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Faculty of Engineering
Civil Engineering Department

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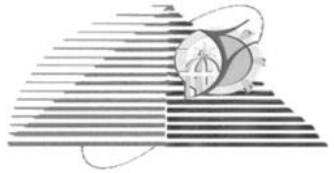
قسم الهندسة المدنية



Global Positioning System

(GPS)

By

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Dr. Ramadan H. Abdel-Maguid

Global Positioning System (GPS)

تطور الاجهزة

Current Satellite Systems (GNSS)
GPS
GLONASS
GALILEO (2014)

أنواع الاجهزة

GPS system description

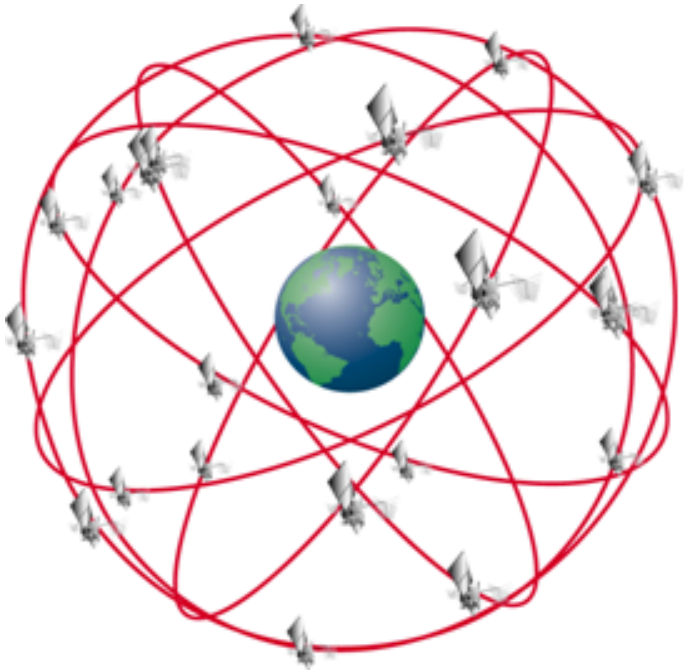
24 satellites (check),
orbit at an altitude 20200 km,
Accuracy from 10m down to miltimeter,
available 24h a day,
to many users , with no charge
6 orbial planes

Segments of GPS

Control Segments

Space segment

User Segment



GPS satellites

http://www.spectrum.ieee.org/pubs/spectrum/0400/gpsf2.html

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System components

- Space Segment (30 satellites at six orbital planes 20200km above earth surface in a period of about 12 hr, satellites equipped with atomic clocks)
- Control segment (five tracking stations – Master Station at Colorado Springs)
- User segment (receivers) (geodetic, survey-level, mapping and GIS , marine, hiking)

GPS Satellite Signal

- $\lambda = c/f$
- L1 frequency F=1575.42 MHz
- λ=0.19m
- L2 frequency F=1277.60 MHz
- $\lambda 2$=0.244m

