CHAPTER 4 NUMERICAL STANDARDS

Table 4.1 listing numerical standards is organized into 5 columns: item, value, uncertainty, reference, comment. All values are given in terms of SI units (*Le Système International d'Unités (SI)*, 1991). The SI second, the basic unit of the TT time scale, is specifically assumed. If the TDB time scale is used, new units of time, t_{TDB}, and length, ℓ_{TDB}, are implicitly defined by the expressions (Seidelmann and Fukushima, 1992)

$$t_{TDB} = t/(1 - L_B), \text{and}$$
$$\ell_{TDB} = \ell/(1 - L_B),$$

where t and ℓ are the SI units and L_B is a derived constant given in Table 4.1. Chapter 11 provides further details on the transformations between time scales.

The 1976 IAU System of Astronomical Constants (*Astronomical Almanac for the Year 1984*) is adopted for all astronomical constants which do not appear in Table 4.1.

References

Astronomical Almanac for the Year 1984, U.S. Government Printing Office, Washington, DC.

[1] Burša, M., 1995, Report of the I.A.G. Special Commission SC3, Fundamental Constants, XXI, I.A.G. General Assembly.

[2] Cohen, E. R. and Taylor, B. N., 1973, *J. Phys. Chem. Ref. Data*, **2**, p. 663.

[3] Cohen, E. R. and Taylor, B. N., 1986, "The 1986 Adjustment of the Fundamental Physical Constants," CODATA Bulletin, Bureau International des Poids et Mesures.

[4] Fukushima, T., 1994, "Time Ephemeris," *Astron. Astrophys.*, **294**, pp. 895–906.

[5] Herring, T., 1996, "KSV-1 Precession/Nutation," personal communication.

Le Système International d'Unités (SI), 1991, Bureau International des Poids et Mesures, Sèvres, France.

Seidelmann, P. K. and Fukushima, T., 1992, "Why New Time Scales?" *Astron. Astrophys.*, **265**, pp. 833–838.

[6] Standish, E. M., 1994, Report of the IAU WGAS Sub-group on Numerical Standards.

[7] Standish, E. M., Newhall, X X, Williams, J. G., and Follkner, W. F., 1995 "JPL Planetary and Lunar Ephemerides, DE403/LE403," JPL IOM 314.10–127 to be submitted to *Astron. Astrophys.*

Table 4.1. IERS Numerical Standards.

ITEM	VALUE	UNCERTAINTY	REF.	COMMENTS
c	$299792458 ms^{-1}$	Defining	[2]	Speed of light
L_B	$1.550519748 \times 10^{-8}$	4×10^{-17}	[4]	Average value of d(TCB)/d(TT)-1
L_C	$1.4808268457 \times 10^{-8}$	1×10^{-17}	[4]	Average value of d(TCB)/d(TCG)-1
L_G	$6.9692903 \times 10^{-10}$	1×10^{-17}	[4]	Average value of d(TCG)/d(TT)-1
W_0	$62636856.85 m^2 s^{-2}$	$1.0 m^2 s^{-2}$	[1]	Potential of the geoid
τ_A	$499.0047838061 s$	$0.00000002 s$	[7]	Astronomical unit in seconds
$c\tau_A$	$149597870691 m$	$30 m$	[7]	Astronomical unit in meters
P	$5029''.0965/century$	$0''.3/century$	[5]	General precession in longitude at J2000.0
ϵ_0	$84381''.412$	$0''.005$	[7]	Obliquity of the ecliptic at J2000.0
a_E	$6378136.49 m$	$0.10 m$	[1]	Equatorial radius of the Earth
$1/f$	298.25645	0.00001	[1]	Flattening factor of the Earth
$J_{2\oplus}$	1.0826359×10^{-3}	1.0×10^{-10}	[1]	Dynamical form-factor of the Earth
G	$6.67259 \times 10^{-11} m^3 kg^{-1} s^{-2}$	$8.54 \times 10^{-15} m^3 kg^{-1} s^{-2}$	[3]	Constant of gravitation
$GM_\oplus$	$3.986004418 \times 10^{14} m^3 s^{-2}$	$8 \times 10^5 m^3 s^{-2}$	[1]	Geocentric gravitational constant
μ	0.0123000345	5×10^{-10}	[7]	Moon-Earth mass ratio
ω	$7.292115 \times 10^{-5} rad s^{-1}$	variable	[1]	Nominal mean angular velocity of the Earth
$GM_\odot$	$1.327124 \times 10^{20} m^3 s^{-2}$		[6]	Heliocentric gravitational constant
g_e	$9.780327 ms^{-2}$	$1 \times 10^{-6} ms^{-2}$	[1]	Mean equatorial gravity
$R_0 = GM_\oplus/W_0$	$6363672.461 m$	$0.1 m$	[1]	Geopotential scale factor

Some geodetic parameters are affected by tidal variations (see Chapter 3). The values given in Table 4.1 are in the zero-tide system so that they correspond to a realistic time-averaged crust. This is done to be consistent with XVIII IAG General Assembly Resolution 16.