

Index

a

Acoustical branch 193
 Acoustical mode 194
 Action 125, 141
 Action integral 125, 126
 Adhesion theory 9
 Adiabatic potential 17, 19
 Adiabatic theorem 12, 44
 Almost periodic data 232
 Amontons 1, 2
 Amplitude modulation 172
 Amplitude spectrum 232
 Analytical mechanics 118
 Angular frequency 160
 Angular velocity vector 157
 Area element 113
 Atomic force microscope 85
 Atomic mass unit 268
 Atomic number 52
 Atomic structure 51
 Atomic weight 52
 Atomic-level friction 10
 Atomic-scale stick-slip 86
 Atomically clean surface 85
 Atomistic locking 15, 21, 23, 31, 45
 Atomistic model 69
 Atomistic origin 29
 Atomistic origin of friction 9
 Atomistic origins of friction 23
 Atomistics 6
 Aubry transition 11, 48
 Auger electron spectroscopy 92
 Autocorrelation function 233, 237
 Avogadro 6
 Avogadro's constant 268, 269

b

Avogadro's hypothesis 269
 Azimuthal quantum number 54
b
 Body-centered cubic structure 256
 Bohr model 54
 Bohr's theory of atomic structure 53
 Boltzmann constant 135
 Boltzmann factor 181
 Boltzmann principle 147
 Boltzmann's constant 180
 Boltzmann's principle 145
 Bonding force 55, 60
 Bonding force in metals 62
 Bragg's diffraction condition 264
 Brillouin zone 189, 191, 195
 Brownian motion 269

c

Canonical conjugate variable 116, 132
 Canonical ensemble 149, 151
 Canonically conjugate 119
 Capillary force 85
 Carbon fullerene 87
 Carbon nanotube 87, 91
 Cartesian coordinate system 103, 104
 Cartesian curvilinear coordinates 111
 Central force 155
 Cesium chloride structure 259
 Chaos 50
 Characteristic polynomial 222
 Charge density wave 10, 47, 88
 Classical mechanics 154

- Classical statistical mechanics 139,
 179, 180
 Cohesion 55
 Cohesive force 55
 Commensurability 10, 88, 89, 97
 Commensurability in two different
 periodicities 88
 Complex exponential function 206,
 241
 Complex frequency response 248
 Computer experiment 1, 49, 50
 Computer simulation 1, 49
 Conduction electron 61, 66
 Conduction electrons 61
 Continuum approximation 185, 186,
 188, 189
 Convolution integral 146, 251
 Coulomb 2, 4
 Coulomb's friction law 1
 Covalent bond 10, 58, 60
 Covalent crystal 60, 66
 Critical atom 39, 40
 Crystal lattice 179
 Crystal structure 255
 Cumulative probability distribution
 function 236
 Curvilinear coordinates system 103
 Cyclic coordinates 119
 Cylindrical coordinates 113
- d**
- d'Alembert's principle 126, 127
 Dalton 6
 Dalton's atomistics 6
 de Broglie 53
 Debye temperature 183
 Debye's theory 184
 Degeneracy 222
 Degree of freedom 113
 Density of states 142
 Desaguliers 4
 Deterministic data 227
 Diagonalization 223
 Diamond structure 60, 260
 Diamond-like carbon 97
 Difference equation 68
 Dipole oscillator 63
- Discrete Fourier transform 243, 245
 Dispersion force 62
 Dispersion relation 171, 189
 Dulong–Petit's law 180, 183
 Dynamic friction 29, 32, 99
 Dynamic locking 15, 22, 23, 46
 Dynamical matrix 195
- e**
- Einstein model 182, 184
 Einstein theory 184
 Einstein's characteristic temperature
 182
 Einstein's specific heat equation 182
 Einstein's theory 183
 Elastic constant 68
 Electron density 56
 Electron gas 61
 Electron orbital 58
 Electron shell 58
 Electron volt 54
 Electron-pair bond 57, 60, 66
 Electronic state 51, 52, 53
 Electrostatic energy 57
 Electrostatic force 66, 85
 Electrostatic potential 56
 Energy dissipation 75, 99
 Energy level 55
 Energy recurrence 75
 Equal probability 150
 Equation of motion in dimensionless
 form 70
 Equations of motion of atoms 68
 Equipartition of energy 179
 Equipartition theorem 20
 Ergodic 33, 234
 Ergodic hypothesis 50, 134, 138, 139
 Ergodic property 33
 Euclidean geometry 104
 Euler 3
 Euler formula 207
 Euler's equation 125
 Euler's formula 163
 Euler–Lagrange equation 123, 125
 Ewing 5

