

Index

A

Action variables, 139
Adaptive mesh refinement, 334
Adiabatic, 219, 222
Airy's canal theory, 20
Amphidromic points, 104, 105
Amphidromic system, 104
Amplitudes of the tides, 49, 56
Andoyer variables, 138, 142
Anelasticity, 293
Angle variables, 139
Angular momentum, 146, 205, 210, 301–304,
306, 311, 314, 317, 323
Angular velocity, 303, 305, 311, 320
Annual retrograde nutation, 156
Antennae galaxies, 346
Apparent angular diameter, 3
Atmospheric tides, 79
Axis of angular momentum, 142
Axis of figure, 119, 159
Axis of rotation, 117, 119

B

Bay of Fundy, 16
BCRS (Barycentric Celestial Reference
System), 132, 162
Black hole, 30
Bradley, 115, 116
Bridges, 329

C

Cassini, 168, 188–190, 195
Chandler Wobble (CW), 155, 157, 159
CIO (Celestial Intermediate Origin), 132, 138
CIP (Celestial Intermediate Pole), 132, 137,
163

Circular nutations, 153
Circularization, 302, 306, 310, 312–318, 320,
321, 323
Clumpy disks, 357
Co-tidal line, 104
Compressive, 338, 339
Compressive tidal modes, 354
Conservation of mass, 68, 70
Core-accretion, 242
Core-mantle boundary (CMB), 160
Coriolis acceleration, 71
Coriolis force, 26
Corotation torque, 202, 205, 210, 220,
223–225, 247
Crossed nutation effects, 151
Cryovolcanism, 192, 195

D

Daily amplitude of the tide, 16
D'Alembert, 116
Dark galaxies, 350
Dark matter, 359
Dark-matter halo, 333, 344
Darwin's expansions, 93
De Sitter precession, 149
Departure point, 140
Differential forces, 331, 338, 339, 343
Direct planetary effects, 148, 150
Dissipation, 302, 304–309, 312, 315, 316,
320–323
Dissipation factor, 175, 179, 183, 184, 195
Disturbing potential, 143
Diurnal component, 103
Diurnal inequality, 49, 103, 107
Diurnal (or tesseral) waves, 98
Diurnal tide, 108
Doodson expansion, 92

Doodson's constant, 93, 94
 Doodson's expansion, 100
 Drift, 27
 Drift of the lunar nodes, 44
 Dynamical ellipticity, 130, 146, 148, 149, 159
 Dynamical equations, 70, 73
 Dynamical friction, 333, 343, 361
 Dynamical tide, 280–282, 285, 288, 290–294, 296, 297, 316, 320, 321, 323, 324

E

Earth Orientation Parameters (EOP), 163
 Earth Rotation Angle (ERA), 137
 Earth-Moon system, 83
 Earth-Sun system, 83
 Eccentricity, 302, 306, 310, 312–315, 320
 Ecliptic pole, 119
 Eigenmode of oscillation, 65, 75
 Eigenvalues, 338
 Electromagnetic coupling, 160
 Ellipsoid, 117
 Enceladus, 168–170, 181, 182, 184, 189–192, 195, 196
 Entropy, 210, 221, 225
 Equatorial bulge, 118
 Equilibrium, 307
 Equilibrium state, 302–304
 Equilibrium tide, 168–170, 280, 282–290, 293, 294, 297, 304, 312, 314, 316, 320–324
 Equipotential, 6, 8
 Equipotential surface, 88
 Eulerian angles, 139
 Eulerian free wobble, 157
 Euler's angles, 123
 Euler's dynamical equations, 135
 Euler's kinematical equations, 134
 Europa, 168–170, 182, 183, 188, 189
 Evection, 95
 Exoplanet, 242, 245
 Extensive, 338
 Extrasolar planets, 201, 245

F

Figure axis, 142
 Figure of equilibrium, 38, 48, 56, 61, 64, 75
 Flybys, 340, 350
 FOC (Fluid Outer Core), 156
 Fortnightly tides, 106
 Fourier series of nutation, 148
 Free Core Nutation (FCN), 155, 157, 159
 Free Inner Core Nutation (FICN), 157
 Free polar motion, 157
 Friction, 256, 279, 280, 282–284, 287, 302, 305, 306, 309–311, 323