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GPS MEASUREMENT PRINCIPLE

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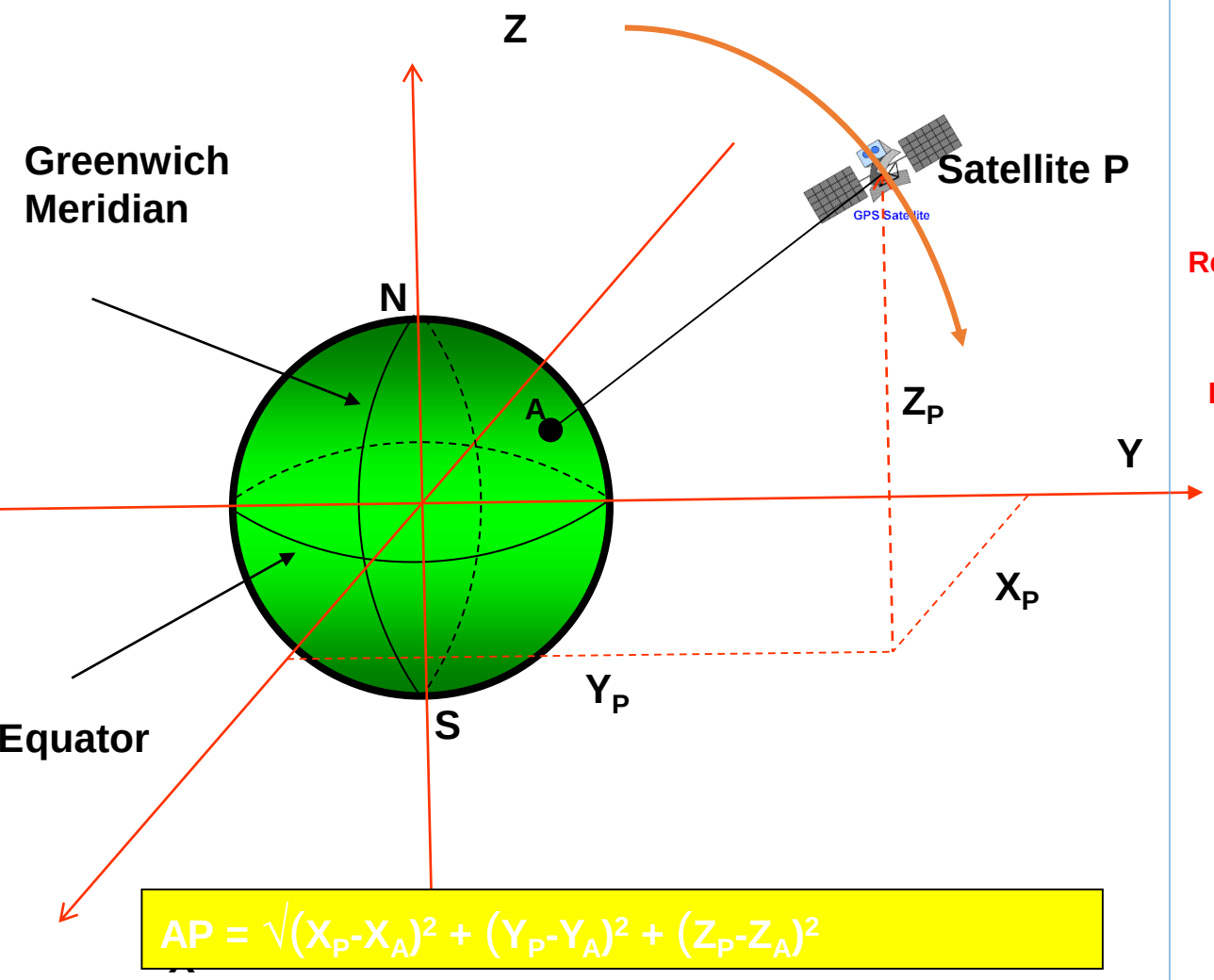
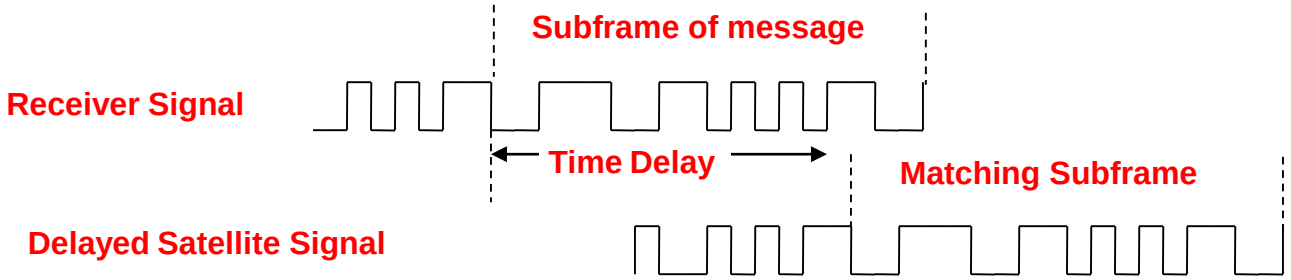


$$AP = \sqrt{(X_P-X_A)^2 + (Y_P-Y_A)^2 + (Z_P-Z_A)^2}$$

Code Signal Positioning



distance = velocity * time

The 'mis-match' between the code patterns is a defined by a measure of the time the signal has taken to travel from on board satellites to user receiver.

