

Orbit simulations of some hypothetical stable three-body systems

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The simulations presented here are of the 129 retrograde systems which are described and illustrated in orbit diagrams by Chen & Lin in [1].

The initial parameters for each of the systems was sourced from the high precision data file by Chen & Lin [2]. That data file provides, for each of the systems, the mass, the initial position, and the initial velocity, of each of the three bodies. I wrote a small QT C++ program to transform that data file into a large number of XML files, one for each system.

Online orbit simulation software, which I wrote in Javascript and HTML5, takes those XML files as input, numerically integrates the orbits, and displays each system in motion.

The names of the simulations refer to the Figures of orbit diagrams in [1]. For example: simulation "4a" corresponds to the the 1st diagram in Figure 4, simulation "4b" corresponds to the 2nd diagram in Figure 4, and simulation "19d" corresponds to the the 4th diagram in Figure 19.

In addition, each simulation is labeled with the mass ratio, and the orbital period ratio.

The orbital period ratio is in the format...

orbital period of the outer orbit : orbital period of the inner orbit

where "inner orbit" and "outer orbit" have the meanings traditionally used in the literature.

All of the orbital systems simulated here are coplanar, and retrograde, which means that the outer orbit goes in the opposite orbital direction to the inner orbit. (The smaller number of prograde systems in [1] are not simulated here).

The systems in sets 15 16 17 and 18 are remarkable in that the outer orbit and the inner orbit both have the same orbital period.

Also remarkable are the systems in set 19 where the period of the outer orbit is shorter than the period of the inner orbit.

The simulations are online and can be found at [3].

References:

[1] Chen, K. C., & Lin, Y. C. (2009)
On action-minimizing retrograde and prograde orbits of the three-body problem
Communications in Mathematical Physics, 291(2), 403-441
<http://www.math.cts.nthu.edu.tw/download.php>

[2] Chen, K. C., & Lin, Y. C.
Data file
<http://www.math.nthu.edu.tw/~kchen/papers/retr-prog-initial-data.txt>

[3] Edgeworth, S.
HTML5 orbit simulations
<http://www.orbsi.uk/space/simulator/browse2.php>

Note: The simulator is currently compatible with many browser/OS/device permutations, but not with all permutations.
The next stage of development will aim to widen compatibility.