G

Galilean satellites, 168, 175, 182–184, 188, 189, 193, 195
 Galileo, 167, 170, 181, 188, 189, 193, 195
 Gap, 232, 241, 242
 GCRS (Geocentric Celestial Reference System), 132, 137, 162
 Geodetic precession, 148, 149, 162
 Globular clusters, 354
 Gravitational attraction between the Earth and the Moon, 3
 Gravitational instability, 243
 Green's function for the Laplacian, 3

H

Hamiltonian, 132, 141
 Harbor establishment law, 35
 Harmonic expansion, 85, 93
 Harmonic series, 111
 Hipparchus, 115
 Horizon, 29
 Horizon of a black hole, 29
 Horseshoe drag, 210, 213, 216, 217, 220, 225
 Horseshoe region, 212
 Hour angle, 94
 Hydrodynamic equations, 84
 Hydrodynamics, 102
 Hydrostatic equilibrium, 181, 184, 186–191, 196

I

IAU 2000 resolutions, 132
 IAU 2006 (P03) precession, 162
 IAU 2006/2000 precession-nutation, 158, 163
 IAU 2006/2000 precession-nutation model, 163
 Impact parameter, 343
 In phase, 18, 21
 Indirect planetary effects, 148, 151
 Inner Core Boundary (ICB), 158
 Instantaneous axis of rotation, 134
 Instantaneous pole of rotation, 119
 Inverse cube, 12
 Io, 168, 169, 175, 182, 183, 188, 189, 193–195
 ITRS (International Terrestrial Reference System), 137

J

J_2 tilt effects, 152
 Jacobi polynomials, 144

K

Kennicutt-Schmidt relation, 352
 Key ratio, 14, 18

L

Lagrange's equations, 134
 Lagrangian, 135
 Laplace equation, 84, 85, 102
 Laplace method, 84
 Legendre polynomials, 9, 13, 62, 86, 143
 Libration, 213, 229
 Lindblad resonances, 206, 209
 Lindblad torque, 202, 205, 207, 209
 Local tidal force, 91
 Locked, 25
 Long periodic (or zonal) waves, 99
 Long wave approximation, 69
 Love number, 169, 173–175, 179, 185–187, 189, 192, 194
 Luni-solar precession in longitude, 121
 Lunisolar potential, 92
 Lunisolar torque, 128

M

M81, 348
 MacCullagh's formulae, 10
 Magellanic Stream, 349
 Main lunar terms, 150
 Main problem, 96
 Main solar terms, 150
 Major mergers, 343
 Mantle anelasticity, 160
 Mass of the Moon, 50, 59, 79
 Merger rate, 357
 MHB2000, 159
 MHB2000 nutation series, 161
 Milky Way, 349
 Minor mergers, 343
 Mixed tide, 108
 Modern nutation theory, 153
 Modified Newtonian Dynamics, 360
 Moments of inertia, 125
 Monoceros streams, 350

N

Neap tides, 18, 106
 Newton, 116
 Non-rigid Earth model, 153
 Non-rigid Earth nutation, 154
 Normal modes of the rotation of the Earth, 156
 Nutation coefficients, 149

O

Obliquity angle, 133
 Observations of tides, 32, 54, 78
 Ocean tides effects, 160
 Orbit, 256, 277–280, 285, 291, 297

Orbital angular momentum, 25, 27
 Out of phase, 18, 21

P

Peculiar galaxies, 329
 Periodic external forcing, 18
 Physical explanation
 abysses, 35
 currents, 36
 Earth's vortex, 34, 42
 gravitational attraction of the Moon, 38, 43
 humid nature of the Moon, 36, 38
 moonlight, 34–36
 role of the Sun, 37, 38
 rotation and revolution of the Earth, 39
 virtue of the Moon, 35–37
 Planetary migration, 201
 Planetary systems, 202, 246
 Planetary tilt effect, 152
 Potential (concept of), 68
 Precession angle, 133
 Precession-nutation, 132, 142
 Precession-nutation motion, 120
 Precession-nutation theories, 147
 Precessional motion, 119
 Preliminary Reference Earth Model (PREM), 160
 Primary, 12
 Principal nutation, 121
 Prograde, 342
 Prograde Free Core Nutation (PFCN), 157
 Proper rotation, 134
 Protoplanetary disc, 204
 Ptolemy, 115

