

عنوان مقاله:

Comparative Study on the Effect of Leading Edge Protuberance of Different Shapes on the Aerodynamic Performance of Two Distinct Airfoils

محل انتشار:

دوماهنامه مکانیک سیالات کاربردی، دوره 16، شماره 1 (سال: 1402)

تعداد صفحات اصل مقاله: 21

نویسندگان:

C. Jayapal Reddy - Department of Mechanical Engineering, NITK Surathkal, Mangalore – 575025, Karnataka, India

A. Sathyabhama - Department of Mechanical Engineering, NITK Surathkal, Mangalore – 575025, Karnataka, India

خلاصه مقاله:

This study investigated the effect of leading-edge protuberances on the aerodynamic performance of two distinct airfoils with low Reynold's number (Re): E216 and SG6043. Three protuberance shapes, namely sinusoidal, slot, and triangular, were considered. The amplitudes (A) of protuberances considered were 0.03c, 0.06c, and 0.11c, and the wavelengths (W) were 0.11c, 0.21c, and 0.43c, where c is the chord of the airfoil. The numerical and experimental analyses were performed in the angle of attack (AoA) range of 0° to +20° at and Re of 105. The numerical investigation was performed using the commercial computational fluid dynamics package ANSYS FLUENT. The SST k- ω model was used to simulate turbulent flow. The experimental force measurements were conducted using a highly sensitive three-component force balance in a subsonic wind tunnel facility. The flow physics was analyzed using vorticity contours in streamwise and spanwise slices and static pressure distribution contours. The smoke flow visualization technique was used to observe flow streamlines, boundary layer separation, and reattachment over the airfoil surface. The result indicated that the triangular and slot protuberances were the most beneficial for improving poststall lift and reducing skin friction drag. The operating mechanism involved a shift in pressure distribution due to leading-edge alterations and flow energization by secondary flow emanating from the protuberances.

کلمات کلیدی:

Tubercles, Passive flow control, Airfoil Performance, Post-stall improvement, Stall delay, Biomimicry

لینک ثابت مقاله در پایگاه سیویلیکا:

<https://civilica.com/doc/1555205>

