APPENDIX B

NOTATION

It was not practicable to employ a completely uniform system of notations throughout this Volume. The reasons for this were partly historical—certain conventions had developed in the Hipparcos literature and documentation and could not easily be disregarded. There were also practical considerations: strict observance of a general system, if at all possible, would often lead to a profusion of suffixes and mathematical accents obscuring the particular relationships relevant in a given context. Nevertheless, an attempt was made to simplify the cross-referencing of the various chapters by using, as far as practicable, similar notations for quantities with a similar meaning. This Appendix lists a number of notations that had a more than 'local' usage, or at least a meaning outside the specific context in which they were introduced.

Throughout this Volume, the prime symbol ($'$) associated with matrices and vectors denotes transposition. In particular, for vectors, it denotes scalar multiplication: thus $\mathbf{a}'\mathbf{b}$ is equivalent to the scalar product of $\mathbf{a}$ and $\mathbf{b}$. The angular brackets, when applied to a vector, denote normalisation of the vector length: thus $\langle\mathbf{a}\rangle = \mathbf{a}|\mathbf{a}|^{-1}$ is a unit vector in the direction of $\mathbf{a}$. For scalar quantities the angular brackets denote averaging. The asterisk has a special meaning in entities like $\mu_{\alpha*}$ and $\sigma_{\lambda*}$, where it signifies an implicit cosine factor, i.e. $\mu_{\alpha*} = \mu_\alpha \cos\delta$ and $\sigma_{\lambda*} = \sigma_\lambda \cos\beta$. Suffixes F, N and H are often employed to distinguish quantities related to FAST, NDAC, and the Hipparcos Catalogue. Similarly p and f may denote the preceding and following fields of view, while obs and calc usually refer to observed (derived from data) and calculated (theoretical or fitted) quantities.

A	the astronomical unit (Table 12.1)
A_k	in double-star treatment: same as I_k
$a_1 \ldots a_5$	(1) the astrometric parameters as components of the vector **a** (2) harmonic coefficients of the main detector signal (FAST)
a_{ij}^{p}, a_{ij}^{f}	instrument parameters for field-to-grid transformation in preceding and following field (FAST)
a	(1) vector of the (five) astrometric parameters of a star, α, δ, π, $\mu_{\alpha *}$, μ_δ, or their differential corrections $\Delta\alpha *$, etc. (2) vector of signal parameters $a_1 \ldots a_5$ (FAST)
α	(1) right ascension (2) solar phase angle for solar system object
α_0	(1) barycentric right ascension at catalogue epoch T_0 (2) geocentric right ascension of the reference point for an observation of a solar system object
α_j	in double star treatment (FAST): spatial frequency of the grid in the direction of increasing right ascension during transit j (cf. f_x, f_y, f_p)
α_{R}	right ascension of reference great circle pole
B	magnitude in the (Johnson) UBV photometric system
$B-V$	colour index in the (Johnson) UBV photometric system, also written $(B-V)_{\mathrm{J}}$
B_T	Tycho magnitude in the 'blue' spectral band of the star mapper
b	galactic latitude
$b_1 \ldots b_5$	harmonic coefficients of the main detector signal
b_{ij}^{p}, a_{ij}^{f}	chromatic instrument parameters for field-to-grid transformation in preceding and following field (FAST)
b	(1) general barycentric position (2) vector of signal parameters $b_1 \ldots b_5$
$\mathbf{b}_{\mathrm{E}}$	barycentric position of the Earth
$\mathbf{b}_{\mathrm{S}}$	barycentric position of the Sun
β	ecliptic latitude
β_{R}	ecliptic latitude of reference great circle pole
$\beta_1 \ldots \beta_5$	parameters of the main detector five-parameter model (NDAC)
β_j	in double star treatment (FAST): spatial frequency of the grid in the direction of increasing declination during transit j (cf. f_x, f_y f_p)
$\boldsymbol{\beta}$	vector of the signal parameters $\beta_1 \ldots \beta_5$ (NDAC)
C	(centred) colour index, e.g. $(V-I)-0.5$
C_j, S_j	coefficients of the 6th harmonic of abscissa error for reference great circle j
c	speed of light (Table 12.1)
c_j	abscissa zero point correction for reference great circle j
c_{ij}	chromatic instrument parameters for field-to-grid transformation (NDAC)
D	in double star treatment: a measure of the 'difficulty' of resolving a double star
$d_1 \ldots d_4$	relative positions of the four slits in a star mapper slit group
d_{ij}	chromatic instrument parameters for field-to-grid transformation (NDAC)
d	vector of instrument parameters in great-circle reduction
δ	declination
δ_0	(1) barycentric declination at catalogue epoch T_0 (2) geocentric declination of the reference point for an observation of a solar system object
δ_{R}	declination of reference great circle pole
δG	medium-scale distortion in the G coordinate on the main grid
δg	small-scale distortion in the G coordinate on the main grid
ΔG	(1) (large-scale) distortion in the G coordinate on main grid or star mapper (2) in great-circle reductions: observed minus calculated grid coordinate

