Workflow

Point positioning in single epoch on single frequency code observations by least squares

Enriching the script in file Ex04_comments.m compute the coordinates of the receiver.

The scripts calls Ex04_variables.m, that loads the following variables:

- obs_head : epoch of the measurements and id of the GPS satellites.
- obs_block : GPS observations;
  first column is pseudorange,
  second column is phase,

third column is doppler,
and last column is signal to noise ratio.

- xyz_sat : coordinates of the satellites.
- dtS : clock offsets of the satellites.
- ionoparams : parameters of the Klobuchar model.
- xyz_real : true coordinates of the receiver.

Then, contains suggestions on the solution!

You will use the following functions:

- topocent.m : compute azimuth, elevation and distance given the satellite and receiver coordinates.
- cart2geod.m : compute geodetic coordinates from cartesian ones.
- tropo_error_correction.m : compute tropospheric error.
- iono_error_correction.m : compute ionospheric correction.
- weektow2time.m : compute GPS time from GPS week and GPS second of week.
- time2weektow.m : compute GPS week and second of week from GPS
time.
- date2gps.m : calendar date to GPS time.

You have to produce a script that compute

- the coordinates of the receiver and its clock offset,
- the variance covariance matrix of the coordinates
- and the PDOP value.

A possible workflow could be:

1. Start from the center of the Earth (0,0,0) and 0 clock error.
2. Build the system using approximate values and atmospheric model.
3. Solve for the correction of apriori values x.
4. Add the corrections to the apriori values.
6. Repeat points 2,3,4 till the correction of apriori values approaches zero (it should take no more than 5 iteration)

7. Compute variance covariance matrix of the estimates
8. Rotate the variance covariance matrix and compute PDOP

Results (five iterations)

X= 4407368.1 m
Y= 700838.6 m
Z= 4542060.6 m
PDOP=0.95

Bonus:
compute again with a cutoff of 5°

Theory recall for point positioning

The system structure
Pos08, slides 1-4

The atmospheric models
Pos07, slides 10 (iono) & 15 (tropo)

Least Squares estimate
Gf02 (in OneDrive, /handnotes), slides 26 & 46/48

DOP estimate
Pos08, slides 13-14