PyMap3D: 3-D coordinate conversions for terrestrial and geospace environments

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Summary

PyMap3D (Michael Hirsch 2018) is a pure Python coordinate transformation program that converts between geographic coordinate systems and local coordinate systems useful for airborne, space and remote sensing systems. Additional standalone coordinate conversions are provided for Matlab/GNU Octave and Fortran. A subset of PyMap3D functions using syntax compatible with the $1000 Matlab Mapping Toolbox is provided for Matlab and GNU Octave users in the matlab/ directory. A modern Fortran 2018 implementation of many of the PyMap3D routines is provided in the fortran/ directory.

The Fortran procedures are “elemental”, so they may be used for massively parallel processing of arbitrarily shaped coordinate arrays. For Python, increased performance and accuracy is optionally available for certain functions with AstroPy. Numpy is optional to enable multi-dimensional array inputs, but most of the functions work with Python alone (without Numpy). Other functions that are iterative could possibly be sped up with modules such as Cython or Numba.

PyMap3D is targeted for users needing conversions between coordinate systems for observation platforms near Earth’s surface, whether underwater, ground-based or space-based platforms. This includes rocket launches, orbiting spacecrafts, UAVs, cameras, radars and many more. By adding ellipsoid parameters, it could be readily be used for other planets as well. The coordinate systems included are: * ECEF (Earth centered, Earth fixed) * ENU (East, North, Up) * NED (North, East, Down) * ECI (Earth Centered Inertial) * Geodetic (Latitude, Longitude, Altitude) * Horizontal Celestial (Alt-Az or Az-El) * Equatorial Celestial (Right Ascension, Declination)

Additionally, Vincenty (Vincenty 1975, Veness (2016)) geodesic distances and direction are computed.


Other Programs

Other Python geodesy programs include:

- PyGeodesy MIT license
- PyProj ISC license

These programs are targeted for geodesy experts, and require additional packages beyond Python that may not be readily accessible to users. Further, these programs do not include all the functions of PyMap3D, and do not have the straightforward function-based API of PyMap3D.
References