	(3) in double-star treatment: component separation projected on grid coordinate
ΔH	distortion in the H coordinate on the main grid
ΔHp	(1) magnitude difference in a double star (also written Δm)
	(2) difference $Hp_{\rm ac} - Hp_{\rm dc}$, indicator of duplicity or an extended object
Δm	magnitude difference in a double star (also written ΔHp)
$\Delta\gamma_0$, $\Delta\gamma_1$	instrument parameters representing corrections to the nominal basic angle (FAST)
$\Delta\phi$	difference in modulation phase between components of double star
E	residual sum of squares in great-circle reduction
$\mathcal{E}$	extragalactic reference frame, [$\mathbf{x}_{\rm E}$ $\mathbf{y}_{\rm E}$ $\mathbf{z}_{\rm E}$]
$\mathbf{e}$	noise (error) vector in great-circle reduction
ϵ	(1) obliquity of ecliptic (Table 12.1)
	(2) 'cosmic error' in stochastic solution
	(3) *a priori* correction of relative intensity in photometric calibration (FAST)
	(4) general noise term
ε_{0x}, ε_{0y}, ε_{0z}	equatorial components of the orientation vector $\boldsymbol{\varepsilon}$ at the reference epoch T_0
$\boldsymbol{\varepsilon}$	orientation difference between two reference frames, in particular the provisional Hipparcos reference frame with respect to the extragalactic reference frame
η	(1) longitudinal field angle, see η, ζ
	(2) local rectangular coordinate on sky, ~ $\Delta\delta$
	(3) general noise term
η, ζ	field angles along and normal to the nominal scan direction
η_0	reference position for star mapper slit group (FAST)
F	(1) statistical index indicating modulation of the main detector signal
	(2) statistical index for great-circle reductions
F_{35}	statistical index indicating non-single star (FAST)
f	field of view index (±1 for preceding/following field)
f_x, f_y f_p	derivatives of modulation phase with respect to $\alpha*$, δ, π
g	star mapper slit-group index (0, ±1 for vertical, upper/lower inclined slit groups)
g_0	reference modulation phase on main grid
g_1, g_2	modulation phases on main grid of first and second harmonic
g_{ij}	instrument parameters for field-to-grid transformation (NDAC)
$g_{\alpha*}$, g_δ	acceleration components in α and δ of binary photocentre from orbital motion
$\mathbf{g}$	(1) general geocentric vector
	(2) vector of gyro readings (NDAC)
$\mathbf{g}_0$	geocentric position of Hipparcos
G	grid coordinate on the main grid
GE	geocentric gravitational constant (Table 12.1)
GS	heliocentric gravitational constant (Table 12.1)
Γ	generic global parameter in sphere solution
$\boldsymbol{\Gamma}$	vector of global parameters in sphere solution
γ	(1) basic angle of the Hipparcos instrument ($\simeq 58^\circ\,00'\,30''$)
	(2) parametrised post-Newtonian (PPN) parameter of the heliocentric metric
	(3) in double-star treatment: local position angle of scan
H	hypothesis for statistical testing
H	coordinate perpendicular to the nominal scan direction
$\mathcal{H}$	Hipparcos reference frame, [$\mathbf{x}_{\rm H}$ $\mathbf{y}_{\rm H}$ $\mathbf{z}_{\rm H}$]
Hp	magnitude in the Hipparcos main detector photometric system
$Hp_{\rm ac}$, $Hp_{\rm dc}$	Hp magnitudes derived from the modulated (AC) and mean (DC) detector signal
$Hp_{\rm max}$	Hp magnitudes of variable star at maximum luminosity
$Hp_{\rm min}$	Hp magnitudes of variable star at minimum luminosity (note: $Hp_{\rm min} \geq Hp_{\rm max}$)
h_{ij}	instrument parameters for field-to-grid transformation (NDAC)
$\mathbf{h}_0$	heliocentric position of the Hipparcos satellite

