

Introduction to RINEX, GPS Raw Data



Geodetic Survey Section
Miss CHAN Wing-yee

21 June 2006

RINEX

- Receiver Independent Exchange Format
- Developed by the Astronomical Institute of the University of Berne in 1989
- For the easy exchange of the GPS data to be collected
- For processing in various software
- Version 2.10 used in SatRef System

RINEX

- Consists of 3 ASCII file types available to be downloaded from SatRef System

File Type	Containing Information
Observation Data File	GPS Measurements
GPS Navigation Message File	Ephemeris (Orbit information)
Meteorological Data File	Pressure, Temperature, Relative Humidity, etc

RINEX

Survey And Mapping Office - Geodetic Survey - Microsoft Internet Explorer

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

← 上一頁 → 搜尋 我的最愛 媒體

網址 http://www.geodetic.gov.hk/smo/index.htm 移至 連結

Survey & Mapping Office

Government Information Center 繁體版 简体版

Geodetic Survey

Hong Kong Satellite Positioning Reference Station Network (SatRef)

SEARCH SIT

Current User: gps [\[Back to Main\]](#) | [\[User Guide\]](#) | [\[Logout\]](#)

Station Selected : HKSC
 Data Type : O, N, M
 Selected :
 Start Time : 05-Jun-2006 03:00
 End Time : 05-Jun-2006 04:00

Selected Data File(s)							
	Click to Remove	Station Selected	Type of File Selected	Time Period of Data Request	Data Available	File Name	File Size
1.	Remove	HKSC	O	05-Jun-2006 03:00 to 05-Jun-2006 04:00	YES	HKSC_200606050300_200606050400.06o	475KB
2.	Remove	HKSC	N	05-Jun-2006 03:00 to 05-Jun-2006 04:00	YES	HKSC_200606050300_200606050400.06n	107KB
3.	Remove	HKSC	M	05-Jun-2006 03:00 to 05-Jun-2006 04:00	YES	HKSC_200606050300_200606050400.06m	3KB

Total number of file(s) = 3 (585.35KB)

[Confirm Selection & Start Download](#) [Back \(Re-select\)](#)

Welcome to SMO SatRef System 網際網路

RINEX

名稱	大小	類型
HKSC_200606050300_200606050400	4 KB	06M 檔案
HKSC_200606050300_200606050400	107 KB	06N 檔案
HKSC_200606050300_200606050400.06o	476 KB	06O 檔案

M: Meteorological Data File
N: Navigation File
O: Observation File

RINEX Data of the station HKSC on 5 June 2006 from UTC Time 3:00 to 4:00

Observation File

HKSC_200606050300_200606050400 - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

2.10
Leica Spider
HKSC
HKSC

455681

-2414266.9102
0.0083
1 1
4 C1
5.0000
2006 6
2006 6
14

OBSERVATION DATA

LEICA GRX1200PRO
LEIAT504
5386768.9793
0.0000
L1
P2
L2
5
5

G (GPS)
20060606 00:18:55UTC

2.00/2.121
LEIS
2407460.0272
0.0000
0
59
0.000000
55.000000

RINEX VERSION / TYPE
PGM / RUN BY / DATE
MARKER NAME
MARKER NUMBER
OBSERVER / AGENCY
REC # / TYPE / VERS
ANT # / TYPE
APPROX POSITION XYZ
ANTENNA: DELTA H/E/N
WAVELENGTH FACT L1/2
/ TYPES OF OBSERV
INTERVAL
TIME OF FIRST OBS
TIME OF LAST OBS
LEAP SECONDS
END OF HEADER

