

ECEF TO GEODETIC COORDINATES (INVERSE) -
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Given ellipsoid “a” and “f”

Given X, Y, Z, get Latitude, Longitude, Ellipsoidal Height (λ , ϕ , h)

$$e^2 = 2 * f - f^2$$

$$\lambda = \text{atan}\left(\frac{X}{Y}\right)$$

$$r = \sqrt{X^2 + Y^2 + Z^2}$$

$$p = \sqrt{X^2 + Y^2}$$

$$\phi_{initial} = \text{acos}\left(\frac{r}{p}\right)$$

Seed value for ϕ

$$w = \sqrt{1 - e^2 * \sin^2(\phi)}$$

$$R_N = \frac{a}{w}$$

$$h = \frac{p}{\cos(\phi)} - R_N$$

$$v = \sqrt{1 - e^2 \left(\frac{R_N}{R_N+h}\right)}$$

$$\phi = \text{atan}\left(\frac{Z*v}{p}\right)$$

Loop at least 4 times (or check for change in $h < 1\text{mm}$), capturing the last ϕ and h

