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CFD analysis of sd 7003 airfoil at low reynolds number with a laiminar kinetic energy based transition model (Article)

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Abstract

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The characteristics of laminar separation bubbles (LSBs) on the SD 7003 airfoil have been extensively studied in the past at low Reynolds numbers. It has been found that the LSB is extensive, especially at airfoil at angle of attack (a) of 4°. To analyze separation, transition and reattachment of flow around SD 7003 airfoil effectively, Computational Fluid Dynamics (CFD) analysis can be performed with suitable transition models. In this article, a modified version of k-k_L-ω transition model, originally proposed by Walter and Cokljat [1], has been used with open source CFD tool OpenFOAM for analyzing SD 7003 at Reynolds number (Re) of 60,000. The article investigated k-k_L-ω transition model with two recently developed variants for analyzing SD7003 airfoil. These two variants are based on Pohlhausen and Falkner-Skan profiles to consider effect of pressure-gradient for natural transition. It has been found that both the variants under-predicted the lift coefficients and slightly over-predicted the drag coefficients. Both of the pressure-gradient sensitive variants gave better prediction of separation of the laminar BL. However, the reattachment locations were delayed significantly. Among the two variants, the Falkner-Skan based variant predicted the reattachment location slightly earlier than the Pohlhausen based variant and thus conforming better with different experimental and computational results.

Author keywords

Airfoil CFD Falkner-skan K-k_L-ω LSB OpenFOAM Pohlhausen SD7003 Transition modeling

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