$\mathbf{h}_{\rm E}$	heliocentric position of the Earth
I	magnitude in Cousins' system; see $V-I$
I_b	background count rate (intensity) of the main detector
$I_{b,c}$	background count rate (intensity) of the star mapper in channel $c = B_T$ or V_T
I_k	expected count (intensity) for sample k of the main detector
$I_{k,c}$	expected count (intensity) for sample k of the star mapper in channel $c = B_T$ or V_T
I_s	mean stellar count rate (intensity) of the main detector
$I_{s,c}$	peak stellar count rate (intensity) of the star mapper in channel $c = B_T$ or V_T
$I_{xx} \ldots I_{zz}$	elements of the inertia tensor $\mathbf{I}$ in body coordinates
i_G	longitudinal scan field index (main grid)
i_H	transverse scan field index (main grid)
$\mathbf{I}$	inertia tensor of the Hipparcos satellite
$\imath$	imaginary unit $= \sqrt{-1}$
κ	(1) condition number of least-squares equations
	(2) correction factor for photometric standard errors of bright stars
l	galactic longitude
λ	ecliptic longitude
$\lambda_{\rm R}$	ecliptic longitude of reference great circle pole
$\lambda_\odot$	ecliptic longitude of the Sun
M	in double-star treatment: same as M_1
M_1, M_2	modulation coefficients for the first and second harmonics of the main detector signal
$\mu_{\alpha*}$	proper motion in right ascension, including $\cos\delta$ factor
μ_β	proper motion in ecliptic latitude
μ_δ	proper motion in declination
$\mu_{\lambda*}$	proper motion in ecliptic longitude, including $\cos\beta$ factor
N	in double-star treatment: same as M_2
$N(0,1)$	normal (Gaussian) distribution with mean value zero and unit variance
N_k	photon counts for sample k of the main detector
$N_{k,c}$	photon counts for sample k of the star mapper in channel $c = B_T$ or V_T
$\mathbf{N}$	vector sum of external torques acting on the Hipparcos satellite
$\mathcal{N}_i$	binned photon counts of the main detector
ν	in statistical tests: the number of degrees of freedom
ν, ξ, Ω	heliotropic angles describing the scanning law and instrument attitude (NDAC)
o	'orbit number', sequential numbering of perigee passages and data sets
ω	(1) scan velocity of the grid on the sky ($\simeq 168.75$ arcsec/s)
	(2) angular frequency of main detector signal modulation ($\simeq 878$ rad/s)
$\omega(x)$	influence function for robust estimation
ω_x, ω_y, ω_z	(1) components of instrument spin vector $\boldsymbol{\omega}$ in body coordinates
	(2) components of reference frame spin vector in equatorial coordinates
$\boldsymbol{\omega}$	(1) inertial spin (angular velocity) of instrument
	(2) spin difference between two reference frames, in particular the spin of the provisional Hipparcos reference frame with respect to the extragalactic reference frame
Ω	heliotropic spin phase (NDAC); see ν, ξ, Ω
P	period of photometric variability
$\mathbf{P}$	unit vector towards the abscissa origin on the reference great circle
p_k	grid modulation phase for sample k relative to the mid-frame time
$\mathbf{p}$	unit vector in the local direction $+\alpha$, see [**p q r**]
[**p q r**]	normal triad at **r** relative to the equatorial or ecliptic frame
π	trigonometric parallax
$\Phi(b)$	normalised galactic luminosity profile (FAST)
ϕ	(1) attitude angle; see ψ, θ, ϕ
	(2) modulation phase of first harmonic of main detector signal (also written g_1 and a_3)

