Name(s)

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Project Number

S1303

Project Title

Pseudorange Fit Algorithm

Abstract

Objectives/Goals

This is my third in a series of three science projects on GPS Multipath. This year, my research focused on multipath signals that are refracted from above the GPS antenna. My project objective was to create a pseudorange fit algorithm that would remove the corrupted pseudorange measurements caused by this multipath and eliminate GPS receiver position jumps.

Methods/Materials

I collected positioning data from the GPS constellation for every second using a special Garmin GPS receiver that supplied the #raw# pseudorange measurement data. This resulted in a very large volume of data. I then used my laptop and some special software supplied by Garmin for data analysis. My data collection area did have potential sources of multipath signals that I was able to take advantage of since my receiver supplied the azimuths of the GPS satellites.

Results

I collected GPS position data from seven satellites from 22:30:00 to 23:19:10 for every second. This resulted in about 190,000 points of data. Data analysis identified a potential multipath problem from 22:44:36 to 23:00:46 with 40,180 points of data. Further data analyzed determined that PRN 11 had pseudorange measurements corrupted by multipath and resulted in 971 data points. I then created a pseudorange fit algorithm based on least mean squares theory. This resulted in a best-fit line gradient to which I applied the corrupted PRN 11 data. With the correct fitted boundaries set into the algorithm, it did remove the corrupted data points and keep the uncorrupted pseudorange measurements.

Conclusions/Discussion

My hypothesis was proven valid and I was able to develop a pseudorange fit algorithm that eliminated the bad pseudorange measurement data that causes GPS position jumps. In addition, by knowing PRN 11#s elevation and azimuth in the sky and my receiver location, I was also able to identify the tower that had caused the diffracted multipath condition.

Summary Statement

My project developed a pseudorange fit algorithm to eliminate GPS receiver position jumps caused by a diffracted multipath condition.

Help Received

Dad helped with test set up.