Intelligent Systems

GPS lab
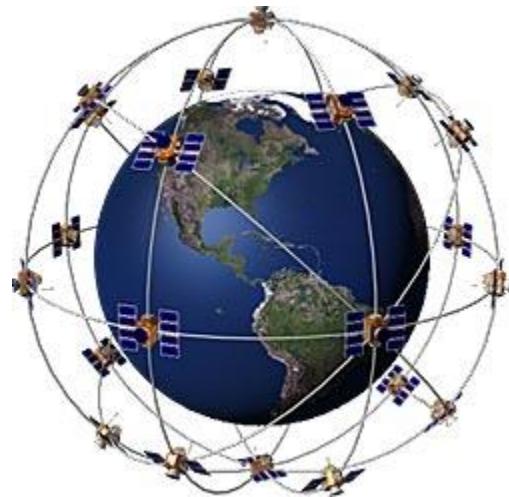
GPGGA NMEA sentence

$GPGGA,542.600,3314.8961,N,11142.2714,W,1,10,.86,395.2,M,-26.6,M,,*52

- 1 = UTC of Position
- 2 = Latitude
- 3 = N or S
- 4 = Longitude
- 5 = E or W
- 6 = GPS quality indicator (0=invalid; 1=GPS fix; 2=Diff. GPS fix)
- 7 = Number of satellites in use [not those in view]
- 8 = Horizontal dilution of position
- 9 = Antenna altitude above/below mean sea level (geoid)
- 10 = Meters (Antenna height unit)
- 11 = Geoidal separation (Diff. between WGS-84 earth ellipsoid and
       mean sea level. -=geoid is below WGS-84 ellipsoid)
- 12 = Meters (Units of geoidal separation)
- 13 = Age in seconds since last update from diff. reference station
- 14 = Diff. reference station ID#
- 15 = Checksum

Checksum

$GPGGA,542.600,3314.8961,N,11142.2714,W,1,10,.86,395.2,M,-26.6,M,,*52

▸ Checksum: 0x52 (0x00...0xFF)

```
Loop(i=2 to length-3)
{
        chk=bitwise_xor(chk, line(i));
}
Loop ends
```

# Matlab commands

- help cmd
- clc – clrear screen
- clear all – clear vars
- cell_array = importdata('filename.txt');
- string = char(cell_array(i));
- strcmp(a,b) //0 or 1
- dec_var = hex2dec(hex_var);
- dec_var = unicode2native(character)
- result = bitxor(a,b);
- double_var = str2double(string_var);
- plot(x), plot(x,y), plot3(x,y,z)
- stem3(x,y,z)
- strsplit(s,delimiter)

Code

```matlab
clc
clear all
filename='gps.txt';
gps = importdata(filename);
delimiter=',';
s=0;
idx=1;
altitude=0;
chk=0;
nmea_type='$GPGGA';
calculated_chk=0;
for i=1:length(gps)
 s=char(gps(i));
 splitted=strsplit(s,delimiter);
 if strcmp(splitted(1),nmea_type)==1
   chk=char(splitted(length(splitted)));
   chk=chk(2:length(chk));
   chk=hex2dec(chk);
   for j=2:length(s)-3
     num = unicode2native(s(j));
     calculated_chk=bitxor(calculated_chk,num);
   end
   if(chk==calculated_chk)
     altitude (idx)=str2double(splitted(10));
     idx=idx+1;
   end
  end
end
plot(altitude);
ylabel('Altitude [m]');
```