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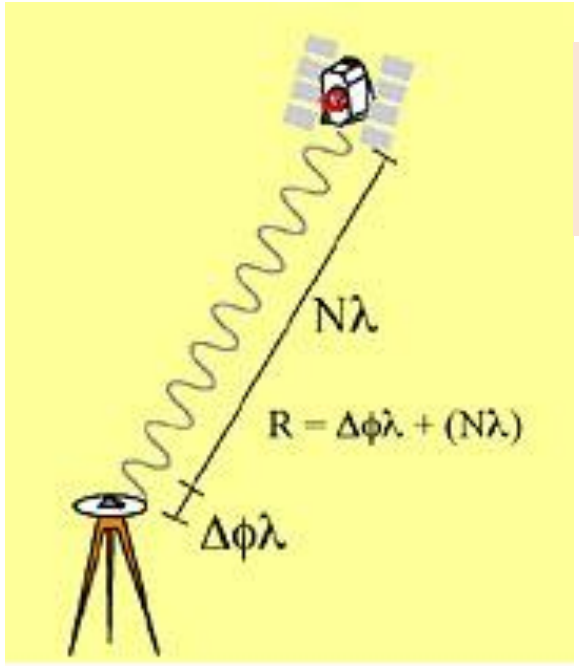


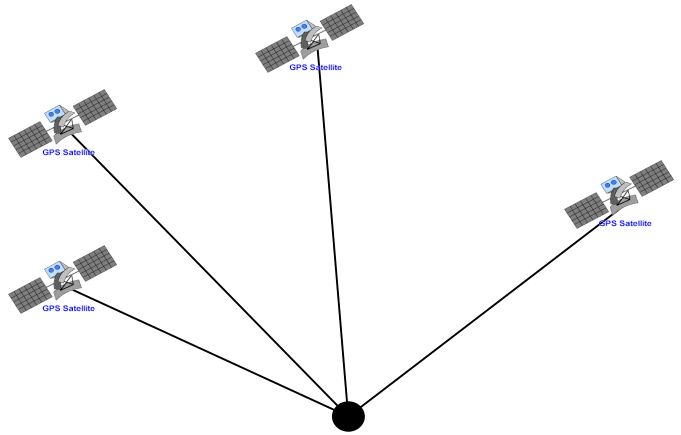
distance = velocity * time

Carrier phase measurements

GPS Positioning

Point and Relative Positioning

point positioning (Absolute Positioning)
With respect to a coordinate system whose origin is uniquely defined, and generally inaccessible. Positioning in this system is known



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Global Positioning System (GPS)

