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Astrodynamics.jl: A Julia-based Open Source Framework for Orbital Mechanics

This paper presents Astrodynamics.jl an open source framework for high-performance, interactive orbital mechanics implemented in the Julia programming language. The implementation language was chosen based on previous work that demonstrated that it is possible to bridge the performance gap between compiled and dynamic programming languages by using Just-in-time (JIT) compilation and was presented at the last edition of ICATT in 2016 [1].

We demonstrate the capabilities of the Astrodynamics.jl framework based on real-world applications, such as lunar transfer trajectory optimisation, and discuss how the unique properties of the Julia language enable us to develop human-friendly, easy-to-understand interfaces while at the same time achieving competitive performance in comparison to established libraries such as Orekit or AstroPy.

The Astrodynamics.jl open source project is part of a larger initiative to further the use of open source software in astrodynamics and space science in general. We want to highlight how the umbrella organisations OpenAstronomy and OpenAstrodynamics promote knowledge transfer, interoperability and use of standards across open source projects, communities, and programming language barriers.

[1] Eichhorn, H., Cano, J.L., McLean, F. et al. CEAS Space J (2018) 10: 115. https://doi.org/10.1007/s12567-017-0170-8

Summary

This paper presents Astrodynamics.jl an open source framework for high-performance, interactive orbital mechanics implemented in the Julia programming language. We demonstrate its capabilities based on real-world applications, such as lunar transfer trajectory optimisation, and discuss how the unique properties of the Julia language enable us to develop human-friendly, easy-to-understand interfaces while at the same time achieving competitive performance in comparison to established libraries such as Orekit or AstroPy.

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