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CFD Simulation of Spray Mechanism for De-Iceing on Wings Leading Edge

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Abstract: *This report summarizes the computational fluid dynamics research conducted towards airflow circulation estimation and forecast around an aerodynamic surface. The subject matter of this study is the NACA 641-212 airfoil. A model of the wing with the original geometrical ratios was integrated to improve exposition clarity. The simulations were done in ANSYS Fluent and involved the testing of the airfoil under two scenarios: a single-phase flow scenario with only air and the other scenario of air plus water droplets as a two-phase flow. To prove the model, we applied the Spalart-Allmaras turbulence model for an extreme airfoil surface, performed water droplet dispersion with air within the Distinct Phase Model (DPM) framework, which is standard in such verifications. We conducted a three-dimensional validation test of the NACA 641-212 airfoil using ANSYS Fluent. We simulated the three-dimensional airfoil, and recorded more representative flow behaviour especially around the edges and surfaces. We utilized cutting-edge (Ansys Fluent) simulation tools to test how rain behaves when coming into contact with a 3D wing, and compared our results to real test data to validate that our model was accurate.*

Keywords: CFD; Spalart–Allmaras; discrete phase model (DPM); structured mesh; two-phase flow; Ansys Fluent

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