Nomenclature

Symbol:	Definition:
A, **B**, **C**	flux Jacobians
a	speed of sound
b	part of viscous term in energy equation; also, compression parameter in minmod flux limiter
C	constant
C_μ	modeling variable in turbulence model equations
D	diffusion term in turbulence model equations
D_1, D_2	damping terms in Baldwin-Barth turbulence model
d	distance to nearest wall; also, directed distance to the wall
E	total energy
e	total energy per unit volume
F	function
f	damping function; also, frequency
F, **G**, **H**	inviscid fluxes
$\mathbf{F}_v$, $\mathbf{G}_v$, $\mathbf{H}_v$	viscous fluxes
G_1	modeling variable (similar to $-C_\mu$ term) in turbulence model equations
H	total enthalpy
I	restriction operator
I	identity matrix
i, j, k	grid indices
J	transformation Jacobian, $J = \partial(\xi, \eta, \zeta)/\partial(x, y, z)$
k_r	reduced frequency
k_g	growth rate

Symbol:	Definition:
k	kinetic energy in turbulence model equations
$\tilde{L}$	characteristic length
L_{ref}	length in grid corresponding to $\tilde{L}$
$\tilde{L}_R$	reference length used by code $\tilde{L}_R = \tilde{L}/L_{ref}$
l	reference length; also, length scale in Baldwin-Lomax turbulence model
M	Mach number, $M = \lvert\tilde{\mathbf{V}}\rvert/\tilde{a}$
$\mathbf{M}$	transformation matrix from conserved variables to primitive variables, $\partial\mathbf{Q}/\partial\mathbf{q}$
m	sub-iteration counter
N	spatially-factored implicit matrix term
n	direction normal to the wall
n	current iteration
P	production term in turbulence model equations
Pr	Prandtl number
p	static pressure
$\mathbf{Q}$	conserved variables
$\mathbf{q}$	primitive variables
$\dot{q}$	heat flux terms
$\mathbf{R}$	residual vector
R	turbulent Reynolds number term in Baldwin-Barth turbulence model; also, residual term
$Re_{\tilde{L}}$	Reynolds number, $Re_{\tilde{L}} = \tilde{\rho}_\infty\lvert\tilde{\mathbf{V}}\rvert_\infty\tilde{L}/\tilde{\mu}_\infty$
S	mean rate-of-strain tensor
S_P	production source term in turbulence model equations
S_D	destruction source term in turbulence model equations
s	entropy; also, parameter used in smooth flux limiter
$\mathbf{T}$	matrix of eigenvectors
t	time; also, parameter used in smooth flux limiter
U, V, W	contravariant velocities

Symbol:	Definition:
u, v, w	Cartesian velocities in x, y, z directions
u^+	law-of-the-wall variable, $u^+ = \tilde{u}\sqrt{\tilde{\rho}/\tilde{\tau}_w}$
V	corrections on coarser meshes, used to update finer mesh in the multigrid algorithm
V	velocity vector, (u, v, w)
$\|\mathbf{V}\|$	total velocity
W	mean vorticity tensor
X	represents either k, ω, or ε in general turbulence model equations
x, y, z	Cartesian coordinates
y^+	law-of-the-wall variable, $y^+ = \sqrt{\tilde{\rho}\tilde{\tau}_w}\tilde{y}/\tilde{\mu}$
α	angle of attack; also, used as constant in turbulence model equations
β	side-slip angle; also, used as constant in turbulence model equations
γ	ratio of specific heats, $\gamma = 1.4$; also, variable in turbulence model equations
Δ	incremental quantity; also, forward difference operator
δ	difference operator
ε	dissipation term in turbulence model equations; also, small constant used in flux limiters
κ	spatial differencing parameter; also, von Karman constant used in turbulence model equations
Λ	matrix of eigenvalues
λ	bulk viscosity coefficient
μ	molecular viscosity coefficient
ν	kinematic viscosity
$\hat{\nu}$	field equation variable in Spalart-Allmaras turbulence model
ξ, η, ζ	general curvilinear coordinates; also, η and ζ used as variables in EASM turbulence model equations
ρ	density
τ	shear stress tensor; also, relative truncation error
ϕ	parameter governing the temporal order of accuracy of the scheme
Ω	magnitude of vorticity

Symbol:	Definition:
ω	rotational velocity; also, variable in turbulence model equations, $\omega = \varepsilon/k$
∇	gradient operator $\nabla X = \partial X/\partial x_i$

Subscripts

Symbol:	Definition:
e	denotes estimated value
i, *j*, *k*	denote grid indices; also, summation convention where specified
inv	denotes inviscid part
k	denotes k turbulence model quantity
L	denotes left-hand state; also, denotes laminar quantity where specified
l	denotes summation convention
R	denotes right-hand state
T	denotes turbulent quantity
t	denotes total quantity; e.g. $p_t \Rightarrow$ total pressure; also, denotes differentiation with respect to time
v	denotes viscous term
w	denotes wall condition
x, *y*, *z*	denote differentiation with respect to *x*, *y*, *z*; *x* also denotes tensor notation where specified
ε	denotes ε turbulence model quantity
ω	denotes ω turbulence model quantity
∞	denotes reference conditions, typically free-stream conditions
+, –	denotes forward or backward difference operator
ξ, η, ζ	denotes reference to a particular coordinate direction

Superscripts

Symbol:	Definition:
b	denotes biased gradient
c	denotes correction term

Superscripts

Symbol:	Definition:
r	denotes residual smoothing term
$\wedge$	denotes quantities in generalized coordinates
$\sim$	denotes dimensional value; also, denotes Roe-averaged variable where specified
$'$	denotes partial derivative with respect to **q** and intermediate values in the time advancement scheme
$\rightarrow$	denotes a vector quantity
+, –	denotes forward or backward difference operator

Abbreviations

CFD	Computational Fluid Dynamics
CFL	Courant number
CFL3D	Computational Fluids Laboratory 3-Dimensional (flow solver)
CPU	Central Processing Unit
EASM	Explicit Algebraic Stress Model
FAST	Flow Analysis Software Toolkit[44]
LRR	Launder-Reese-Rodi
GRIDGEN	GRID GENeration[36]
MaGGiE	MultiGeometry Grid Embedder[11]
NACA	National Advisory Committee for Aeronautics
PLOT3D	PLOT 3-Dimensional[43]
RAE	Royal Aircraft Establishment
SSG	Speziale-Sarkar-Gatski
SST	Shear Stress Transport
TLNS3D	Thin-Layer Navier-Stokes 3-Dimensional (flow solver)[42]