06 6 5 3 0 0.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29
23288740.069 122383102.613 7 23288741.198 95363442.36846
21880080.633 114980606.034 8 21880082.183 89595291.87246
25444792.816 133713291.799 5 25444797.337 104192196.61943
25044883.981 131611749.406 5 25044886.790 102554615.56243
23132107.018 121560054.186 8 23132109.516 94722138.03345
22831131.339 119978376.225 8 22831132.526 93489632.07445
24295861.158 127675626.689 6 24295863.505 99487514.10744
23541073.298 123709200.932 7 23541074.035 96396801.34144
20027575.007 105245634.134 9 20027575.488 82009601.79249
20726963.026 108920944.359 9 20726963.361 84873469.49848
06 6 5 3 0 5.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29

Header Section

Data Section

Header
Section

Data
Section

Observation File of HKSC on 5 June 2006 from UTC Time 3:00 to 4:00

Observation File: Header Section

```

2.10      OBSERVATION DATA      G (GPS)      RINEX VERSION / TYPE
Leica Spider      20060606 00:18:55UTCPGM / RUN BY / DATE
HKSC      MARKER NAME
HKSC      MARKER NUMBER
455681      LEICA GRX1200PRO      2.00/2.121      OBSERVER / AGENCY
      LEIAT504      LEIS      REC # / TYPE / VERS
      -2414266.9102 5386768.9793 2407460.0272      ANT # / TYPE
      0.0083      0.0000      0.0000      APPROX POSITION XYZ
      1      1      ANTENNA: DELTA H/E/N
      4      C1      L1      P2      L2      WAVELENGTH FACT L1/2
      # / TYPES OF OBSERV
      Terval
      ME OF FIRST OBS
      ME OF LAST OBS
      AP SECONDS
      D OF HEADER
  
```

C1 : Pseudorange using C/A code on L1
 L1 : Phase measurements on L1
 P2 : Pseudorange using P-Code on L2
 L2 : Phase measurements on L2

PGM/ RUN BY / DATE	Program, Agency, date of creating the file
REC # / TYPE / VERS	Receiver Number, type, version
ANT # / TYPE	Antenna Number, TYPE
APPROX POSITION XYZ	Approximation marker position (in WGS84)
ANTENNA: DELTA H/E/N	Antenna height, Eccentricities of antenna centre relative to marker in east and north (in metres)
WAVELENGTH FACT L1/2	Wavelength factors for L1 and L2
# / TYPES OF OBSERV	Number of observation types, observation types
TIME OF FIRST OBS	Time of first observation record

Observation File: Data Section

HKSC_200606050300_200606050400 - 記事本										
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)										
4	C1	L1	P2	L2	# / TYPES OF OBSERV					
5.0000					INTERVAL					
2006	6	5	3	0	0.000000					
2006	6	5	3	59	55.000000					
14					TIME OF FIRST OBS					
					TIME OF LAST OBS					
					LEAP SECONDS					
					END OF HEADER					
06	6	5	3	0	0.0000000	0	10G	2G	6G	7G 8G 9G10G18G21G26G29
23288740.069		122383102.613	7		23288741.198				95363442.36846	
21880080.633		114980606.034	8		21880082.183				89595291.87246	
25444792.816		133713291.799	5		25444797.337				104192196.61943	
25044883.981		131611749.406	5		25044886.790				102554615.56243	
23132107.018		121560054.186	8		23132109.516				94722138.03345	
22831131.339		119978376.225	8		22831132.526				93489632.07445	
24295861.158		127675626.689	6		24295863.505				99487514.10744	
23541073.298		123709200.932	7		23541074.035				96396801.34144	
20027575.007		105245634.134	9		20027575.488				82009601.79249	
20726963.026		108920944.359	9		20726963.361				84873469.49848	
06	6	5	3	0	5.0000000	0	10G	2G	6G	7G 8G 9G10G18G21G26G29
23291559.271		122397917.273	7		23291560.326				95374986.22846	
21880617.447		114983427.385	8		21880619.188				89597490.32046	
25442764.306		133702631.753	5		25442768.975				104183890.06743	
25046659.646		131621080.776	5		25046662.260				102561886.72244	
23128799.496		121542673.822	8		23128801.914				94708594.89645	
22832491.735		119985525.278	8		22832492.731				93495202.76146	
24294351.121		127667691.106	5		24294353.332				99481330.54944	
23537923.383		123692647.640	7		23537924.019				96383902.67844	
20028745.148		105251783.331	9		20028745.740				82014393.37349	
20728854.360		108930883.386	9		20728854.771				84881214.19448	
06	6	5	3	0	10.0000000	0	10G	2G	6G	7G 8G 9G10G18G21G26G29

