

Aerodynamic and aeroacoustic performance of high-lift airfoil fitted with slat cove fillers

Abstract

Experimental measurements were carried out to assess the aerodynamic and aeroacoustic performance of an MDA 30P30N airfoil fitted with two different types of slat cove fillers. The aerodynamic results are presented for lift and drag measurements and mean surface pressure measurements, while the aeroacoustic results are presented for the near-field surface pressure fluctuations and far-field noise measurement. The flow measurement results show that there is no significant difference in the aerodynamic lift and drag between the tested cases, however, the slat cove filler configurations exhibit a much better lift-to-drag performance. The pressure coefficient results show that the use of slat cove fillers lead to a slight decrease in the suction peak over the main-element of the airfoil. In order to better understand the flow-field and the noise generation mechanism of the airfoil with slat cove fillers, simultaneous near-field and far-field noise measurements were carried out. The result shows that the use of the slat cove filler can generally lead to a significant reduction of the broadband noise and eliminate the characteristic tonal noise generated by the slat. The directivity pattern and the overall sound pressure level of the radiated noise have shown that a significant noise reduction can be achieved with the applications of the slat cove fillers. The multiple tonal phenomena generated by the slat were also analyzed using the continuous wavelet transform method and higher order spectral analysis methods.

Keywords

30P30N; Aeroacoustics; High-lift airfoil; Slat cove filler; Slat noise