

## GNSS VISIBILITY

Assigned : 18 September 2013

Due : 25 September 2013

CAETE students have one more week

## OBJECTIVES

- Predict satellite visibility using the broadcast almanac
- Explore the visibility limits at different locations on the earth

## OVERVIEW

This software project provides you with codes for determining satellite position from the broadcast almanac data (note: the broadcast almanac is not the same as the broadcast ephemeris). You will use and expand on these codes to generate visibility plots and explore satellite coverage at different locations on the earth.

## ASSIGNMENT

- 1) You are provided with MATLAB code written by Ben K. Bradley that sets up a GUI for user input, computes satellite positions from a YUMA almanac file, handles a number of time conversions and produces nice plots. Familiarize yourself with the code, working out the file formats, input, and output. To understand what is going on, you should start with the simplified GPSVisibility\_script. This will allow you to see how to run some of the key functions and you can use it to debug the functions you are writing.
- 2) (5 pts) What is the name of the YUMA almanac file that you should use to compute satellite visibility on September 20, 2012? Download and view this almanac. Identify which GPS PRNs are in each of the 6 orbit planes.
- 3) (5 pts) Modify the function ASEN5090\_ecef2azelrange2.m to return the azimuth, elevation and range. Check to make sure that your function works correctly.
- 4) (5 pts) Modify the function ASEN5090\_GPSvis.m to correctly determine which satellites are visible given the mask angle set by the user. Check to make sure that your function works correctly.
- 5) (5 pts) Find the satellites visible September 20, 2012 at 12:00PM local time in Boulder (Latitude 40.0, Longitude -105.0, and Altitude 1631 meters). Turn in satellite PRNs, azimuth and elevation angle in degrees to 2 decimal points. You can compare these results with a handheld receiver. (If you miss the opportunity to check on this day, please show an az-el plot of the predicted and actually observed satellites on another date and time in addition to providing the requested results.)
- 6) (15 pts) Create an AZEL plot of the satellites visible above **0 deg** elevation throughout the day on Sept 20, 2012 from 0 to 24 hours GMT at the following locations on the earth:
  - a) 0 N, 0 E
  - b) 90 N, 0 E
  - c) BoulderDescribe the differences in visibility.
- 7) (5 pts) For the North pole case, show analytically what the highest elevation visible should be.
- 8) (5 pts) Using your previous results for Boulder, CO, calculate and plot the number of satellites that are visible above 10 degrees elevation as a function of time for a little over one day starting at 0:00 GMT on the specified date.
- 9) (5 pts) For Boulder, CO, compute the time shifts for a few satellites (3 or 4) to each reappear in the same place in the sky on Sept 20 and 21. Describe your approach and your results using figures or tables as needed.

**REPORT OUTLINE AND GRADING**

Title Page Not Required – Your name on the upper right hand corner is sufficient. No executive summary!

50 Questions 1-9 with points as listed above

5 Conclusions and Recommendations - describe what you learned about satellite visibility and recommend changes to the project, the codes, or potential for future investigations

References

Appendix - Well commented code for any new or modified routines

10 Style and Clarity - clarity, spelling, grammar, organization, neatness

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65 TOTAL