DPI Library

Dynamical Plug-In for Binary Star Systems for Mercury 6

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Library Description

DPI (ascl:1504.012) is a FORTRAN77 library that supplies the symplectic mapping method for binary star systems (Chambers, Quintana, Duncan & Lissauer, 2002, The Astronomical Journal 123, 2884-2894) for the Mercury N-Body software package by John E. Chambers (ascl:1201.008). The binary symplectic mapping is implemented as a hybrid symplectic method (Chambers, 1999, MNRAS 304, 793-799) that allows close encounters and collisions between massive bodies and is therefore suitable for planetary accretion simulations.

Current Version

Release 1.0 (stable)

Note on the current release

Release 1.0 supplies the symplectic mapping for S-type binary systems (also called wide binary systems in Chambers et al. 2002), where the planets orbit one of the stars and are perturbed by the stellar companion (which is the outermost body of the system).

License

Disclaimer

The DPI library is supplied with a modified version of Mercury 6 for the convenience of the users; however, only those files whose name begins with "dpi" are property of the author and are released under GPL 3 license.

Distribution Website

http://ascl.net/1504.012

Using the DPI Library with Mercury 6

The use of DPI in conjunction with Mercury 6 should be straightforward for Mercury's users. Users not familiar with Mercury 6 are advised to first read Mercury's manual (included in the DPI distribution) to get in touch with its working.

In order to use Mercury together with DPI the users need to compile together the following two files:

- *dpi1_0.for*, containing the DPI library
- *mercury6_2-dpi.for*, containing a modified version of Mercury 6 adapted to call the subroutines provided by the DPI library

The two files can either be compiled together, e.g:

gfortran mercury6_2-dpi.for dpi-rc2.for -o executablename

or separately by using the option "-c" to create binary object files, e.g.:

gfortran -c mercury6_2-dpi.for

gfortran -c dpi1_0.for

gfortran mercury6_2-dpi.o dpi1_0.o -o executablename

Once compiled, to use the S-type symplectic mapping:

- create a file *big.in* with the bodies you want to integrate. N.B.: the binary companion should be the last massive body listed
- indicate "wb" (wide binary, since the binary star is the outermost body of the system) as the algorithm in the file *param.in* of Mercury

If the program is run using the test input files supplied with DPI, the energy error should oscillate around 10^{-7} and the angular momentum error varying between 10^{-13} and 10^{-14}. Note however that the behaviour of the latter quantity can vary depending on the hardware and the compiler due to the actual precision of the computations and the way rounding errors are handled.