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**Numerical Study of Ice Accretion over Aircraft Wings Using Delayed Detached Eddy Simulation** SIBO LI, Department of Mechanical and Industrial Engineering, University of Illinois at Chicago, Chicago IL, USA, ROBERTO PAOLI, Leadership Computing Facility, Argonne National Laboratory, Lemont IL, USA — Ice accretion on aircraft surfaces has been the principal cause of several flight accidents in the past and represents now a source of major concern in aviation. It is a complex Multiphysics phenomenon that includes fluid dynamics, heat transfer and multi-phase flows. In this study, a mathematical model based on the delayed detached eddy simulation (DDES) is developed to study the ice accretion on 3D aircraft wings. The model is validated by comparing the computed results with experimental data. For the air flow field, the statistical results, instantaneous flow fields, and pressure fluctuations are first analyzed. Then, the droplet-phase governing equations are solved to obtain the droplet collection efficiency. To best mimic the droplets impingement, a permeable wall boundary condition is proposed. Then, the thermodynamic process of ice accretion is built based on the classical Messinger model but further including the freezing fraction as a changing variable in the icing simulation. Thus, the ice amount generated at each time step can be obtained. The DDES is able to capture the turbulent flowfield around the iced wing, which makes this model useful for not only predicting ice accretion and studying the effect of ice shape on the air flow field as well.

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