Symbols Used in "Solar System Dynamics"

Several people have suggested that it might be a good idea to include a list of symbols used in the book together with their meanings. Here we provide such a list. While writing the book we did try to develop a consistent set of notation and avoid instances of the same symbol being used to denote different quantities, at least in the same chapter. In some cases this was unavoidable. However, in most cases it should be obvious from the context (or the text!) which meaning is implied.

The list we give below is not complete because although we have tried to include all symbols that are used more than once, in some cases the use is fleeting and the symbol used is not particularly important.

Symbol	Meaning
$\dot{}$	first derivative with respect to time
$\ddot{}$	second derivative with respect to time
$\hat{}$	unit vector
$\tilde{}$	vector expressed in the Jacobian coordinate system
$\cdot$	scalar product of two vectors
$\times$	vector product of two vectors
∇	the vector differential operator
$'$	denotes quantity associated with outer body in three-body problem
$\vert\ \vert$	absolute value
$\langle\ \rangle$	mean value
A	area
A	radius
A	natural pericentre precession rate in secular theory
A	amplitude of ring wave
$\mathcal{A}$,$\mathcal{B}$,$\mathcal{C}$	moments of inertia about the principal axes
$\mathbf{a}$	acceleration
a	semi-major axis of an ellipse
a,b,c	semi-axes of triaxial ellipsoid
α	a/a', the ratio of semi-major axes of inner and outer bodies in three-body problem
α	$(\mu_2/3\mu_1)^{1/3}$ in the restrcited three-body problem
α	scattering angle
B	radius
B	natural nodal regression rate in secular theory
b	semi-minor axis of an ellipse
$b_s^{(j)}(\alpha)$	Laplace coefficient
β	ratio of force due to radiation pressure to the gravitational force
β_i	phase associated with mode i in e–ϖ secular solution
C	energy constant in two-body problem
C	radius
$C_{\rm H}$	Jacobi constant in Hill's problem
$C_{\rm J}$	Jacobi constant in restricted three-body problem
$\mathcal{C}_{\rm r}$	$(m'/m_{\rm c})n\alpha f_{\rm d}$, magnitude of perturbation from resonant term
$\mathcal{C}_{\rm s}$	$(m'/m_{\rm c})n\alpha f_{\rm d}$, magnitude of perturbation from secular term
$\bar{\mathcal{C}}$	moment of inertia factor
c	speed of light
χ	root mean square value
D	differential operator $\mathrm{d}/\mathrm{d}\alpha$
D	diameter
$\mathcal{D}$,$\mathcal{E}$,$\mathcal{F}$	products of inertia
d	distance

d	ordinary derivative
Δ	change in a quantity (e.g. Δa)
Δ	separation
Δ_{H}	$(\mu_2/3)^{1/3}$, radius of Hill's sphere
δ	small change in a quantity (e.g. δr)
δ	measure of proximity to resonance used in modelling of resonance encounter
$\bar{\delta}$	measure of proximity to resonance with $\bar{\delta} = 0$ corresponding to exact resonance
$\delta_{2\pi}(t)$	2π-perioidc Dirac delta function
det	determinant of a matrix
∂	partial derivative
E	eccentric anomaly
E	energy
E^*	total orbital energy in the two-body problem
$\mathbf{e}$	eccentricity vector
e	eccentricity
e	base of the natural logarithms, numerical value 2.71828182846...
e_{ji}	component of the eigenvector for body j and mode i in e–ϖ secular solution
$\dot{\eta}$	satellite rotation rate in rotating frame
ϵ	mean longitude at epoch
ϵ	angle between axis of symmetry and planet-satellite line in tidal theory
ϵ	coefficient of restitution
ϵ	obliquity
ε	relative difference in semi-major axis used in encounter maps
$\mathbf{F}$	force vector
F	magnitude of a force
$F_{lmp}(I)$	inclination function in disturbing function
f	true anomaly
f	flattening or oblateness
f_i	eigenfrequency associated with mode i in I–Ω secular solution
f_{d}	terms in α due to direct part of disturbing function for particular resonance
$\mathcal{G}$	universal gravitational constant
g	eccentricity gradient
g_i	eigenfrequency associated with mode i in e–ϖ secular solution
$\mathbf{\Gamma}$	torque
γ	parameter used to define Jacobi constant for tadpole orbit
γ	density
γ	the angle $\theta - pM$ (where p is a rational) in spin-orbit coupling
γ_i	phase associated with mode i in I–Ω secular solution
γ	maximum Lyapounov characteristic exponent
$\mathcal{H}$	Hamiltonian
H_{K}	$\sqrt{1-e^2}\cos I$, the Kozai constant
$H(p,e)$	functions of eccentricity in the averaged spin-orbit resonance problem
$\mathbf{h}$	angular momentum vector per unit mass
h	magnitude of angular momentum per unit mass
h	mean amplitude of ocean tide
h,k	the quantities $e\sin\varpi$,$e\cos\varpi$ used in secular theory
h_2	Love number
$\mathbf{I}$	unit diagonal matrix
I	inclination
I	moment of inertia
I,θ	action-angle variables
I_{ji}	component of the eigenvector for body j and mode i in I–Ω secular solution
i	$\sqrt{-1}$

