

EE 570: Homework 4

1. Given the geodetic coordinates of the peak of Mt. Everest as Latitude (L_b) 27deg 59min 16sec N, Longitude (γ_b) 86deg 56min 40sec E, and height (h_b) 8850 meters (derived by GPS in 1999):

- (a) Develop a MATLAB

```
function [r_e__e_b]=llh2xyz(L_b,lambda_b,h_b)
```

to convert from geodetic curvilinear lat, lon, and height to ECEF rectangular x , y , and z coordinates (Please use SI units). Attach a printout of your function.

- i. Test your llh2xyz function using coordinates of the peak of Mt Everest. What is \vec{r}_{eb}^e at the peak?

- (b) Develop a MATLAB function

```
function [L_b,lambda_b,h_b] = xyz2llh(r_e__e_b)
```

to convert ECEF x , y , and z coordinates to lat, lon, and height (use SI units). HINT: This should be an iterative transformation (i.e., not closed form).

Test your xyz2llh function with the ECEF coords obtained from part a)i). Tabulate the error in lat (in deg), lon (in deg) and height (in m) for 1 to 10 iterations.

	Method #1			Method #2		
Iter	$\Delta Lat(^{\circ})$	$\Delta Lon(^{\circ})$	Δh (m)	$\Delta Lat(^{\circ})$	$\Delta Lon(^{\circ})$	Δh (m)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

- (c) What is the acceleration due to gravity at the ellipsoid (i.e., at the ellipsoid $h_b = 0$. HINT: This should only be a function of lat—see page 70 of text)?
- (d) What is the magnitude of the centrifugal acceleration ($-\Omega_{ie}^e \Omega_{ie}^e \vec{r}_{eb}^e$) at the ellipsoid and at the peak?
- (e) What is the magnitude of the gravitational attraction at the ellipsoid and at the peak? HINT: See page 72 to compute $\vec{\gamma}_{ib}^e = \vec{\gamma}_{ib}^i |_{\vec{r}_{ib}^i = \vec{r}_{eb}^e}$.

2. Develop a MATLAB function

```
function [g_n__bD] = gravity(L_b,h_b)
```

(see eqn. 2.139 on page 71 of Groves) to approximate the “down” component of the acceleration due to gravity as a function of lat & height (Please use SI units).

- (a) Use this function to compute the acceleration due to gravity at the peak
- (b) What is the difference in m/s^2 between the answer obtained in Q.2(a) and that of 1(c)?
- i. Based on this difference how much less would you weigh at the peak than at the ellipsoid (in lbs)?