

## **HOMEWORK 1 - Satellite Orbits - due April 11**

(Please hand in paper for homework and e-mail matlab files for labs.)

- 1) What is the speed of a satellite in a circular orbit about the earth at an altitude of 800 km as well as 1500 km? How many complete orbits occur in one day (86400 sec) for each case? What is the speed of the subsatellite point along the ground for each case. (Assume a spherical earth.)
  
- 2) Why is there an effective upper limit of roughly 2000 km for the orbital altitude of a low earth orbiting satellite?
  
- 3) Given a satellite in a circular orbit around the earth at an orbital frequency of  $\omega_s$  and an inclination of  $i$ , develop a formula for the latitude velocity  $d\theta/dt$  of the satellite. (Assume a spherical earth.) What happens when the inclination is  $0^\circ$ ? What happens when the inclination is  $90^\circ$ ?
  
- 4) How many elements does it take to describe the position and velocity of a satellite at a particular time? What are two ways of defining this "state vector" for satellite orbits?
  
- 5) What is a sidereal day? How long is it?
  
- 6) What velocity is needed to launch a satellite into a circular orbit at an altitude of 800 km above the surface of the Earth?