VISUALIZATION OF THE HEAT TRANSFER ON A WING LEADING EDGE SURFACE INTERNALLY IMPINGED BY A ROW OF AIR JETS

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Other keywords: piccolo tube, turbulence

ABSTRACT:

The ice formation on wing and engine inlets leading edges can dramatically compromise aircraft performance and operation[1] and several methods of ice prevention and removal have been designed. Ice formation on wings and engine inlets for modern commercial transport aircraft can be prevented by extracting hot air from the compressor and blowing it on the inside surface of the leading edge through small holes drilled in a pipe in order to supply enough energy to evaporate the impinging water or to maintain a surface temperature above freezing. In this work the heat transfer performances of rows of circular jets internally impinging on airfoil leading edge region are experimentally studied by means of IR thermography with the heated thin foil heat transfer sensor[2] and the Nusselt number distribution are shown in 3D rebuilding[3]. In Fig. 1 is shown a typical example of the Nusselt number maps rebuilt on the leading edge surface. The jets, impinging on leading edge, provide very high Nusselt number values in a small region with localized peaks corresponding to jet impingement. Even though the holes are perfectly circular, the high Nusselt region has tendency to stretch in chordwise direction. The behavior is due to the jets inclination respect to the foil surface. The effect of jets inclination on leading edge surface, Mach number, Reynolds number and jet-to-jet spacing are investigated by testing several configurations and some correlations are also proposed.

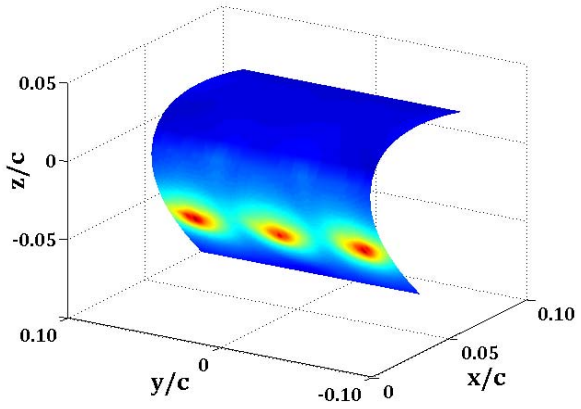

Fig. 1 Nusselt maps rebuilding on a reproduced wing leading edge surface

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