

Homework2 Coordinate Conversion

- Coordinate conversion: find a point A on SJTU campus, marked on the Baidu/Google Map to obtain the geodetic coordinate(l,l,h), and convert it to ECEF, and ECI (optional).
- Given a point B (121.455899°, 31.036321°, 100m), calculate the ENU of point B relative to your own Point A. Plot the skymap marked with elevation and azimuth.

LLA to ECEF

given latitude ϕ , longitude λ , height h ;

$$\begin{aligned}X &= (N(\phi) + h) \cos \phi \cos \lambda \\Y &= (N(\phi) + h) \cos \phi \sin \lambda \\Z &= ((1 - e^2)N(\phi) + h) \sin \phi\end{aligned}$$

where

$$N(\phi) = \frac{a}{\sqrt{1 - e^2 \sin^2 \phi}}$$

set $A(31.036, 121.455, 0)$, the coordinate in **ECEF** is
 $(-2.86023 * 10^6, 5.1901 * 10^6, -2.35059 * 10^6)$

ENU

- get the **ECEF** position of point A
- get the **ECEF** position of point B
- using transferring matrix

the vector in **ENU** coordinate from **r** to **p** is:

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -\sin \lambda_r & \cos \lambda_r & 0 \\ -\sin \phi_r \cos \lambda_r & -\sin \phi_r \sin \lambda_r & \cos \phi_r \\ \cos \phi_r \cos \lambda_r & \cos \phi_r \sin \lambda_r & \sin \phi_r \end{bmatrix} \begin{bmatrix} X_p - X_r \\ Y_p - Y_r \\ Z_p - Z_r \end{bmatrix}$$

so the vector $r \rightarrow p$ will be the vector in sky map.

