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Effects of bio-inspired surface roughness on a swept back tapered NACA 4412 wing (Article) (Open Access)

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Abstract

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This paper presents the overall pros and cons of the effect of surface roughness elements over a NACA 4412 tapered, swept back half wing with a sweep angle of 30° and a dihedral angle of 5°. The tests were conducted at a Reynolds number of 4×10^5 in the IIUM Low Speed wind tunnel. Different roughness sizes and roughness locations were tested for a range of angle of attack. Lift, drag and pitching moment coefficients were measured for the smooth wing and with roughness elements. Surface roughness delays the stall angle and decreases the lift. The wing with the roughness elements located at 75% to 95% of mean chord from leading edge shows minimum drag and maximum lift compared to other locations. Significant increase in the pitching moment coefficient was found for flexible roughness elements. In case of rigid surface roughness, the effect on pitching moment is small.

SciVal Topic Prominence

Topic: Wing | Wings | Flapping flight

Prominence percentile: 86.545

Author keywords

3D wing aerodynamic coeffi cients | Bio-inspired roughness elements | NACA 4412

Indexed keywords

Engineering controlled terms: Angle of attack | Dihedral angle | Drag | Reynolds number | Swept wings | Wind tunnels

Engineering uncontrolled terms: 3D wings | Low-speed wind tunnel | NACA 4412 | Pitching moment coefficients | Pitching moments | Roughness elements | Roughness size | Stall angles

Engineering main heading: Surface roughness

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