INTRODUCTION

This document is intended to define the standard reference system to be used by the International Earth Rotation Service (IERS). It is based largely on the Project MERIT Standards (1983) with revisions being made to reflect improvements in models or constants since the Project MERIT Standards were published. If contributors to IERS do not fully comply with these guidelines, they will carefully identify the exceptions. In these cases, the institution is obliged to provide an assessment of the effects of the departures from the standards so that its results can be referred to the IERS Reference System. In the case of models, contributors may use models equivalent to those specified herein. Different observing methods have varying sensitivity to the adopted standards and reference systems. No attempt has been made in this document to assess the sensitivity of each technique to the adopted reference systems and standards.

The recommended system of astronomical constants corresponds closely to those of the Merit Standards (Melbourne, et al., 1983) with the exception of the following changes: the radius of the Earth; the dynamical form factor of the Earth; the gravitational constants G and $GM_{\oplus}$; the obliquity of the ecliptic ϵ_0; and the masses of the Earth-Moon system and of Saturn. The units of length, mass, and time are in the International System of Units (SI) as expressed by the meter (m), kilogram (kg) and second (s). The astronomical unit of time is the day containing 86400 SI seconds. The Julian century contains 36525 days of atomic time. The Gaussian constant, k = 0.01720209895, is the defining constant relating the heliocentric gravitational constant ($GM_{\odot}$) to the astronomical unit of length (A) and to the unit of time through the relationship

$$GM_{\odot} = A^3 k'^2$$

where $GM_{\odot}$ is expressed in $m^3\ s^{-2}$, A is the astronomical unit in meters (derived from the measured value of the astronomical unit in light-seconds and the defined value of the velocity of light in $m\ s^{-1}$), and k' is k/86400.

In general, each observational technique uses different realizations of both the terrestrial and celestial frames. In addition, the techniques use different transformations between these frames. The J2000.0 epoch is recommended for use in reference system algorithms. Further, the mean equator and equinox at J2000.0 is recommended as the space-fixed coordinate frame. The transformation from the 1950.0 frame to J2000.0 should use the IAU 1976 value of the precession constant. The value of the correction to the FK4 equinox is (Fricke, 1982)

$$E(T) = 0^{s}.035 + 0^{s}.085T,$$

where T is measured in Julian centuries from 1950.0. This expression for E(T) is adopted and is applied at the epoch J2000.0. A corresponding relationship between Greenwich Mean Sidereal Time (GMST) and Universal Time is given by (Aoki, et al., 1982)

$$\text{GMST at } 0^{h}\text{UT1} = 6^{h}\ 41^{m}\ 50^{s}.54841 + 8640184^{s}.812866T_u$$

$$+ 0^{s}.093104T_u^2 - 6^{s}.2 \times 10^{-6}T_u^3,$$

where T_u is measured in Julian centuries from J2000.0. This expression does lead, however, to a discontinuity and a change in rate of UT1 as measured by space techniques that are fixed to an inertial celestial frame. (See Williams and Melbourne, 1982; also Zhu and Mueller, 1983.) Although optical observations are not used in the IERS system, Chapter 5 "Procedure for Computing Apparent Places" is included for the purpose of clarifying coordinate transformations.

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