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Master Thesis Proposal

Estimation of Fuel Burn for Airline Planning

Fuel burn is frequently mentioned as the largest cost factor of airlines and therefore it is also considered as part of the cost function for most planning and scheduling models. Additionally, fuel burn is the focus of the airline industries' efforts to become more sustainable as the emission of CO_2 and other climate gases represent by far the largest negative impact of the airline industry. Estimating the amount of fuel burn represents a challenge for optimization model developers; therefore, several models to predict it have been developed. These models use parameters such as mass of the aircraft and cruise speed but their output depends also on the aircraft type. Among them is the BADA model developed by Eurocontrol. It offers aircraft type specific parameters to estimate the fuel consumption during cruise and other flight phases. While most OR models have been using Version 3, Version 4 has been published recently.

Aim of the master thesis should be to…

- introduce fuel burn models and their use in the OR literature,
- compare the different models (in particular Version 3 and 4 of BADA),
- to implement one model in Excel or a programming language of your own choice,
- to analyze the model output for a few exemplary routes and conduct a sensitivity analysis with some of the common parameters,
- to provide open research gaps and future trends.

Recommended basic literature:

Akturk, M.S., Atamtürk, A., and Gürel S. (2014). Aircraft rescheduling with cruise speed control. *Operations Research*, 62(4):829–845

DuBois, D. and Paynter, G. C. (2009). Fuel flow method2 for estimating aircraft emissions. *Journal of Aerospace*, 115(1): 1–14

EUROCONTROL (2009). Base of aircraft data (bada) aircraft performance modelling report: Eec technical/scientific report no. 2009-009. URL https://www.eurocontrol.int/sites/default/files/library/009_BADA_Aircraft_performance_modelling.pdf *accessed 13.11.2023*

Noorafza, M., Santos, B. F., Sharpanskykh, A., Zengerling, Z. L., Weder, C. M., Linke, F., & Grewe, V. (2023). Airline Network Planning Considering Climate Impact: Assessing New Operational Improvements. *Applied Sciences*, *13*(11), 6722.

Turgut, E. T., Cavcar, M., Usanmaz, O., Canarslanlar, A. O., Dogeroglu, T., Armutlu, K., & Yay, O. D. (2014). Fuel flow analysis for the cruise phase of commercial aircraft on domestic routes. *Aerospace Science and Technology*, *37*, 1-9.