ABSTRACT

DEPARTURE FLIGHT TRAJECTORY OPTIMIZATION FOR NOISE ABATEMENT PROCEDURE IN SOEKARNO-HATTA INTERNATIONAL AIRPORT

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Air traffic noise emission has been a growing concern for communities living within the vicinity of airports due to a massive increase in air traffic volume in recent years. The thesis focuses on noise annoyance problems and attempts to mitigate the concern by creating a new Area Navigation (RNAV) trajectory, which aims to minimize the noise footprint of a flying aircraft in departure trajectory. Optimal control theory is used and applied to minimize the number of awakenings of departing aircraft by employing fuel consumption and noise as its objective function.

The problem is built as a Bolza problem, and it is solved by using the trapezoidal collocation method via nonlinear programming software. The whole process is demonstrated for the Soekarno-Hatta International Airport (CGK) in Jakarta, where the comparison between the fuel-minimal trajectories and the noise-minimal trajectories are discussed in detail.

In short, the result shows that the new trajectories reduced noise exposures in departure trajectories by over 30.3% for 5% additional fuel consumed, and it demonstrates that Optimal Control Theory and the research methodology used are effective in reducing noise footprints. Due to the limitations of this work, it is recommended to improve the optimization process by adding factors such as aircraft separation to cease the gap between the simulated result and real-time environment. Although there are a considerable amount of other factors to make the method to become applicable in a real-time environment, the success of this method will contribute to more sustainable aircraft operations.

Keyword: Optimal Control Theory, Trajectory Optimization, BADA Model, Bolza Problem, Noise Minimization