Performance assessment of a transonic wing-body configuration with riblets installed*

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The effectiveness of the riblets, one of the most interesting drag-reduction device, is discussed in this paper. Numerical simulations by the Reynolds Averaged Navier-Stokes equations with the riblets properly taken into account are presented. Riblets are modeled as a *singular* roughness problem by modifying the classical Wilcox boundary condition for rough walls. The boundary condition is able to predict the flow features in the low roughness range (transitional roughness) where riblets operate. A brief discussion of the simulations performed to validate the model is first presented. Then, a complex wing-body configuration is analyzed and the overall effect of riblets on the aerodynamic coefficients evaluated. Calculations of a complete aircraft configuration at transonic conditions show how a proper optimized choice of the riblet height can significantly improve the drag reduction.

I. Introduction

Riblets, essentially consisting of stream-wise grooved surfaces, are one of the most interesting passive drag reduction device in turbulent flows. Fundamental studies on the riblets were performed at NASA by Walsh & Weinstein[1] in the 70's and 80's. Further experiments were performed by Bechert *et al.*[2–4] in Germany. Naturalistic studies had shown that the skin of fast moving sharks is covered by stream-wise microscopic ridges. The tests

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