Navigation system

Geodetic coordinate system

Geodetic coordinate system is a coordinate system which a position defined by 3 numbers, a latitude, longitude, and altitude. A position which is defined by a geodetic coordinate system is a position on a globe. Latitude is a line that intersects the defined position and a line which parallel to an equator line. Longitude is a line that intersects the defined position and a line which parallel to a prime meridian line. Altitude is a distance between defined position and the ellipsoid.

Body coordinate system

Body coordinate system is a coordinate system which the origins of 3 axes (x, y, and z) are the center of mass of the vehicle. In a NED (North, East, Down) system, x axis points towards the head of the vehicle, y axis points towards the right side of the vehicle, and the z axis points towards the down side of the vehicle.

Bearing

Bearing is an angle between 2 geodetic coordinates. To find bearing a bearing between current position and destination position, the formula is stated below:

$$d_\lambda = p^c_\lambda - p^d_\lambda$$

$$X = \cos\left(p^d_\varphi\right) \sin\left(d_\lambda\right)$$

$$Y = \cos\left(p^c_\varphi\right) \sin\left(p^d_\varphi\right) - \sin\left(p^c_\varphi\right) \cos\left(p^d_\varphi\right) \cos\left(d_\lambda\right)$$

$$B = atan2(X, Y)$$

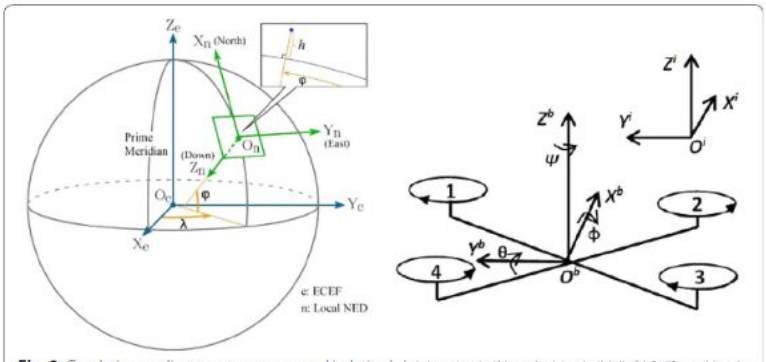

Fig. 2 Geodetic coordinate system, expressed in *latitude* (φ), *longitude* (λ) and *altitude* (h) (left) [15], and body coordinate system expressed in X^b, Y^b, Z^b (right) [16]