Observation File of HKSC on 5 June 2006 from UTC Time 3:00 to 4:00

Observation File: Data Section

The screenshot shows a Notepad window titled "HKSC_200606050300_200606050400 - 記事本". The text content is a data file with columns for Epoch, Event Flag, Number of Satellites, and Satellite Number. Red boxes and arrows highlight these fields.

Annotations:

- Epoch:** Points to the first column of data (e.g., 06, 6, 5, 3, 0).
- Event Flag:** Points to the second column of data (e.g., 0, 10, 6).
- Number of Satellites:** Points to the third column of data (e.g., 2G, 6G, 7G, 8G, 9G, 10G, 18G, 21G, 26G, 29).
- Satellite Number:** Points to the fourth column of data (e.g., 23288740.069, 122383102.613, 7).

Data File Content (Approximate):

Epoch	Event Flag	Number of Satellites	Satellite Number
06 6 5 3 0	0	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	23288740.069 122383102.613 7
06 6 5 3 0	10	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	23291559.271 122397917.273 7
06 6 5 3 0	6	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	23291560.326 95374986.22846
06 6 5 3 0	8	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	21880617.447 114983427.385 8
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	21880619.188 89597490.32046
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	25442764.306 133702631.753 5
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	25442768.975 104183890.06743
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	25046659.646 131621080.776 5
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	102561886.72244
06 6 5 3 0	8	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	23128799.496 121542673.822 8
06 6 5 3 0	8	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	23128801.914 94708594.89645
06 6 5 3 0	8	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	22832491.735 119985525.278 8
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	93495202.76146
06 6 5 3 0	5	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	24294351.121 127667691.106 5
06 6 5 3 0	7	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	99481330.54944
06 6 5 3 0	7	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	23537923.383 123692647.640 7
06 6 5 3 0	9	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	96383902.67844
06 6 5 3 0	9	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	20028745.148 105251783.331 9
06 6 5 3 0	9	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	82014393.37349
06 6 5 3 0	9	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	20728854.360 108930883.386 9
06 6 5 3 0	9	2G 6G 7G 8G 9G 10G 18G 21G 26G 29	84881214.19448

Observation File of HKSC on 5 June 2006 from UTC Time 3:00 to 4:00

Observation File: Data Section

HKSC_200606050300_200606050400 - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

4	C1	L1	P2	L2	# / TYPES OF OBSERV
5.0000					INTERVAL
2006	6	5	3	0	TIME OF FIRST OBS
2006	6	5	3	59	TIME OF LAST OBS
14					LEAP SECONDS
					END OF HEAD
06	6	5	3	0	0.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29
23288740.069		122383102.613	7	23288741.198	95363442.36846
21880080.633		114980606.034	8	21880082.183	89595291.87246
25444792.816		133713291.799	5	25444797.337	104192196.61943
25044883.981		131611749.406	5	25044886.790	102554615.56243
23132107.018		121560054.186	8	23132109.516	94722138.03345
22831131.339		119978376.225	8	22831132.526	93489632.07445
24295861.158		127675626.689	6	24295863.505	99487514.10744
23541073.298		123709200.932	7	23541074.035	96396801.34144
20027575.007		105245634.134	9	20027575.488	82009601.79249
20726963.026		108920944.359	9	20726963.361	84873469.49848
06	6	5	3	0	5.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29
23291559.271		122397917.273	7	23291560.326	95374986.22846
21880617.447		114983427.385	8	21880619.188	89597490.32046
25442764.306		133702631.753	5	25442768.975	104183890.06743
25046659.646		131621080.776	5	25046662.260	102561886.72244
23128799.496		121542673.822	8	23128801.914	94708594.89645
22832491.735		119985525.278	8	22832492.731	93495202.76146
24294351.121		127667691.106	5	24294353.332	99481330.54944
23537923.383		123692647.640	7	23537924.019	96383902.67844
20028745.148		105251783.331	9	20028745.740	82014393.37349
20728854.360		108930883.386	9	20728854.771	84881214.19448
06	6	5	3	0	10.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29