J	action of an orbit
J_n	n^{th} harmonic coefficient of gravity field
J_s	Bessel function of the first kind
K	complete elliptical integral of the first kind
K_0,K_1	modified Bessel function of the second kind
k	Gaussian gravitational constant
k_2	Love number
κ	radial or epicyclic frequency
L	total (i.e. orbital and rotational) angular momentum
L	solar luminosity
L^*	total orbital angular momentum in two-body problem
L_1,L_2,L_3	collinear Lagrangian equilibrium points in restricted three-body problem
L_4	leading triangular Lagrangian equilibrium point in restricted three-body problem
L_5	trailing triangular Lagrangian equilibrium point in restricted three-body problem
L,G,H	Delaunay momenta
ℓ	wavelength of ring wave
l,g,h	Delaunay coordinates
l,m,n	direction cosines
Λ,Γ,Z	Poincaré momenta
λ,γ,z	Poincaré coordinates
λ	mean longitude
λ	eigenvalue of a matrix
M	mean anomaly
m	mass
m_{c}	mass of central object
μ	$\mathcal{G}(m_1 + m_2)$ in the two-body problem
μ	cosine of the colatitude
μ	rigidity in tidal theory
$\tilde{\mu}$	effective rigidity in tidal theory
μ^*	reduced mass $m_1 m_2/(m_1 + m_2)$ in the two-body problem
$\bar{\mu}$	scaled mass $m_2/(m_1 + m_2)$ in the restricted three-body problem
N_{s}	magnitude of tidal torque acting on satellite
$\mathcal{N}$	n'/n, ratio of mean motions
n	mean motion
ν	vertical frequency
ν	effective kinematic viscosity
ν_i	secular eigenfrequency
O	origin
$\mathcal{O}$	terms of order
Ω	longitude of ascending node
Ω	rate of rotation
Ω_{p}	pattern speed
ω	argument of pericentre
ω	rotation frequency
ϖ	longitude of pericentre
P	probability
P	pressure in tidal theory
P	orbital period
P_l	Legendre polynomial of degree l
$\mathcal{P}_l$	Legendre polynomial of degree l
$\mathbf{p}$	linear momentum vector
$\mathbf{p}$, $\mathbf{q}$, $\mathbf{r}$	position vectors (x, y, z), (x', y', z') and (x'', y'', z'')
p	semilatus rectum of an ellipse

p_i,q_i	momenta and coordinates in Hamiltonian system
p,q	the quantities $I \sin\Omega$,$I \cos\Omega$ used in secular theory
p,q	integers used to denote a resonance such as $p+q:p$
ϕ	longitude in tidal theory
φ	separation angle
π	constant with numerical value $3.1415926535\ldots$
ψ	angular measure
ψ	the angle $\theta - f$ in spin-orbit coupling
Q	tidal dissipation function
$Q_{\rm PR}$	coefficient used in determining magnitude of Poynting-Robertson effect
q	ratio of centrifugal acceleration at equator to gravitational acceleration
$\mathbf{R}$	position vector
R	radial distance
$\bar{R}$,$\bar{T}$,$\bar{N}$	radial, tangential and normal components of perturbing force
$\mathcal{R}$	disturbing function
$\mathcal{R}_{\rm D}$	direct part of disturbing function
$\mathcal{R}_{\rm E}$	indirect part of disturbing function for external perturber
$\mathcal{R}_{\rm I}$	indirect part of disturbing function for internal perturber
$\mathbf{r}$	position vector
r	radial distance or magnitude of position vector
ρ	density
S	sheer stress
s	$\sin\frac{1}{2}I$ in disturbing function expansion
σ	density
σ	surface density of ring
T	orbital period
$\mathcal{T}$	tensile strength
t	time
τ	time of pericentre passage
τ	timescale
τ	optical depth
θ	general angular coordinate
θ	true longitude
θ	colatitude in tidal theory
θ_i,Θ_i	general coordinates and momenta in Hamiltonian approach to resonance
U	pseudo-potential in restricted three-body problem
U	relative angular velocity
$\mathbf{V}$	velocity vector
V	magnitude of velocity vector
V	potential
$\mathcal{V}$	volume
$\mathbf{v}$	velocity vector
v	magnitude of velocity vector
W	radial width
X,Y,Z	Cartesian components of position vector
$X_c^{a,b}(e)$	Hansen coefficient
$X_{c,d}^{a,b}$	Newcomb operator
x,y,z	Cartesian components of position vector
ξ,η,ζ	Cartesian components of position vector
z	$e\exp(\mathrm{i}\varpi)$, complex eccentricity used in encounter maps
ζ	parameter used to define Jacobi constant for horseshoe orbit
ζ	measure of the amplitude of an equlibrium tide

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