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Modifications To Conventional Jet Flaps using Liquid Sprays

GEORGE LOUBIMOV, DOUGLAS FONTES, MICHAEL KINZEL, University of Central Florida — Conventional jet flaps or blown flaps use high velocity jets to replicate the effects of a conventional flap. The performance of jet flaps is primarily influenced by the jet momentum ratio which is a function of exit jet density and velocity. In this study the conventional jet flap is modified by replacing the gas-phase jet with a sprayed-liquid jet. This modification is inspired by fire-fighting aircraft which reported increases in lift during liquid-dumping maneuvers. Previous research has shown that these fire-fighting maneuvers yield increases to the lift coefficient due to the water volume altering the external flow around the aircraft. A CFD approach consisting of a Dispersed Multi-Phase solver is used to examine the interaction of a sprayed-liquid jet in the context of a conventional jet flap to further expand upon these observations and potentially improve the conventional jet flap in certain settings. In this study two parametric studies including: (1) the chordal jet-flap placement position and (2) the liquid-jet momentum ratio at a fixed jet-flap location are conducted on an NACA 0012 airfoil operating at a Reynolds number of 500,000 and a 5 degree angle of attack. Results show that the presence of the sprayed, liquid-jet flap results in an increase in lift coefficient and decrease in drag coefficient. Furthermore, it is possible to achieve thrust producing configurations with very large jet momentum coefficients..

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