

SOFA support for the IAU 2006 precession model

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SOFA, which stands for "Standards Of Fundamental Astronomy", is an IAU Service which operates under Division 1 (Fundamental Astronomy) and reports through Commission 19 (Rotation of the Earth). It provides official IAU algorithms for fundamental-astronomy computations, in the form of computer subroutines in source code form. The subroutines at present comprise 109 "astronomy" routines supported by 52 "vector/matrix" routines. All are written in Fortran, though a C implementation is planned. The SOFA Review Board announced the latest release in August 2007, and the software can be downloaded from www.iau-sofa.rl.ac.uk/2007_0810.

The latest Earth-attitude models supported by SOFA are based on the IAU 2006 precession, the IERS Conventions (2003) polar motion and the IAU 2000 nutation and Earth rotation. A feature of the SOFA software is that the new-paradigm and classical methods are both supported, with equal efficiency and wherever possible sharing the same low-level components.

With one exception all the SOFA routines rest upon a non-redundant set of models, guaranteeing self consistency: the same quantity computed via different sequences of SOFA calls should not vary apart from rounding errors. This "primary canonical basis" comprises (i) The IAU 2006 precession model, in the Fukushima-Williams four angle parameterization, (ii) the IAU 2000A nutation model, (iii) the IAU 2006 adjustments to the IAU 2000A nutation model, (iv) the IAU 2006 model for the quantity $s+XY/2$, (v) the IAU 2000 model for the quantity s' , (vi) the IAU 2000 expression for ERA(UT1) and (vii) a GMST model consistent with IAU 2006. The products that are derived from this basis are (a) precession-nutation matrices, (b) the CIP coordinates X,Y, (c) the equation of the origins, (d) Greenwich (apparent) sidereal time, GST and (e) the equation of the equinoxes.

The other canonical basis offered by SOFA is based on direct series for the IAU 2006/2000A CIP X,Y, plus items (iv), (v) and (vi), above. This option, which simplifies the computation of the CIO based products, is included in order to harmonize with IERS Conventions and to make it possible to construct purely SOFA based software for IERS use. The two bases agree to microarcsecond accuracy.

A new feature in the 2007 SOFA release is a 38-page "cookbook" that includes example programs and numerical results. As well as demonstrating the latest models (due to come into use at the beginning of 2009), it shows how to perform the same calculations using earlier models, and compares the results.