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Aircraft's Trajectory Optimization During Descent Using Kriging Model Based Genetic Algorithm

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To develop the next generation aircraft, the safety, the efficiency by reducing fuel consumption and the reducing environmental impact are critical issues because of higher density landing in the future. A microburst is a typical hazard to aircraft descent.

Several studies have investigated control strategies to overcome the hazardous conditions using a successive quadratic programs trajectory optimization algorithm. They showed the ability of their algorithms to decide time-series control such as angle of attack, and pitch angle. However, these studies did not address in detail the major effect of the aerodynamics associated with the hazardous conditions during takeoff or descent.

In this study, the time-series trajectory optimization problem for a conventional civil aircraft is considered. The trajectory is estimated by the 3-degree-of-freedom (3DoF) equations of motion (EoM); the aerodynamics are estimated through the trajectory evaluation by USAF stability and control DATCOM. Global optimization is carried out by means of Kriging model based multi-objective evolutionary algorithm (MOEA). Objective functions are to minimize the cost function, which indicates the efficiency trajectory profile during the descent of an aircraft and the minimization of the maximum acceleration, which decides the impact load to passengers and payloads. The trajectory is evaluated time wise and two cases are compared; one is the trajectory when no microburst occurs and the other is the trajectory with a microburst. Analysis of variance (ANOVA) is used to investigate effects of the input variables.