Julia Mihaylov, Renee Spear
College of Engineering, Aerospace Engineering
Kaela Martin
College of Engineering, Aerospace Engineering
Damon Landau
Jet Propulsion Laboratory, California Institute of Technology

Julia Language Ephemeris and Physical Constants Reader for Solar System Bodies

Publicly released in 2012, the Julia language is a relatively new, open source dynamic language. One major benefit of Julia is its combined capabilities of both dynamic and static coding languages. It nearly matches the computational efficiency of static languages, such as FORTRAN or C, and exceeds that of dynamic languages, such as MATLAB or Python. Additionally, unlike Python, Julia was designed with numerical programming in mind. With these functionalities, Julia operates as a high-performance, flexible language through an interactive and productive interface.

While there have been advances since its 2012 release, an ephemeris reader for both major and small bodies that incorporates spherical harmonics and asteroid shape modeling does not exist in the Julia Language. An ephemeris tool with such capabilities offers a fast and convenient approach to astrodynamics applications, such as satellite navigation and trajectory optimization.

The first-generation of the ephemeris reader was designed in Julia 0.6 with the ability to calculate characteristics of major and small bodies at user-defined times and find Lagrange points of user-defined bodies. The second-generation ephemeris reader presented here was updated to be compatible with Julia 1.0, and its added multifunctionality is derived from the newly added higher order spherical harmonics and asteroid shape modeling utilities in addition to typical ephemeris reader capabilities. This project can be utilized as a tool for trajectory design, optimization, and modeling as applied to astronautics and interplanetary travel.