f

- Face-centered cubic structure 257
 Fast fourier transform 239
 Field emission microscope 92
 Fourier series 240
 Fourier series expansion 230, 240
 Fourier transform 242
 Fowler–Nordheim plot 92
 Free electron 61
 Free electron model 61
 Frenkel–Kontorova model 10, 11, 69, 76, 88, 89
 Frequency response function 246
 Friction diagram 72, 74
 Friction force microscope 85
 Friction model 69
 Friction transition 23, 35, 37, 40, 48, 73, 79
 Fundamental harmonic wave 230

g

- Gas constant 180
 Gas molecular kinetics 134
 Gaussian function 135
 Gaussian integral 138
 Gaussian integral formula 135
 Generalized coordinates 113, 116
 Generalized force 116, 117
 Generalized momentum 116, 119
 Gibbs' theorem 147, 148
 Golden mean number 70
 Group velocity 161, 172, 174

h

- Hamaker constant 64
 Hamilton's canonical equation 129, 132
 Hamilton's function 130
 Hamilton's variational principle 125
 Hamiltonian 129, 130
 Hardy 5
 Harmonic oscillation 160, 162, 179, 227
 Harmonic vibration 160
 Heat bath 147
 Heat of evaporation 65

Heat of fusion 65

- Helmholtz 6
 Hertz 5
 Hertzian contact 5
 Hexagonal closed-packed structure 258
 High dimensionality 46, 76
 Higher harmonic wave 230
 Highly oriented pyrolytic graphite 86
 Holm 5
 Holonomic constraint condition 115
 Hydrogen bonds 10
 Hydrogen molecule 56, 57
 Hydrogen-bonded crystal 64, 66

i

- Incommensurate 10, 11
 Independent oscillator model 10
 Interatomic potential 66
 Internal energy 139
 Internal resonance phenomena 75
 International atomic time 268
 Ionic crystal 59, 66

j

- Jacobian 112
 Johnson potential 25, 40

k

- Kilogramme des Archives 268
 Kinetic energy of electron 61
 Kinetic theory of gases 134, 139
 Kolmogorov–Arnold–Moser stability 33

l

- Lagrange equation 119, 125
 Lagrange equation of motion 118, 119
 Lagrange method 107
 Lagrange's equation 120, 121
 Lagrange's method of undetermined multipliers 150
 Lagrangian 119, 122
 Langmuir–Blodgett film 86, 90
 Lattice vibration 179
 Lennard–Jones potential 67, 71

Leonardo da Vinci 1, 2
 Leslie 4
 Liquid 65
 Longitudinal wave 197
 Lorentz 61
 Low-energy electron diffraction 92

m

Mètre des Archives 267
 Maclaurin expansion 204
 Magnetic force 85
 Many-body interatomic potentials 80
 Matter waves 53
 Maxwell–Boltzmann distribution 72, 135, 137, 139
 McClelland 10
 Mean free path 134
 Mechanical adiabaticity 11
 Mechanical locking 9, 21, 99
 Metallic bond 10
 Metallic bonding 11
 Metallic crystal 61, 66
 Microcanonical ensemble 148
 Microscopic state 139, 142
 Molecular crystal 62, 66
 Molecular dynamics 68, 72, 91
 Molecular theory 4
 Molybdenum disulfide 96
 Morse potential 40, 46, 67, 80
 Muscovite mica 89

