NASA TECH BRIEF
Langley Research Center

Prediction of Stall Characteristics of Straight Wing Aircraft

The problem:

To calculate the spanwise distributions of lift, drag, and pitching moment coefficients on a wing-fuselage combination up to the angle-of-attack at which stall occurs, and to predict the spanwise position of initial stall.

The solution:

A digital computer program which considers an unswept wing with a circular or elliptical fuselage. The wing may have partial or full span deflected flaps and must have an aspect ratio of 6 or greater.

How it's done:

For a wing without fuselage, Sivells' lifting-line method (NACA TR 1090) is employed. When a fuselage is present, Multhopp's method (NACA TM 1036) is used to transform the wing-fuselage combination into an equivalent wing-alone configuration. Lifting-line theory is then applied to this transformed configuration. The theory employs two-dimensional, experimental airfoil characteristics to obtain the lift, drag, and pitching moment coefficients at each station on the wing span.

The program determines the wing spanwise lift distribution by an iterative procedure. Once this distribution is established, the distributions of drag and pitching moment are obtained from the curves of experimental two-dimensional airfoil section characteristics. Spanwise integration of the lift, drag, and pitching moment distributions yields the overall wing lift, drag, and pitching moment, respectively.

If calculations are made at a sufficiently high value of fuselage angle-of-attack, a spanwise section will reach a point equal to the angle-of-attack for maximum lift, as determined from the two-dimensional section data. When this occurs, the wing is said to stall. Thus the method can be used to determine the point of initial stall on the wings of wing-fuselage combinations.

Notes:

1. This program is written in FORTRAN IV for use on a CDC-6600, version 2.3, with a Scope 3.0 operating system and library tape.

2. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference:
   NASA CR-1646 (N71-31154), A Design Summary of Stall Characteristics of Straight Wing Aircraft

3. Requests for further information on the program may be directed to:
   COSMIC
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10501

Patent status:

No patent action is contemplated by NASA.

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