

AA575: Satellite Navigation

Homework 5: PVT Solutions

Assigned: Friday, December 2, 2011

Due: Saturday, December 17, 2011 (Last day of finals)

You are given two files of data collected at one time from a GPS receiver: “eph.dat” contains the data in the broadcast ephemeris, and “rcvrc.dat” contains the corrected pseudorange and other raw measurements obtained for the same set of 8 satellites. Note that the effects of the ionosphere, troposphere and satellite clock biases, have been removed from these measurements. The format of the ephemeris files (“Format A”) is defined in Appendix A.3.1 (p 554) of *Misra and Enge*. The format of “rcvrc.dat” is 3 columns; time of the measurement (GPS time, in sec), satellite PRN, and corrected pseudorange (m). One row for each satellite.

Problem 1 (85 Percent): From these measurements, compute the position of the receiver. Express this position in geodetic coordinates.

- Try an initial guess of your position (in ECEF) of:

$$\begin{aligned} X &= -2701206.38\text{m} \\ Y &= -4293642.366\text{m} \\ Z &= 3857878.924\text{m} \end{aligned}$$

- Use the ephemeris program that you wrote for HW4 to find the positions of the 8 satellites, remembering that this position must be computed at the time that the signal was **transmitted**. This may require iteration. Rotate this position into the ECEF reference frame at the time of **reception**.
- Compute the **H** linear observation matrix, linearized about this position and the 8 visible satellites.
- Using the **H** matrix derived earlier, and the 8 observations, estimate the position. Print out the updated estimate at each step of the iteration. Stop the iterations when they change by less than the desired precision of 0.5 meters.

Problem 2 (15 Percent): From the data given in problem 1, find the following:

- Geometric Dilution of Precision (GDOP)
- Position Dilution of Precision (PDOP)
- Time Dilution of Precision (TDOP)