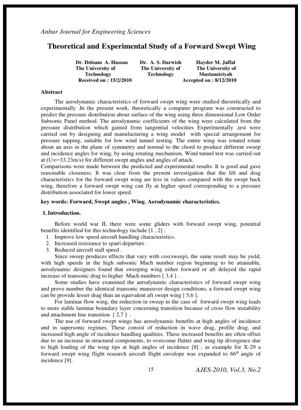
Flight experiments on the boundary layer characteristics of a swept back wing

College of Aeronautics - Flow Patterns and Aerodynamic Performance of Unswept and Swept


Anbar Journal for Engineering Sciences

Theoretical and Experimental Study of a Forward Swept Wing

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Received on : 15/2/2010 Accepted on : 8/12/2010

Abstract

The aerodynamic characteristics of forward swept wing were studied theoretically and experimentally .In the present work, theoretically a computer program was constructed to predict the pressure distribution about surface of the wing using three dimensional Low Order Subsonic Panel method. The aerodynamic coefficients of the wing were calculated from the pressure distribution which gained from tangential velocities Experimentally ,test were carried out by designing and manufacturing a wing model with special arrangement for pressure tapping, suitable for low wind tunnel testing. The entire wing was rotated rotate about an axis in the plane of symmetry and normal to the chord to produce different sweep and incidence angles for wing, by using rotating mechanism. Wind tunnel test was carried out at ($U\infty$=33.23m/s) for different swept angles and angles of attack.
Comparisons were made between the predicted and experimental results. It is good and gave reasonable closeness. It was clear from the present investigation that the lift and drag characteristics for the forward swept wing are less in values compared with the swept back wing, therefore a forward swept wing can fly at higher speed corresponding to a pressure distribution associated for lower speed.

key words: Forward, Swept angles , Wing, Aerodynamic characteristics.

1. Introduction.

Before world war II, there were some gliders with forward swept wing, potential benefits identified for this technology include [1 , 2] :

1. Improve low speed aircraft handling characteristics.
2. Increased resistance to span\ departure .
3. Reduced aircraft stall speed .

Since sweep produces effects that vary with cos(sweep), the same result may be yield, with high speeds in the high subsonic Mach number region beginning to be attainable, aerodynamic designers found that sweeping wing either forward or aft delayed the rapid increase of transonic drag to higher Mach numbers [3,4] .

Some studies have examined the aerodynamic characteristics of forward swept wing and prove number the identical transonic maneuver design conditions, a forward swept wing can be provide lesser drag than an equivalent aft swept wing [5,6].

For laminar flow wing, the reduction in sweep in the case of forward swept wing leads to more stable laminar boundary layer concerning transition because of cross flow instability and attachment line transition [2,7] .

The use of forward swept wings has aerodynamic benefits at high angles of incidence and in supersonic regimes. These consist of reduction in wave drag, profile drag, and increased high angle of incidence handling qualities. These increased benefits are often offset due to an increase in structural components, to overcome flutter and wing tip divergence due to high loading of the wing tips at high angles of incidence [8] , as example for X-29 a forward swept wing flight research aircraft flight envelope was expanded to 66° angle of incidence [9].

15 *AJES-2010, Vol.3, No.2*

Description: -
-Flight experiments on the boundary layer characteristics of a swept back wing
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College of Aeronautics -- Cranfield. CoA report ; no. 104Flight experiments on the boundary layer characteristics of a swept back wing
Notes: Bibliography: p. 24-25.
This edition was published in 1956

Tags: #Linear #and #nonlinear #development #of #controlled #disturbances #in #the #supersonic #boundary #layer #on #a #swept #wing #at #Mach #2.5

Swept Wings

In the Ames tests,flapping of the teetering rotors during maneuvers introduced momentsthat reduced damping of the longitudinal. Vulcan Test Pilot: My Experiences in the Cockpit of a Cold War Icon.

Linear and nonlinear development of controlled disturbances in the supersonic boundary layer on a swept wing at Mach 2.5

The amount of spanwise flow compounds as you approach the wingtip, decreasing the wingtip's effective airspeed and thickening the boundary layer. High speed aircraft, due to their clean low drag design, use spoilers as speed brakes to slow them down.

ch8

The experiment was performed at the DLR by Sobieczky 1994 and consists of a wing mounted to the tunnel sidewall which is assumed to have transitioned far upstream of the wing. Previous experiments have shown success by placing the DRE arrays, spaced at the control wavelength, at the branch I neutral point of the most unstable wavelength. Back row: Frank Pauli, Seth Anderson.

Linear and nonlinear development of controlled disturbances in the supersonic boundary layer on a swept wing at Mach 2.5

Compressibility and to a lesser extent viscosity is of paramount importance at speeds approaching the speed of sound.

Boundary Layer and Flow Control

Based on the flow visualization and the pressure measurements a diagram of the flow field around the wing was constructed and can be seen in Figure 8 middle. This airflow on the swept wing has the effect of persuading the wing into believing that it is flying slower than it really is; thus the formation of shock waves is delayed. Surface streaklines were obtained using an oil flow visualisation technique, performed using a mixture of titanium dioxide and light oil.

Experiments on Discrete Roughness Element Technology for Swept

Thus the economy of the use of suction should be considered.

Linear and nonlinear development of controlled disturbances in the supersonic boundary layer on a swept wing at Mach 2.5

Details of the IR processing technique can be found in the work of Crawford et al. Wing sweep at high speeds was first investigated in Germany as early as 1935 by and , finding application just before the end of the.

Swept Wings

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