Sources of errors

1- orbital errors,
on board clock errors

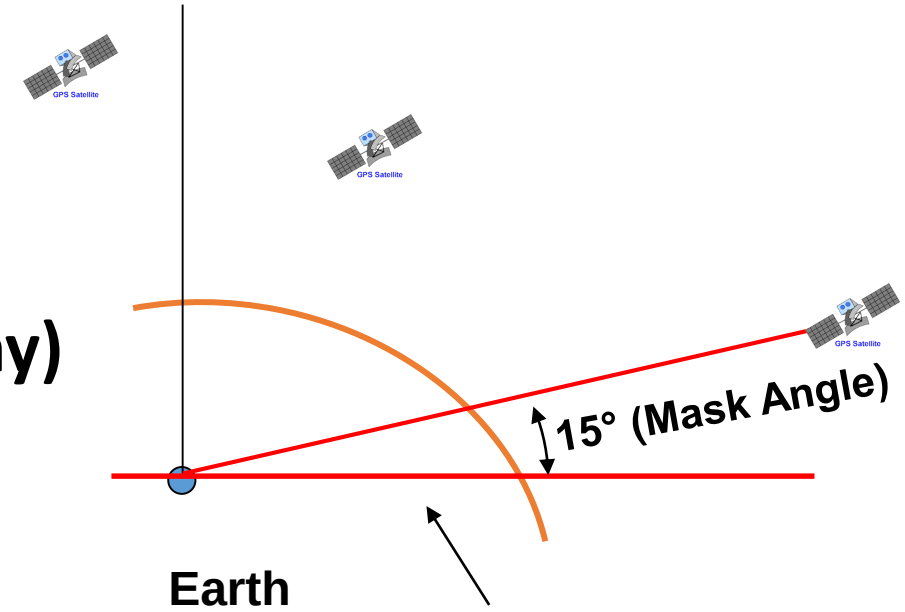
2- Inospheric , tropospheric errors

3- Receivers errors

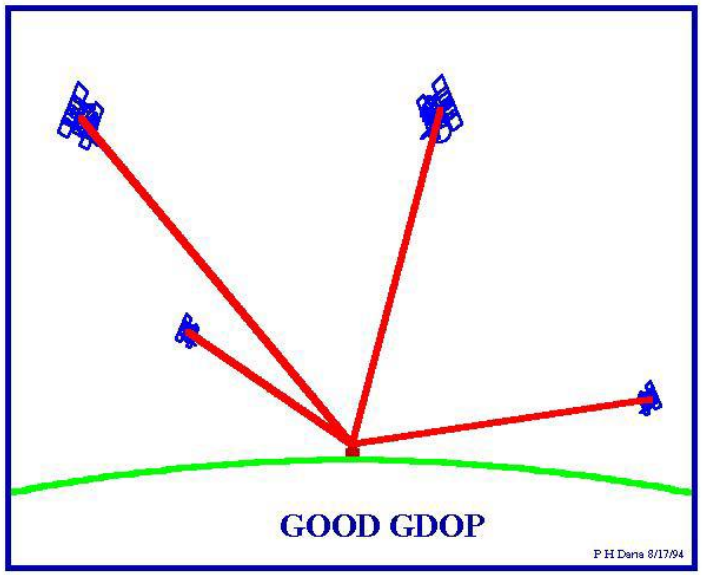
4- Multipath error

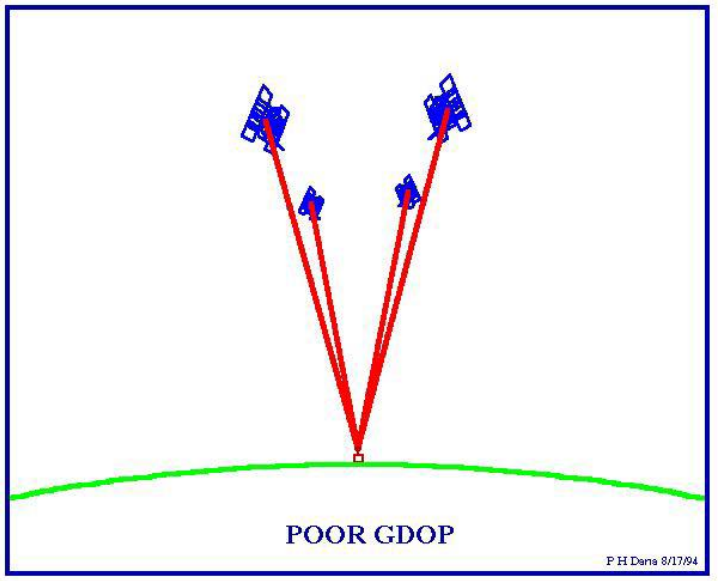
5- weak PDOP

6- Selective availability (if any)



Global Positioning System (GPS)





Position Dilution of Precision

- Measures the effect of geometry on the precision of the observations (position)
-

Position Dilution of Precision (PDOP)

- This is positional part of GDOP

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GPS Applications

- Offshore positioning
- Plate tectonics forecasting earthquakes

Aviation and landing