**Distributed structures on the sphere**

Joseph J. Smulsky
Institute of Earth's Cryosphere, Tyum SC of SB RAS,
625026, Tyumen, Malygina Str. 86, Russia,
jsmulsky@mail.ru, http://www.ikz.ru/~smulski/smul1/

Completed 27.06.2018
Revised version of 07.10.2026

Description of the spherically distributed structures is given in the paper [1] at: http://www.ikz.ru/~smulski/Papers/OsMVStr.pdf. This paper also describes the program SphDsSt4.for (https://www.ikz.ru/~smulski/Data/SphDsStr/SphDsSt4.for) for creating them. The structure parameters are specified in the data file SphDsSt4.dat. The text of the program in FORTRAN is located in the file SphDsSt4.for. The executable program with the number of bodies to one thousand is represented by the file SphDsSt4.exe. The program is executed with a double number length.

The result of the program SphDsSt4.exe is a file of initial parameters and initial conditions for the Galactica system [2] - [3], as well as the information file SphDsSt4Err. This file displays error messages about the program. If they are absent, the coordinates and velocities of the bodies in dimensional form, the period of rotation P, the minimum distances between the bodies and the parameters from the file SphDsSt4.dat are recorded in it. The sample files St4D99be.dat, St4D99bg.dat and St4D99bh.dat show the results of the SphDsSt4.exe program with the following structure parameters in the SphDsSt4.dat file:

| SphDsSt4.dat | St4D99be.dat | St4D99bg.dat | St4D99bh.dat |
|---|---|---|---|
| N3 | 99 | 99 | 99 |
| smi | 1.99179D+30 | 1.99179D+30 | 1.99179D+30 |
| pm0 | 0.99866D+0 | 0.99866D+0 | 0.99866D+0 |
| Asm | 1.00000D+0 | 1.00000D+0 | 1.00000D+0 |
| ec | 0.00000D+0 | 0.00000D+0 | 0.00000D+0 |
| okf | 1.732341654683966 | 2.828902235710249 | 4.585660416713051 |
| okfv | 1.00000D+0 | 1.00000D+0 | 2.00000D+0 |
| eps0 | 0.00000D+0 | 0.00000D+0 | 0.00000D+0 |
| Rob | 5000. | 5000. | 5000. |
| Ivr | 4 | 4 | 4 |
| dt | 1.00000D-6 | 1.00000D-6 | 1.00000D-6 |
| FIMA5 | St4D99be.dat | St4D99bg.dat | St4D99bh.dat |
| Idta | 20160131 | 20160206 | 20160326 |

All data in the SphDsSt4.dat file is specified with 6 decimal digits. In the above examples, the coefficient okf is shown with 16 decimal digits. In this case, it is specified in the file file_okf.dat. In order for the okf coefficient to be read from the file SphDsSt4.dat, the file file_okf.dat must be deleted or corrupted in it.

The structure view and its parameter values can be viewed in the MathCad environment using the ReadFile4.mcd program. It allows to obtain a spatial image of the structure, analyze it and clarify the distance between the first and last bodies on the sphere. In the file ReadFile4R.mcd the comments are in Russian.

The system Galactica [2] - [3] (files glc3b30t, glc3b30t.exe and glc3pb30t.exe) allows to see the form of a spherically distributed structure, calculate its dynamics and evolution. In addition, it is used to complete the creation of the structure. The initial data for the Galactica program is specified in the file galacf26.dat. The executable program works with a number of bodies up to 30 thousand. The glc3pb30t.exe module provides a graphical representation of the structure on the personal computer screen, and the glc3b30t module is designed for a supercomputer on UNIX systems. A guide for the Galactica program is in [2] - [3].

**References**

1. Smulsky J.J. Distributed structures on the sphere / Institute of the Earth Cryosphere SB RAS. - Tyumen, 2016. - 43 p. - Fig.: 14. Refer.: 16. - Russian. - Dep. in VINITI 22.08.2016, No. 112-V2016. (In Russian). http://www.ikz.ru/~smulski/Papers/SphDsSt2.pdf.

2. Smulsky J.J. The System of Free Access Galactica to Compute Interactions of N-Bodies // I.J. Modern Education and Computer Science. 2012, 11, pp. 1-20. http://www.mecs-press.org/. doi:10.5815/ijmecs.2012.11.01.

3. Smulsky J.J. System Galactica: user's manual. 2012. http://www.ikz.ru/~smulski/GalactcW/GalDiscrE.pdf.