Opposition:
Evaluation of Arrival Sequencing at Arlanda Airport

Abstract:

In this master thesis, we presented three Key Performance Indicators (KPI) aiming to evaluate the sequencing quality for the arrivals in an airport. The investigated KPIs are minimum time to final, spacing deviation and sequence pressure. We evaluated the KPIs by considering the arrivals at Stockholm Arlanda airport as a case study. In our experiments we computed the KPIs for arrivals during different dates with different traffic conditions to see how the sequencing quality is affected and how it is reflected in our chosen KPIs. Additionally, we proposed an application example of the KPIs where we assessed the sequencing given by optimized arrival routs. A comparison of the KPIs' results between the optimized routes versus the non-optimized ones shows that the first ones have a higher performance which means that the chosen KPIs are in fact good key indicators for assessing arrivals' sequencing. A relevant founding from this work is that sequence pressure is an important indicator that could be used to capture some potential spacing violation during the landing operations.

Short comments on each chapter:

Chapter 1:
More efforts describing the problem formulation is needed in your thesis and based on that you can build the purpose of your work. You could add a small chapter 1.2 and call it "the aim of the thesis".

It is better to define the KPI concept before using it in the research questions.

The research questions should be modified since the report did not fully answer them.

Chapter 2:
A good literature review.

You could describe how the sequencing is generally done and explain what holding and path extension mean.

Chapter 3:
A small presentation on how you found your resources, keywords and databases that you used, would improve this chapter. You can also mention the used software tools such as the programming language and how you accessed the database.

It would be better to have the KPIs under a same sub-chapter, which means that 3.4, 3.5 and 3.6 could be gathered under the same title called "Suggested KPIs" for example.

A small comment on table 1: do not confuse callsign with icao24, the first one is related to the airline and the specific flight.

The used colormap for the heatmap and the contour map is confusing. Better to avoid using continuous values and use discrete ones since you are dealing with id numbers.

Chapter 4:
You have given a good motivation in chapter 4.1.

You have given a good explanation about why the 120 sec. window size is preferred instead of 240. It is better to use only that one in the coming experiments to avoid confusion.

It is better to use *am* and *pm* to describe the time instead of "6:00 in the morning" and "24:00 which is midnight".

You have chosen good scenarios from different days with different traffic conditions.

The investigation of an outlier in sequence pressure results was a good idea. You could maybe dig more to see if the spacing distance was in fact violated.

Chapter 5:

Generally, a good discussion chapter.

I am not sure if it is fine to present more results in this chapter.

Column Min[s] in table 3 is not necessary. The same comment for table 5.

Chapter 6:

Very good idea to use the chosen KPIs on a scenario with optimized routes and compare the results with a data from a real traffic situation.

This chapter should come before the discussion chapter.

It could be better if you describe more the used optimization problem and how its output data looked like.

Figure 46 b has a better legend for describing the callsign. It is an example to use for all your plot that contain discrete attributes.

Figure 46 and table 7 could be put in one single figure with its legend.

Chapter 7:

You never connect the conclusion to your research questions. For example, what section answer which question. This is important to improve the readability of your report.

The last phrase about the future work is not clear, I think you need to clarify more.

Questions:

1- In the third research question, you mentioned that you are going to look on how the sequencing in Arlanda airport differs from other airports in Europe. Do you think you answered that question?
2- In chapter 3.2.1 (data cleaning) you mentioned some errors in the data, and you wrote :" Other errors found were records which footprint did not start by descending but by taking off and continued with a few hours' time gap with landing, these". I did not understand the phrase. Could you explain what you meant? Additionally, how approximately big is the proportion of the data that you excluded (erroneous data)?
3- Why did you choose a grid of 10*15 and not a square for example? This choice may have affected your results on the heatmap in the way that you get longer time to final for the directions north and south compared to east and west (example fig.13b).
4- In chapter 4.1.1, you wrote: "The heatmap and the contour plot both indicate the smooth traffic flow and gradual descending with no sudden delays or holds of aircraft". Do you think, the heatmap and contour plot are able alone to give such information? I mean how would a non-smooth traffic flow look like.
5- In the flight trajectories' plot there are some trajectories that are not complete. Why?
6- Could you explain the spacing deviation plot? I do not understand how the pairs id are made.
7- In chapter 4.2.1 you wrote: "The maximum value reaches five aircraft, which is exceptionally high in comparison with the sequence pressure calculated for 90, or 120 second window sizes". Isn't this obvious?
8- Where did you find the information about the delay to get the day with the highest delays, and what is a definition of a delay in your case?
9- In the experiment where you had two runways (4.2.2 Day-time operations), have you treated the flights separately by each runway? (fig. 16).
10- In chapter 4.2.3.1. Investigation of an outlier in sequence pressure results, you investigate if there was a risk of spacing violation. Have you checked if in fact it was the case?
11- In chapter 7 you wrote:" The potential future work could include the application of these KPIs presented to the evaluation of the real-time operations and for long-term arrival spacing planning". Can you explain more what do you mean?