



ESDU 88040

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Program for calculation of aileron rolling moment and yawing moment coefficients at subsonic speeds

Associated software: ESDUpac A8840



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THE PREPARATION OF THIS DATA ITEM

The work on this particular Data Item which was monitored and guided by the Aerodynamics Committee. This Committee first met in 1942 and at the time of the first issue of the Data Item had the following membership:

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PROGRAM FOR CALCULATION OF AILERON ROLLING MOMENT AND YAWING MOMENT COEFFICIENTS AT SUBSONIC SPEEDS

CONTENTS

	Page
1. NOTATION AND UNITS	1
2. INTRODUCTION	3
3. DERIVATION	5
4. EXAMPLES OF INPUT AND OUTPUT	5
4.1 INPUT	6
4.2 OUTPUT	7

PROGRAM FOR CALCULATION OF AILERON ROLLING MOMENT AND YAWING MOMENT COEFFICIENTS AT SUBSONIC SPEEDS

1. NOTATION AND UNITS

(Only that notation required to define the input and output is detailed. For more information see ESDU 88013 and 88029.)

		SI	British
A	aspect ratio		
b	wing span	m	ft
C_L	lift coefficient of wing and flap system with ailerons undeflected, $L/\frac{1}{2}\rho V^2 S$		
ΔC_{L_f}	component of lift coefficient due to deployment of trailing-edge flaps		
C_l	rolling moment coefficient due to ailerons, $\mathcal{L}/\frac{1}{2}\rho V^2 S b$		
C_n	yawing moment coefficient due to ailerons, $N/\frac{1}{2}\rho V^2 S b$		
c_f/c	ratio of aileron chord aft of hinge line to local wing chord at mid-span of aileron, see Sketch 1.1		
J_f	empirical factor for converting ΔC_{L_f} into effective twist angle, see Equation (2.3) in ESDU 88029. Taken as 18.0 degrees	degree	degree
J_δ	empirical factor applied to δ_t , see Equation (2.3) in ESDU 88029. Taken as 1.4		
L	lift	N	lbf
$\mathcal{L}$	rolling moment, positive starboard wing down	N m	lbf ft

Issued October 1992
 With Amendments A to C, September 2014 – 10 pages
 This page Amendment C

$L_{\xi'}$	rolling moment derivative with respect to ξ' , $\partial C_l / \partial \xi'$	rad^{-1}	rad^{-1}
M	Mach number		
N	yawing moment, positive nose to starboard	N m	lbf ft
R	Reynolds number based on wing mean chord		
S	wing planform area	m^2	ft^2
s	wing semispan, see Sketch 1.1	m	ft
t/c	section thickness-to-chord ratio of wing at mid-span of aileron		
V	free-stream velocity	m/s	ft/s
γ'	angle between chord line of aerofoil section and line joining mid-thickness point at hinge line to trailing edge of undeflected aileron, in plane normal to hinge line, see Sketch 1.1	degree	degree
δ_t	geometric twist angle of wing tip relative to root chord, positive leading-edge up	degree	degree
η	spanwise distance from wing centre-line as fraction of semispan		
η_i	value of η at inboard limit of aileron at hinge line, see Sketch 1.1		
η_o	value of η at outboard limit of aileron at hinge line, see Sketch 1.1		
$\bar{\eta}$	$(\eta_i + \eta_o)/2$, see Sketch 1.1		
λ	wing taper, ratio of tip chord to centre-line chord		
Λ_h	sweepback of aileron hinge line, see sketch 1.1	degree	degree
$\Lambda_{1/2}$	sweepback of wing half-chord line, see sketch 1.1	degree	degree
ξ'	aileron deflection angle measured in plane normal to hinge line, arithmetic mean of deflection angles of port and starboard ailerons, positive for starboard aileron down and port aileron up, $\frac{1}{2}(\xi'_p + \xi'_s)/57.3$	radian	radian
ξ'_p	deflection of port aileron, measured in plane normal to hinge line, positive trailing-edge up	degree	degree
ξ'_s	deflection of starboard aileron, measured in plane normal to hinge line, positive trailing-edge down	degree	degree
ρ	free-stream density of air	kg/m^3	slug/ft^3
τ	section trailing-edge angle at mid-span of aileron	degree	degree