

derivation_rot_pcpf2enu.mlx

Passive rotation matrix from PCPF frame to ENU frame given the planetodetic coordinates of a reference point.

```
% clears Workspace and Command Window, closes all figures  
clear; clc; close all;
```

Passive rotation matrix from PCPF frame to ENU frame.

Initializes the symbolic variables.

```
syms phi lambda;
```

Counterclockwise rotation about the Z -axis by an angle $90^\circ + \lambda$ to align the X -axis with the east-axis. This forms the $X'Y'Z$ coordinate system.

```
R3 = [-sin(lambda)  cos(lambda)  0;  
      -cos(lambda) -sin(lambda)  0;  
      0             0            1];
```

Counterclockwise rotation about the X' axis by an angle $90^\circ - \phi$ to align the Z -axis with the up-axis.

```
R1 = [1  0  0;  
      0  sin(phi)  cos(phi);  
      0 -cos(phi)  sin(phi)];
```

Passive rotation matrix from PCPF frame to ENU frame.

```
R_pcpf2enu = simplify(R1*R3)
```

R_ecef2enu =

$$\begin{pmatrix} -\sin(\lambda) & \cos(\lambda) & 0 \\ -\cos(\lambda) \sin(\phi) & -\sin(\lambda) \sin(\phi) & \cos(\phi) \\ \cos(\lambda) \cos(\phi) & \cos(\phi) \sin(\lambda) & \sin(\phi) \end{pmatrix}$$