Practical Astronomy Algorithms in Various Languages

Wednesday April 3, 2024

For several years, I've worked off-and-on to implement astronomical algorithms from the Practical Astronomy book in various languages. I've just completed a JavaScript version, and I've published it to NPM. I've included a couple of simple code examples in the repo README, including how to calculate details for the April 8 solar eclipse.

Background

The algorithms are described in detail in the Practical Astronomy with your Calculator or Spreadsheet book, by Peter Duffett-Smith. I highly recommend that you get a copy of the book, as it provides lots of explanations and context that you won't get by looking at the code alone. I worked with the 4th edition.

My code is actually a translation of macros from accompanying spreadsheet resources. You can download the spreadsheets from here.

All Languages

These are all the languages for which I've implemented the Practical Astronomy algorithms, and the status of each function's completion[1]. Each language name in the column header is a clickable link to its respective GitHub repository. The .NET version also has a NuGet package.

	Language							
Function	**C**	**C++**	**.NET/C#**	**PHP**	**Python**	**Java**	**JavaScript**	**Rust**
Date/Time								
Calculate → Date of Easter	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Civil Date to Day Number	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Civil Time ↔ Decimal Hours	✔	✔	✔	✔	✔	✔	✔	✔
Extract → Hour, Minutes, and Seconds parts of Decimal Hours	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Local Civil Time ↔ Universal Time	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Universal Time ↔ Greenwich Sidereal Time	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Greenwich Sidereal Time ↔ Local Sidereal Time	✔	✔	✔	✔	✔	✔	✔	✔
Coordinates								
Convert → Angle ↔ Decimal Degrees	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Right Ascension ↔ Hour Angle	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Equatorial Coordinates ↔ Horizon Coordinates	✔	✔	✔	✔	✔	✔	✔	✔

	Language							
Function	**C**	**C++**	**.NET/C#**	**PHP**	**Python**	**Java**	**JavaScript**	**Rust**
Date/Time								
Calculate → Obliquity of the Ecliptic	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Ecliptic Coordinates ↔ Equatorial Coordinates	✔	✔	✔	✔	✔	✔	✔	✔
Convert → Equatorial Coordinates ↔ Galactic Coordinates	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → Angle between two objects	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → Rising and Setting times for an object	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → Precession (corrected coordinates between two epochs)	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → Nutation (in ecliptic longitude and obliquity) for a Greenwich date	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → Effects of aberration for ecliptic coordinates	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → RA and Declination values, corrected for atmospheric refraction	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → RA and Declination values, corrected for geocentric parallax	✔	✔	✔	✔	✔	✔	✔	✔
Calculate → Heliographic coordinates	✔	✔	✔	✔	✔		✔	✔
Calculate → Carrington rotation number	✔	✔	✔	✔	✔		✔	✔
Calculate → Selenographic (lunar) coordinates (sub-Earth and sub-Solar)	✔	✔	✔	✔	✔		✔	✔
The Sun								
Calculate → Approximate and precise positions of the Sun	✔	✔	✔	✔	✔		✔	✔
Calculate → Sun's distance and angular size	✔	✔	✔	✔	✔		✔	✔
Calculate → Local sunrise and sunset	✔	✔	✔		✔		✔	✔
Calculate → Morning and evening twilight	✔	✔	✔		✔		✔	✔
Calculate → Equation of time	✔	✔	✔		✔		✔	✔
Calculate → Solar elongation	✔	✔	✔		✔		✔	✔
Planets								
Calculate → Approximate position of planet	✔	✔	✔		✔		✔	✔
Calculate → Precise position of planet	✔		✔		✔		✔	✔
Calculate → Visual aspects of planet (distance, angular diameter, phase, light time, position angle of bright limb, and apparent magnitude)	✔		✔		✔		✔	✔
Comets								
Calculate → Position of comet (elliptical)	✔		✔		✔		✔	✔
Calculate → Position of comet (parabolic)	✔		✔		✔		✔	✔
Binary Stars								
Calculate → Binary star orbit data	✔		✔		✔		✔	✔
The Moon								
Calculate → Approximate and precise position of Moon	✔		✔		✔		✔	✔

	Language							
Function	**C**	**C++**	**.NET/C#**	**PHP**	**Python**	**Java**	**JavaScript**	**Rust**
Date/Time								
Calculate → Moon phase and position angle of bright limb	✔		✔		✔		✔	✔
Calculate → Times of new Moon and full Moon	✔		✔		✔		✔	✔
Calculate → Moon's distance, angular diameter, and horizontal parallax	✔		✔		✔		✔	✔
Calculate → Local moonrise and moonset	✔		✔		✔		✔	✔
Eclipses								
Calculate → Lunar eclipse occurrence and circumstances	✔		✔		✔		✔	✔
Calculate → Solar eclipse occurrence and circumstances	✔		✔		✔		✔	✔

1)

As of June 1, 2024