



A Computational Study of Icing Effects on the Performance of S-Duct Inlets

The effects of a typical glaze ice accretion shape on the performance of the M2129 S-duct inlets are computationally investigated using the steady-state RANS solution. The glaze ice accreted on the inlet lip causes a significant degradation in the inlet performance, and the degradation is enhanced as free-stream Mach numbers increase. With increasing freestream Mach numbers from $M = 0.13$ to 0.85 , total pressure recovery decreases from 0.985 to 0.61 . And the level of the mass flow rate with the glaze ice accretion is 73 percent of that in the ice-free condition at $M = 0.13$; however, it decreases to 67 percent at $M = 0.475$. In addition, compared to the symmetrical glaze ice shape in the circumferential direction of the inlet lip, an asymmetrical glaze ice on the top ($= 315\sim 45^\circ$) or bottom ($= 135\sim 225^\circ$) side of the inlet lip produces less significant effect on the inlet performance due to the relatively smaller blocking area to the in-flow by the asymmetrical ice accretion. At $M = 0.475$, total pressure recoveries of the top- and bottom-ice case are 0.924 and 0.922 , respectively, while that of the symmetrical case is 0.836 . Also, the bottom-glaze ice produces slightly more degradation in the inlet performance than the top-glaze ice due to the influence of the curvature shape of the S-duct.

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Conference Date:

Monday, July 21, 2008

Paper Reference:

AIAA 2008-4584

Publisher:

the American Institute of Aeronautics and Astronautics

DOI:

<http://www.aiaa.org/IframeTwoColumn.aspx?id=4745>

Conference Name:

44th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit

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