Aerodynamic Shape Multi-Objective Optimization for SAE Aero Design Competition Aircraft

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The SAE Regular Class Aero Design Competition requires students to design a radio-controlled aircraft with limits to the aircraft power consumption, take-off distance, and wingspan, while maximizing the amount of payload it can carry. As a result, the aircraft should be designed subject to these simultaneous and contradicting objectives: 1) minimize the aerodynamic drag force, 2) minimize the aerodynamic pitching moment, and 3) maximize the aerodynamic lift force. In this study, we optimized the geometric design variables of a biplane configuration using 3D aerodynamic analysis using the ANSYS Fluent. Coefficients of lift, drag, and pitching moment were determined from the completed 3D CFD simulations. Extracted coefficients were used in modeFRONTIER multi-objective optimization software to find a set of non-dominated (Pareto-optimal or best trade-off) optimized 3D aircraft shapes from which the winner was selected based to the desired plane performance.