n

Nanotribology 10
 Natural angular frequency 71
 Natural frequency 188
 Natural length 184
 Natural vibration 188
 Nautical mile 273
 Neutron diffraction 197
 Nonadiabatic motion 11, 45, 48
 Nonadiabaticity 12
 Noncontinuous motion 11
 Nonholonomic constraint motion 115
 Normal mode 195
 Nyquist's sampling theorem 240

o

Optical branch 193
 Optical mode 194
 Optical-lever method 85
 Orthogonal coordinate system 103

p

Particle philosophy 6
 Pauli exclusion principle 55
 Periodic boundary condition 185, 187, 195
 Periodic data 228
 Phase space 132
 Phase spectrum 232
 Phase velocity 161, 169, 186
 Phase-space volume 33
 Phonon 197
 Photon 198
 Planck's constant 54, 142
 Plane wave 175
 Polar coordinate system 103
 Power spectral density function 237
 Principal quantum number 54
 Principle of equal probability 146
 Principle of equal *a priori* probabilities 134
 Principle of equal *a priori* probability 138, 139
 Principle of equipartition 50, 138
 Principle of least action 125, 126
 Principle of virtual work 126, 127
 Probability density 235
 Probability density function 236
 Pseudo momentum 198

q

Quantum mechanics 129
 Quantum number 51, 54, 55, 58
 Quantum theory 54

r

Radiocarbon dating method 269
 Random process 233
 Reciprocal lattice 191
 Reciprocal vector 263
 Recurrence phenomenon 76

- Relative atomic mass 52
 Repulsive force 57
 Resolution frequency 239
 Rigid body mode 187
- s**
 Sampling frequency 239
 Sampling time 239
 Savage 99
 Scanning tunneling microscope 85
 Schrödinger equation 54
 SI unit system 267, 269
 Simple cubic structure 256
 Sodium chloride structure 259
 Solid angle 110
 Sota 4
 Sound velocity 183
 Specific heat 179
 Spin quantum number 55
 Stability of superlubricity 82
 Standard deviation 235
 Standing wave 188
 Static friction 29, 31, 99
 Static friction force 87
 Statistical mechanics 129, 134
 Stick-slip 46
 Stirling method 150
 Stochastic process 233
 Strang 5
 Subharmonic oscillation 75
 Summed-and-differential harmonic oscillation 75
 Superharmonic oscillation 75
 Superlubricity 11, 43, 72, 73, 79
 Surface energy 26
 Surface-roughness model 29, 31, 99
- t**
 Taylor expansion 68, 204, 205
 Taylor expansion theorem 186
 Taylor theorem 204
 Theory of specific heat 180
- Thermodynamic absolute temperature 152
 Thermodynamic characteristic functions 139
 Thermodynamic weight 142, 144
 Tomlinson 6, 14, 29, 37, 46
 Tomlinson's mechanism 46
 Tomlinson's picture 13
 Tomlinson's single-pair atom model 7
 Topological description of friction 19
 Transverse wave 197
 Traveling wave 169, 170
 True contact 5, 9
- u**
 Ultrahigh vacuum STM 91
 Uncertainty principle 62, 142, 198
 Unit impulse response 248
- v**
 Valence electron 52, 61
 van der Waals force 10, 62, 63, 66, 85
 Variance 235
 Variational principle 118, 123, 125, 126
 Velocity distribution function 135
 Velocity Verlet method 69
 Verlet method 68
 Vince 5
 Virtual displacement 127
 Volume element 113
- w**
 Wave equation 169
 Wave function 164
 Wave number 161, 170
 Wave number vector 196
 Wave vector 178
 Wavelength 161
 Wear-free friction 9
 Well-defined surface 86
- z**
 Zero friction 11