ψ	(1) attitude angle; see ψ, θ, ϕ
	(2) modulation phase of second harmonic of main detector signal (also written a_5)
ψ, θ, ϕ	attitude angles for instrument in reference great-circle frame
$\Psi(\varrho)$	attenuation profile of the instantaneous field of view
$\mathbf{q}$	unit vector in the local direction $+\delta$, see [**p q r**]
$\mathbf{Q}$	unit vector towards the point $v = 90^\circ$ on the reference great circle
$\mathbf{Q}_y$	in great-circle reductions: variance-covariance matrix of the vector $\mathbf{y}$
r	(1) ordinate of a general direction in the reference great-circle frame
	(2) in double-star treatment: intensity ratio of components
$r_1 \ldots r_3$	parameters of the main detector three-parameter model (NDAC)
$\mathbf{r}$	general vector or direction; in particular the barycentric coordinate direction to an object, see [**p q r**]
R	ratio of modulation coefficients, M_2/M_1 or N/M
R_q	single-slit response function of the star mapper
$\mathcal{R}$	reference great circle triad [**P Q R**]
$\mathbf{R}$	unit vector defining the pole of the reference great circle
$\mathbf{R}_i$	3×3 matrix describing a rotation around axis i
ρ	(1) general statistical correlation coefficient
	(2) angular diameter of solar system object
$\rho^{\delta}_{\alpha *}$ (etc.)	correlation coefficients among the astrometric parameters of a star
ϱ	angular separation of stars, in particular in double stars
S_0	nominal scale of the field-to-grid transformation (= 170749.01 slits/rad)
S_j	see C_j, S_j
s	grid step ($\simeq$ 1.2074 arcsec per slit interval)
$\mathbf{s}$	general satellitocentric vector
σ_x	(estimated) standard error of the estimated value of the generic variable x
t	general time variable, in particular relative to a given reference epoch
T	(1) astronomical time, in particular Terrestrial Time (TT)
	(2) statistical index indicating failure of five-parameter model of main detector signal
T_0	reference epoch of the Hipparcos Catalogue, T_0 = J1991.25(TT)
T_1	main detector sampling interval (1/1200 s)
T_2	main detector repositioning period ($8T_1$ = 1/150 s)
T_3	observing schedule interlacing period ($20T_2$ = 2/15 s)
T_4	observation frame period ($16T_3 = 32/15 = 2.133\ldots$ s)
τ	star mapper transit time
$\Theta_1 \ldots \Theta_3$	Tait-Bryan angles used in real-time attitude determination
θ	(1) position angle of secondary component in double star
	(2) position angle of scan across a solar system object
	(3) attitude angle; see ψ, θ, ϕ
θ_p, θ_f	transverse attitude components in preceding and following field of view (NDAC)
$\boldsymbol{\theta}$	vector for the orientation error of the reference great-circle frame $\mathcal{R}$
U	magnitude in the (Johnson) UBV photometric system
$U(x)$	complex visibility of an extended object in the scan direction
u	unit weight error (u^2 = unit weight variance)
$\bar{\mathbf{u}}$	isotropic coordinate direction to an object
$\hat{\mathbf{u}}$	natural direction to an object
V	magnitude in the (Johnson) UBV photometric system
$V - I$	colour index in Cousins' system; also written $(V - I)_{\mathrm{C}}$
V_{R}	radial velocity
V_T	Tycho magnitude in the 'visual' spectral band of the star mapper
v	abscissa of a general direction in the reference great-circle frame
v_q	local scan velocity across a star mapper slit group

$v_\odot$	abscissa (in $\mathcal{R}$) of the Sun
$\mathbf{V}$	barycentric velocity of the Hipparcos satellite
w	relative weight of the second harmonic of the main detector signal (FAST)
w, z	field coordinates along and normal to the nominal scan direction
$\bar{w}$, $\bar{z}$	normalised field coordinates for field-to-grid transformation (NDAC)
$\mathbf{w}$	unit vector in scanning direction
χ^2	general goodness-of-fit statistic
X, Y	relative Cartesian coordinates of secondary component in double star
x, y	field angles (FAST)
$\bar{x}$, $\bar{y}$	normalised field angles for field-to-grid transformation (FAST)
x, y, z	body coordinates fixed in Hipparcos satellite, along axes $\mathbf{x}$, $\mathbf{y}$, $\mathbf{z}$
$\mathbf{x}$	in great-circle reductions: vector of unknowns
$\mathbf{x}$, $\mathbf{y}$, $\mathbf{z}$	(1) orthogonal axes of the equatorial reference frame (2) orthogonal axes fixed in instrument or satellite
$\mathbf{x}_\mathrm{E}$ $\mathbf{y}_\mathrm{E}$ $\mathbf{z}_\mathrm{E}$	orthogonal axes of the extragalactic reference frame $\mathcal{E}$
$\mathbf{x}_\mathrm{H}$ $\mathbf{y}_\mathrm{H}$ $\mathbf{z}_\mathrm{H}$	orthogonal axes of the Hipparcos reference frame $\mathcal{H}$
ξ	(1) local rectangular coordinate on sky, $\sim \Delta\alpha \cos\delta$ (2) revolving angle ($\sim 43^\circ$); see ν, ξ, Ω
Y	see X, Y
y	see x, y
$\mathbf{y}$	(1) axis in equatorial or instrument frame; see $\mathbf{x}$, $\mathbf{y}$, $\mathbf{z}$
$\mathbf{y}$	(2) in great-circle reductions: vector of observations
$\mathcal{Z}$	test statistic for the distribution of epoch photometry
z	transverse field coordinate; see w, z
$\mathbf{z}$	direction of telescope nominal spin axis; see also $\mathbf{x}$, $\mathbf{y}$, $\mathbf{z}$
ζ	(1) transverse field angle; see η, ζ (2) radial velocity divided by distance, $\zeta = V_\mathrm{R}\pi/A$