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Effects of Supercritical Airfoil Upper Section Thickness Modification on Airfoil Lift Characteristics

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Abstract
This paper explores the effects of a supercritical airplane wing airfoil modification on the aerodynamic characteristics of the wing using primarily lift and drag characteristics. This research is motivated by new approaches in dynamic wing re-configuration studies initiated by NASA. Wing re-configuration via mechanical wing movement has been successfully implemented in military aircraft. The latest approach examines changes in the wing characteristics in a dynamic fashion ("morphing") using smart material and moving parts in the entire wing surface. The research described in this paper examines changes in a super-critical airfoil by simply varying the airfoil upper section thickness to better understand the dynamics of the process. FLUENT software is used with the ANSYS Workbench in order to develop the numerical simulation for compressible flows in the low transonic regime (Mach number 0.7-0.9). The baseline simulations have been successfully compared with published data and selected experimental results. The preliminary findings points to an improved airfoil lift characteristics by increasing the upper section thickness of the airfoil. The increased lift may also result in increased drag depending on the angle of attack. However, overall aerodynamic airfoil performance improves.

***Keywords*:** airfoil, CFD, aerodynamic characteristics, wing morphing.