List of Symbols

a	atmosphere speed of sound
a	exponent in approximate thrust formula
ac	aerodynamic center
$\mathbf{a}$	acceleration vector
a_0	airfoil angle of attack for zero lift
A	aspect ratio
A	system matrix
$\mathbf{A}$	aerodynamic force vector
b	span
b	exponent in approximate SFC formula
c	chord
c_d	airfoil drag coefficient
c_l	airfoil lift coefficient
c_{l_α}	airfoil lift curve slope
$c_{m_{ac}}$	airfoil pitching moment about the aerodynamic center
c_r	root chord
c_t	tip chord
$\bar{c}$	mean aerodynamic chord
C	specfic fuel consumption
C_c	corrected specfic fuel consumption
C_D	drag coefficient
C_{D_f}	friction drag coefficient
C_{D_i}	induced drag coefficient
C_{D_w}	wave drag coefficient
C_{D_0}	zero-lift drag coefficient
C_f	skin friction coefficient
CF	compressibility factor
C_L	lift coefficient

C_{L_α}	lift curve slope
$C_{L_{max}}$	maximum lift coefficient
$C_{m_{ac}}$	pitching moment about the aerodynamic center
C_T	nondimensional thrust
C_m^T	nondimensional thrust moment
C_W	nondimensional weight
d	diameter
det	determinant
D	drag
e	Oswald's efficiency factor
E	origin of ground axes system
E	aerodynamic efficiency or lift to drag ratio
$\mathbf{EO}$	position vector
f	flap f factor
f	equivalent parasite area
F	distance factor
F_S	stick force
$\mathbf{F}$	force vector
FF	form factor
g	acceleration of gravity
$\mathbf{g}$	acceleration of gravity vector
g_s	acceleration of gravity at sea level
g_1	function in Mach number for drag divergence
g_2	function in Mach number for drag divergence
H	elevator hinge moment
G	time factor
G	elevator gearing
h	altitude above sea level
h_t	altitude of the tropopause
h_H	height of HT ac above wing $\bar{c}$
$\dot{h}$	rate of climb

$\mathbf{i}$	unit vector
i_H	horizontal tail incidence
i_W	wing incidence
IF	interference factor
ISA	ideal subsonic airplane
$ISBJ$	ideal subsonic business jet
I_{yy}	mass moment of inertial about the y_b axis
$\mathbf{j}$	unit vector
J	performance index
k	ratio of specific heats
$\mathbf{k}$	unit vector
K	induced drag factor
K	correction factor
l	length
L	lift
L	rolling moment
m	mass
M	Mach number
M	pitching moment
IF	interference factor
M_D	Mach number for drag divergence
M^A	aerodynamic pitching moment
M^T	thrust pitching moment
IF	interference factor
n	number of intervals
n	load factor
N	yawing moment
O	center of gravity
p	atmospheric pressure
P	power setting
P_S	specific excess power
q	pitch rate perturbation

$\bar{q}$	dynamic pressure
$\bar{q}_H$	dynamic pressure in front of horizontal tail
Q	pitch rate
$\widehat{Q}$	nondimensional pitch rate
r	turn radius
r_s	radius of the earth at sea level
R	gas constant for air
R_e	Reynolds number
s	distance along a turn
S	planform area
SBJ	subsonic business jet in App. A
SFC	specific fuel consumption
S_c	planform area of wing associated with control
S_{wet}	wetted area
$6DOF$	six degree of freedom motion
t	time
t	maximum thickness
t/c	thickness ratio
T	Thrust
T_c	corrected thrust
$\mathbf{T}$	thrust vector
$3DOF$	three degree of freedom motion
u	nondimensional speed
u	velocity component along ground x axis
U	velocity component along body x axis
v	velocity along the ground y axis
V	velocity
V_C	corner speed
V_D	decision speed
V_{LO}	lift-off speed

V_R	rotation speed
V_{TD}	touchdown speed
$\mathbf{V}$	velocity vector
V_e	equivalent airspeed
$\bar{V}_H$	horizontal tail volume coefficient
$\mathbf{V}_0$	velocity of the airplane relative to the ground
w	velocity component along ground h axis
w	wind speed
w_h	component of wind speed in the h direction
w_x	component of wind speed in the x direction
$\mathbf{w}$	velocity vector of the atmosphere relative to the ground
W	weight
W	velocity component on body z axis
x	distance
x	coordinate axis
X	distance aft of the wing mean aerodynamic chord leading edge
$\bar{X}$	X divided by $\bar{c}$
y	distance
y	coordinate axis
z	coordinate axis
α	angle of attack
α	angle of attack perturbation
$\bar{\alpha}$	angle of attack in Chaps, 10 and 11
$\dot{\alpha}$	angle of attack rate perturbation
α_H	horizontal tail angle of attack
α_{0L}	zero lift angle of attack
$\dot{\alpha}$	angle of attack rate
β	sideslip angle
γ	flight path inclination, climb angle

δ control delflection angle

δ_E elevator angle

$\bar{\delta}_E$ elevator angle in Chaps. 10 and 11

δ_E elevator angle perturbation

δ_T trim tab angle

ε thrust angle of attack

ε downwash at the horizontal tail

ε_α slope of the downwash curve

ε_0 angle between thrust vector and the body x-axis

ε_0 HT downwash angle at $\alpha = 0$

ζ damping ratio

η corrected engine speed

η_H horizontal tail efficiency factor

θ perturbed pitch angle

Θ pitch angle perturbation

κ ratio of c_{l_α} to $(c_{l_\alpha})_{theory}$

λ scale height

λ taper ratio

λ root of the characteristic equation

Λ sweep angle

μ atmospheric viscosity

μ bank angle

μ coefficient of rolling friction

ξ coordinate of the aerodynamic center in the x direction

ρ atmospheric density

σ ratio of density to density at sea level

Σ summation

τ atmosphere absolute temperature

τ control surface effectiveness

τ nondimensional thrust

τ_E	elevator effectiveness
θ	pitch angle perturbation
$\bar{\tau}$	airfoil elevator effectiveness
ϕ	angle between regular body x axis and stability x axis
ψ	heading angle
$\dot{\psi}$	turn rate
ω_n	natural frequency

Subscripts

ac	aerodynamic center
b	body
cg	center of gravity
D	drag
F	flap
h	local horizon
h	hinge moment
hc	half chord
H	horizontal tail
le	leading edge
L	lift
LO	lift-off
m	moment
max	maximum
mt	maximum thickness
o	relative to the ground
ps	peak suction
q	pitch rate perturbation
qc	quarter chord
Q	nondimensional pitch rate

r	reference
s	sea level
s	stability
S	slat
S	specific
t	troposphere
TD	touchdown
x	component in the x direction
h	component in the h direction
$stall$	stall speed
te	trailing edge
T	tip tank
u	velocity perturbation
w	wind
W	wing
W	weight
WB	wing-body
0	a value with α=0 and δ_E=0
1	steady state
α	angle of attack
δ_E	elevator angle
$\dot{\alpha}$	angle of attack rate

Superscripts

A	aerodynamic
T	thrust
$'$	stick free
$*$	maximum lift to drag ratio