Q

Quadrature, 18
 Quality factor, 309, 310

R

Radau-Darwin approximation, 186, 189, 190
 Ram pressure, 347
 Ratio of the lunar tide to the solar tide, 50, 58, 79
 Rayleigh wave, 22
 Reduced mass, 25
 Representative tidal force, 13, 24, 30
 Resonances, 320–324
 Retrograde, 342
 Retrograde Free Core Nutation (RFCN), 157, 163
 Revival, 106

- Rigid Earth, 132
 Rigid Earth Model, 132, 147
 Rigid Earth nutation, 156
 Rigid Earth precession-nutation, 148
 Ring, 344
 Roche limit, 22, 30
 Rotation vector, 128
 Rotational motion, 127
- S**
- Sagittarius, 350
 Sagittarius stream, 360
 Saturation, 222, 226
 Saturnian satellites, 168–170, 174, 181, 182,
 184, 188–192, 194–196
 Schwarzschild radius, 29, 30
 Second-order potential J_3 , 152
 Secondary, 12
 Sectorial, 91
 Self-gravity, 56, 65, 73
 Semi-annual nutational motion, 120
 Semi-diurnal component, 103
 Semi-diurnal group, 111
 Semi-diurnal (or sectorial) waves, 97
 Semi-diurnal tide, 84, 107
 Shells, 344
 Shocks, 341
 SIC (Solid Inner Core), 156, 158
 Smooth particle hydrodynamics, 333
 Solar torque, 125
 Spherical harmonics, 71, 73
 Spin angular momentum, 25, 27
 Spin-orbit resonance, 170, 180, 181, 185
 Spring tides, 18, 106
 Star formation rate, 352
 Star-formation efficiency, 352
 Stellar streams, 350
 Sticky-particle, 334
 Super Star Clusters, 354
 Surface brightness, 348
 Synchronism, 304, 305, 310
 Synchronization, 305, 306, 313, 314, 317,
 320–322
 Syzygy, 18
- T**
- “Tadpoles” systems, 357
 Tails, 329
 Tectonic patterns, 181, 192, 196
 Tesseral, 90
 Three body problem, 96
- Three species of oscillation, 76
 Tidal bulges, 304, 305, 309
 Tidal component, 104
 Tidal curves, 105, 107, 109
 Tidal deformation, 87
 Tidal dissipation, 25, 26
 Tidal Dwarf Galaxies, 354
 Tidal force, 13, 14, 22, 25, 27, 29, 45, 60, 80,
 83, 88
 Tidal frequency, 255, 265, 266, 269, 279, 282,
 283, 285–288, 290–294, 297, 298, 305,
 309–311, 316, 317, 320–322, 324
 Tidal friction, 283
 Tidal generating force, 84
 Tidal generating potential, 84
 Tidal heating, 27, 182, 183, 192, 194
 Tidal locking, 25
 Tidal potentials, 13, 14, 72, 78, 81, 83, 85, 89,
 92–94, 170–174, 176, 178, 181, 185,
 186, 190–192, 256, 260–262, 266, 274,
 279–288, 293
 Tidal ranges, 106, 107
 Tidal spectrum, 97, 110
 Tidal tensor, 337
 Tidal torque, 123, 304–306, 309, 310, 313,
 321, 323, 324
 Tidal types, 107
 Tidal waves, 100
 Tide, 256, 278, 280–282, 285, 286, 288, 293,
 297
 Tide generating potential (TGP), 155
 Tide potential, 88
 Tide tables, 58
 Timocharis, 115
 Titan, 168–170, 174, 188–190, 195
 Torque equations, 156
 Torques, 342
 Tree-code, 333
 Triaxiality of the Earth, 148, 152
 Tunnel, 8
 Turbulence, 210, 230
 Turbulent friction, 282, 284, 285
 Type I migration, 205, 209, 230, 246, 247
 Type II migration, 238, 241
 Type III migration, 236–238, 242
- V**
- Variation, 95
 VirgoHI21, 350
 VLBI, 132, 163
 VLBI (Very Long Baseline Interferometry),
 163
 Vortensity, 216, 217, 222, 225, 229

Voyager, 167, 181, 193–196

Waste, 106

W

Wake, 205, 209, 232

Warped disks, 344

Z

Zonal potential, 89