaze, Cynthia Barnhart

PII: S0305-0548(18)30102-3
DOI: 10.1016/j.cor.2018.04.011
Reference: CAOR 4452

To appear in: *Computers and Operations Research*

Received date: 11 January 2017
Revised date: 21 January 2018
Accepted date: 16 April 2018

Please cite this article as: Lavanya Marla, Vikrant Vaze, Cynthia Barnhart, Robust Optimization: Lessons Learned from Aircraft Routing, *Computers and Operations Research* (2018), doi: 10.1016/j.cor.2018.04.011

Highlights

- Our first contribution is to demonstrate how uncertainty is modeled in composite variable-based formulations through the Extreme-value Robust Optimization (EV) and Chance-Constrained Programming (CCP) paradigms, and then show how to model the robust aircraft routing problem using the aforementioned three modeling approaches. We compare results from these approaches with the domain-specific LCB model.
- Second, we demonstrate that existing protection-level based models, like CCP and EV, suffer from issues of non-monotonicity due to lack of pareto-optimality of their solutions.
- Third, we develop new models in the extreme-value and chance-constrained modeling paradigms; called and in the extreme-value paradigm, and and , aimed at addressing the identified limitations related to monotonicity, ease of modeling and tractability.
- Fourth, we examine and compare the solution quality of the robust solutions from these different modeling approaches and provide insights in terms of the differences in solution quality, ease of implementation and tractability. The findings and extensions from this work are generally applicable to the broad class of network-based resource allocation problems. Our results are as follows.
- The first take-away from our experiments is that the robust models, by capturing delay propagation explicitly, provide solutions that improve significantly upon the airline's routing with respect to on-time performance metrics, total propagated delays, and passenger disruption metrics.
- Second, although the basic CCP and EV models encounter issues of intractability and difficulty in specifying the 'right' values of protection parameters, when the 'best' parameters are found, the solutions obtained are robust and improve upon the airline's routing.