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ENERGY SAVING VIA OPTIMIZATION OF AIRCRAFT FLIGHT PATH

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ABSTRACT

The continuous increasing cost of aircraft operations, which is greatly related to the cost of fuel, motivated the concerned services to examine all possible solutions that could limit that highly increasing cost. Short term solutions for the actually in service aircrafts can be obtained by optimizing the flight trajectory. This problem has been formulated as an optimal control problem. Most of the available optimization works are based on off-line calculations without any feed back effect. However a real time implementation may offers a highly desirable adaptation to possibly existing non-nominal conditions, which in turns is reflected through a more gain in economy of fuel. The realization of such a real time simulation could be achieved through the use of a Flight Management computer system FMCS. such a system should in addition to other possible tasks, generate, in a real time, the optimal flight profile in the vertical plane. The methodology used to solve this optimal control problem is that of the singular perturbation theory, with which the original problem is decomposed to sub problems of lower dimensions and then matched together to get the composed solution. The detailed analysis and application to different aircrafts yield to the following results:-

- Cruise phase : The optimal cruise is an ascending one. A deterioration in the specific range of the order of 3-4% is noted when the flight altitude is below the optimal one of 4000 ft.
- Climbing phase : The gain is of the order of 5-7% when compared with the conventional profile.
- Descente phase : For a fixed time of arrival option, a substantial economy of fuel is obtained.

The D.O.C gain is of the order of 4% for long range trajectories (those including cruise phase) and 12% for short range tra jectories.

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