

Index

A

Acoustic equations, 30
Acoustic modes, 74, 78
Acoustic waves, 30
Aiming point, 45
Airy function, 92
Anharmonicity of molecular vibrations, 15
Anharmonicity parameter, 15

B

Boltzmann constant, 7
Boltzmann distribution, 10
Boltzmann-type collision integrals, 6
Bulk viscosity, 8, 12, 19, 22, 28

C

Cat's-eye structure, 177
Cauchy data, 45
Chapman-Enskog method, 6
Characteristic relaxation length, 38
Chebyshev polynomial, 65
Coefficient of energy exchange, 22
Collision dynamics, 21
Complex phase velocities, 64
Compressible Couette flow, 112
Compressible flow, 74
Constant mode, 120
Constant viscosity model, 73, 74
Couette flow, 53
Critical Reynolds number, 116, 128

D

Degree of excitation of vibrational mode, 36
Degree of vibrational excitation, 106
Degrees of freedom of molecules, 2
Diatomic gas, 61
Dissipation, 197
Distribution function, 3
Disturbance energy production, 185
Dunn-Lin viscous system, 91, 101

E

Effective relaxation time, 14
Eigenfunction, 46
Eigenvalues, 45
Energy balance equation, 116, 188
Equilibrium vibrational energy, 11
Eucken's semiempirical relations, 54
Euler-Lagrange equations, 118, 136
Even inviscid modes, 74
Even modes, 67

F

First Rayleigh condition, 60
Fluctuation characteristics, 195
Frequency, 31, 77
Frobenius method, 88

G

Gauss-Lobatto points, 65

Generalized Airy function, 92
 Generalized potential vorticity, 38
 Generalized vorticity perturbation, 47
 Growth rates, 45, 69, 70

H

Hankel function, 93
 Heat conductivity coefficient, 54
 Heat flux, 4, 8, 12
 Homogeneous boundary conditions, 40, 87
 Hydrodynamic velocity, 4

I

Ideal gas, 48, 61, 70
 Intermittency coefficient, 154
 Intermittency parameter, 166
 Internal degrees of freedom, 5
 Inviscid modes, 67
 Inviscid nonheat-conducting gas, 7, 11
 Inviscid solutions, 86, 90, 97

K

Karman street, 193
 Kelvin-Helmholtz instability, 172, 177, 191
 Kinematic bulk viscosity, 38
 Kinetic energy of disturbances, 115, 159, 161, 184, 188, 194
 Kinetic energy of the structure, 184, 195
 Kovenya-Yanenko weighted finite-difference scheme, 191

L

Lagrangian formula, 100
 λ -structures, 153
 Laminar-turbulent transition, 111, 153
 Laminar-turbulent transition scenarios, 153
 Landau-Teller equation, 11, 14, 37, 132, 165, 193
 L'Hopital's rule, 45
 Lifetime of the structure, 182, 184, 197
 Lifetime of the vortex, 193
 Linear stability, 53
 Loaded spheres, 21
 Longitudinal long-wave modes, 121

M

Mach number, 28, 36, 54
 Matrix of collocation derivatives, 65, 127
 Maxwell distribution, 7, 10

Maxwell relations, 18
 Method of collocations, 64, 127
 Mixing layer, 154, 163
 Modified Tietjens function, 104

N

Navier-Stokes equations, 9, 172
 Neutral perturbations, 88
 Neutral stability, 104
 Neutral stability curve, 106, 107
 Newton-Cauchy-Poisson phenomenological formula, 16
 Nonequilibrium parameter, 197
 Non-Stokes fluids, 17

O

Odd inviscid modes, 74
 Odd modes, 67

P

Parabolic temperature profile, 60
 Parker's formula, 23
 Perfect gas, 74, 108
 Perturbation energy balance equation, 37
 Perturbation wavelength, 173
 Phase velocity, 69, 70, 107
 Plane waves, 40
 Prandtl number, 54

Q

Quasi-equilibrium Boltzmann distribution, 10
 QZ-algorithm, 66, 128

R

Rankine vortex, 156, 161
 Ratio of specific heats, 36
 Ratio of the bulk and shear viscosities, 25
 Rayleigh condition, 41, 43
 Relative intensity of a vortex structure, 154
 Relative intensity of vortex perturbation, 166
 Relaxation frequency, 31
 Relaxation time, 8
 Relaxing gas, 30
 Resonance VV-exchange, 5, 28
 Reynolds number, 54, 155
 Reynolds stresses, 154, 161, 163, 185, 194
 Ribleting surfaces, 164
 Rotational degrees of freedom, 6

Rotational energy, 4
 Rotational energy fluxes, 4
 Rotational relaxation time, 22
 Rough spheres, 21
 RT-exchange, 2, 9
 RT-transition, 21
 Runge-Kutta procedure, 45, 46, 175

S

Satherland's viscosity model, 73
 Second Rayleigh condition, 60
 Secular equation, 103, 106
 Semicircle theorem, 42, 62
 Semiempirical Millikan-White formula, 29
 Shear flow, 43
 Shear viscosity, 8, 22, 55
 Shooting method, 66
 Simpson's formula, 106
 Singular point, 89
 Solid molecules, 21
 Spherical cylinders, 21
 Squire's theorem, 130
 Static temperature, 36
 Stokes fluids, 17
 Stokes relation, 17
 Streamwise velocity, 90
 Stress tensor, 4, 8, 12
 Sutherland's formula, 25
 System of equations of two-temperature aerodynamics, 12, 53, 131, 191
 System of equations of two-temperature gas dynamics, 36
 System of gas-dynamic equations, 7

T

Temperature profile, 55
 Tietjens function, 93, 103
 Tollmien-Schlichting wave, 74
 Total vorticity, 177
 Transformed energy balance equation, 117
 Translational degrees of freedom, 6
 Translational energy, 4

Translational energy fluxes, 4
 Transverse long-wave modes, 124
 Transverse velocity, 90
 Travelling plane waves, 57, 87
 TR-exchange, 12
 TT-transitions, 2
 Turbulence generation, 153
 Two-dimensional vortex structure, 154

U

Unstable inviscid modes, 71
 Unstable modes, 45

V

Variational eigenvalue problem, 117
 Velocity profile, 55
 Vibrational energy, 4
 Vibrational energy fluxes, 4
 Vibrationally excited gas, 48
 Vibrational relaxation, 197
 Vibrational relaxation process, 168
 Vibrational temperature, 10, 36
 Viscous heat-conducting gas, 9
 Viscous solutions, 86, 90, 97, 99
 Viscous stratification, 74, 81, 83
 Viscous stress tensor, 8
 Vortex structure, 153, 180
 Vortex structure kinematics, 182
 Vorticity distribution, 148
 Vorticity isolines, 177
 Vorticity kinematics, 178, 181
 VT-relaxation, 3
 VT-relaxation time, 14
 VV-exchange, 9, 12
 VV-transitions, 3

W

Wang Chang-Uhlenbeck equation, 3
 Wavelength, 173, 180, 190
 Wavenumbers, 74