Altitude
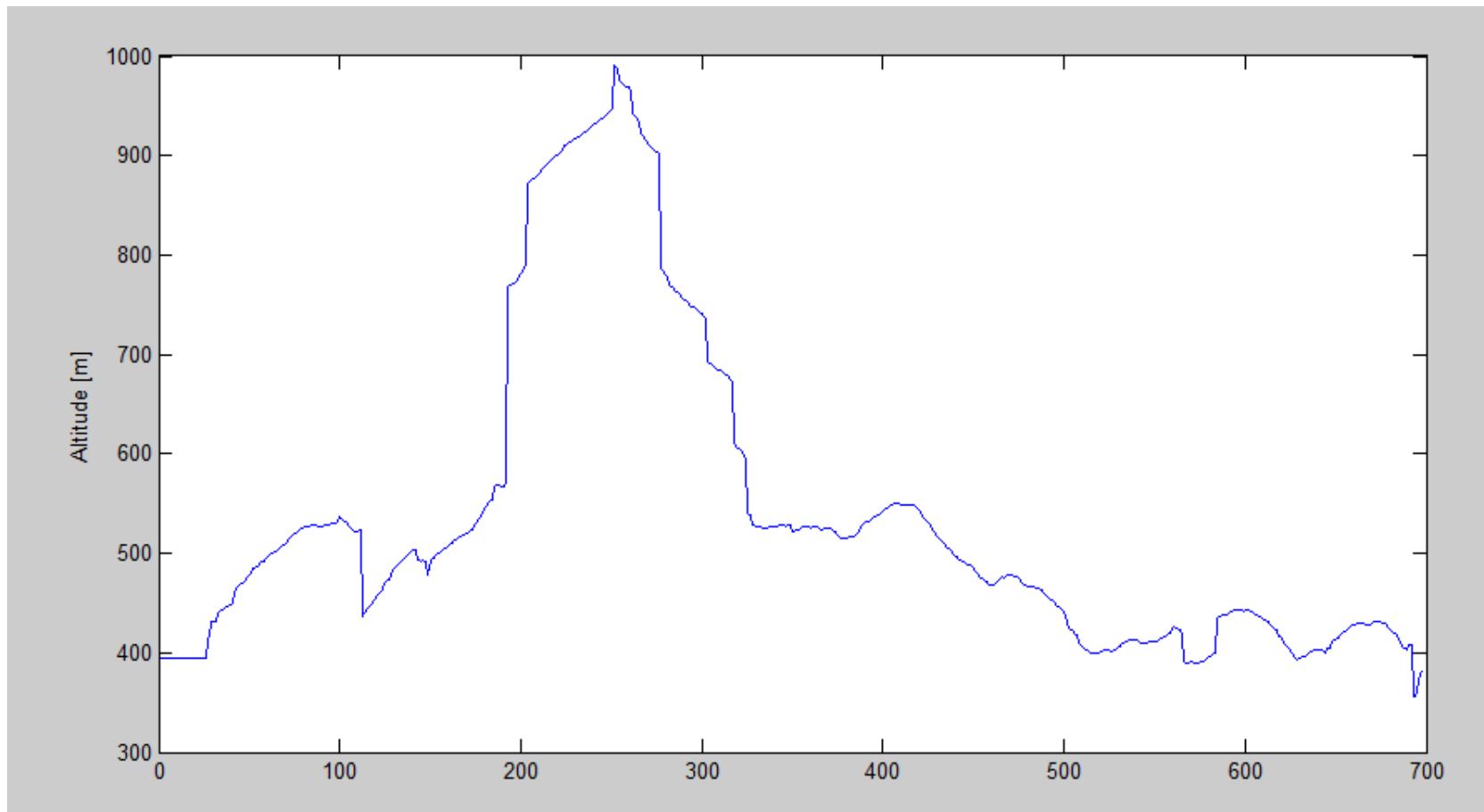
Flight path in 3D

◦ Get the latitude, longitude and altitude data from GPGGA sentences and plot it to a 3D figure!

GGA sentence

▸ $GPGGA,075916,4731.9606,N,01902.2900,E,1,06,2.4,106.3,M,41.0,M,,*46

Latitude:
47° 31.9606'

Longitude:
19°2.2900'

Altitude

▸ DM->DD
  ◦ DecimalDegree = Degree + Minute/60

▸ plot3(lat, lon, alt);
▸ stem3(lat, lon, alt);

Questions for GPS topic

- What is GNSS?
- What is GPS, what is Navigaton?
- What is GLONASS and Galilleo?
- What is DGPS?
- What is AGPS?
- What is GDOP?
- What are the main position error sources (3)?
- What are the common GPS telemetry protocolls?