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(F-29) Chapter 3 Sample Calculations

The sample Fortran code discussed in this chapter can be found in the file sample.f, which is part of the distribution; it is a main program that can be linked to the NOVAS subroutines and executed. If you do so, leave your executable named "a.out" or name it something other than "sample" to avoid confusion with the Unix "sample" command, e.g.

```
gfortran sample.f NOVAS_F3.0.o NOVAS_F3.0_solsys2.o jplsubs.o
```

(If you name your executable "sample," invoke it using "./sample".) The results, when SOLSYS version 2 is used, are given in the file sample.out. (If SOLSYS version 1 is used, the low-order digits of some of the results will be different, most noticeably for the Moon.) The program checkout.f, also part of the distribution, provides other examples of NOVAS subroutine calls.

NOVAS has a number of high-level subroutines that make it easy to obtain frequently needed information on the positions of celestial objects, and some of these will be described below. Before calling these subroutines, however, there are some setup calls that you might want to use. *Note that all floating-point arguments to NOVAS subroutines, input or output, are DOUBLE PRECISION.*

(C-33) Chapter 3 Sample Calculations

The sample C code discussed in this chapter can be found in the file **sample.c**, which is distributed along with NOVAS; it is a main function that can be linked to the NOVAS modules and executed. It requires *solarsystem* version 1, a working copy of the JPL software, and a DEnnn binary file. To use it,

a. compile and link files: **sample.c**, **novas.c**, **novascon.c**, **nutation.c**, **solsys1.c**, **eph_manager.c**, and **readeph0.c**.
b. name the resulting application **sample**.
c. verify that the JPL ephemeris file **JPLEPH**, or an alias to it, is available in the same directory as **sample**.
d. execute the **sample** application. On some Unix systems (e.g., Mac OS X), execute `./sample` to avoid confusion with the system `sample` command.

The results are given in the file **sample-usno.txt**, which was generated at the USNO with the JPL DE405 ephemeris. **sample.c** may be modified for use with *solarsystem* version 2; see the comments within that file for details.

NOVAS has a number of high-level functions that make obtaining frequently needed information on the positions of celestial objects easy; some of these are described below. In addition, Chapter 4 describes many of the functions and all of the structures used in these examples. The checkout programs used to validate a local installation (**checkout-stars.c**, **checkout-stars-full.c**, and **checkout-mp.c**) also provide other examples of NOVAS function calls.

Note that all floating-point arguments to NOVAS functions, input or output, are double precision floating-point values (type double).

(v)

The NOVAS 3.0 algorithms are based on a rigorous vector and matrix formulation and do not use any spherical trigonometry. Objects inside and outside the solar system are treated similarly. The position vectors formed and operated on by NOVAS place each object at its relevant distance (in astronomical units, or AU) from the solar system barycenter. Objects at unknown distance (parallax zero or undetermined) are placed on the "celestial sphere," herein defined to be at a radius of 1 gigaparsec (2.06×10^{14} AU).

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NOVAS FORTRAN DISTRIBUTION FILES

File Name	**Contents**
NOVAS_3.0_Guide.pdf	User's Guide to NOVAS F3.0 (PDF)
NOVAS_F3.0.f	Standard NOVAS Fortran subroutines—Version 3.0
NOVAS_F3.0_alt.f	Alternative versions of some NOVAS subroutines
NOVAS_F3.0_solsys1.f	SOLSYS version 1—reads file SS_EPHEM.TXT
NOVAS_F3.0_solsys2.f	SOLSYS version 2—interface to JPL ephemeris software and
NOVAS_F3.0_solsys3.f	SOLSYS version 3—self-contained Earth and Sun
CIO_RA.TXT	Data file of CIO right ascensions as a function of time
SS_EPHEM.TXT	Solar system 1-day ephemeris file read by SOLSYS version 1
checkout.f	Main program for initial validation
checkout.out.1	Results file from checkout.f when SOLSYS version 1 is in use
checkout.out.3	Results file from checkout.f when SOLSYS version 3 is in use
CIO_file.f	Program to create binary direct-access data file from CIO_RA.TXT
sample.f	Main program with sample code from User's Guide Chapter 3
sample.out	Output from sample code (when SOLSYS version 2 is used)

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VECTRS, CATRAN – 1/(sin(parallax)) now used to compute distance rather than 1/parallax; an inconsequential change, just to make the expression formally correct. Also, the "Doppler Factor", k, mentioned in the Hipparcos documentation and other papers, is now applied in computing the space-motion vector. The change in the units of proper motion and parallax is also implemented here. The computational distance used for objects of zero parallax has been increased to 1 Gpc (2.06×10^{14} AU).

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transform_cat and *starvectors* now use $(\sin(\text{parallax}))^{-1}$ to compute distance, rather than parallax^{-1}; an inconsequential change that just makes the expression formally correct. Also, the "Doppler Factor," *k*, mentioned in the Hipparcos documentation and other papers, is now applied in computing the space-motion vector. The computational distance used for objects of zero parallax has been increased to 1 Gpc (2.06×10^{14} AU).