Observation data
for each Satellite

Observation File: Data Section

HKSC_200606050300_200606050400 - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

4	C1	L1	P2	L2	# / TYPES OF OBSERV
5.0000					INTERVAL
2006	6	5	3	0	TIME OF FIRST OBS
2006	6	5	3	59	TIME OF LAST OBS
14					LEAP SECONDS
					END OF HEAD
06	6	5	3	0	0.000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29
23288740.069	122383102.613	7	23288741.198	95363442.36846	
21880080.633	114980606.034	8	21880082.183	89595291.87246	
25444792.816	133713291.799	5	25444797.337	104192196.61943	
25044883.981	131611749.406	5	25044886.790	102554615.56243	
23132107.018	121560054.186	8	23132109.516	94722138.03345	
22831131.339	119978376.225	8	22831132.526	93489632.07445	
24295861.158	127675626.689	6	24295863.505	99487514.10744	
23541073.298	123709200.932	7	23541074.035	96396801.34144	
20027575.007	105245634.134	9	20027575.488	82009601.79249	
20726963.026	108920944.359	9	20726963.361	84873469.49848	
06	6	5	3	0	5.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29
23291559.271	122397917.273	7	23291560.326	95374986.22846	
21880617.447	114983427.385	8	21880619.188	89597490.32046	
25442764.306	133702631.753	5	25442768.975	104183890.06743	
25046659.646	131621080.776	5	25046662.260	102561886.72244	
23128799.496	121542673.822	8	23128801.914	94708594.89645	
22832491.735	119985525.278	8	22832492.731	93495202.76146	
24294351.121	127667691.106	5	24294353.332	99481330.54944	
23537923.383	123692647.640	7	23537924.019	96383902.67844	
20028745.148	105251783.331	9	20028745.740	82014393.37349	
20728854.360	108930883.386	9	20728854.771	84881214.19448	
06	6	5	3	0	10.0000000 0 10G 2G 6G 7G 8G 9G10G18G21G26G29

Observation data
for each Satellite

Observation File: Data Section

Extracted observation data for GPS Satellite No. 2 at 3:00 on 5 June 2006:

C1	L1	P2	L2
23288740.069	122383102.613_7	23288741.198	95363442.36846

Diagram illustrating the data fields and their components:

- L1** (122383102.613_7) and **L2** (95363442.36846) are split into two parts: **LLI** (Loss of Lock Indicator) and **Signal Strength**.
- LLI** is indicated by an orange arrow pointing to the underscore character in the L1 and L2 fields.
- Signal Strength** is indicated by a green arrow pointing to the last digit (7 for L1, 6 for L2) in the L1 and L2 fields.

LLI (Loss of Lock Indicator)

0: OK

1: Cycle Slip

4: Antispoofing

Blank: not known

Signal Strength

-Interval 1-9

1: minimum possible signal strength

9: maximum possible signal strength

0 or blank: not known

Navigation File

- Data computed for Satellite Position
- Satellite Motion is described by Satellite Orbit
- Satellite Orbit is described by 6 (Keplerian) Elements

Navigation File: Satellite Orbit

- Define satellite position in the satellite orbit - v
- Define size and shape of the satellite orbit - a, e
- Define the orientation of the satellite orbit - ω
- Define the orbital plane in the equatorial system - Ω, I

v True Anomaly

a Semi-major axis of ellipse

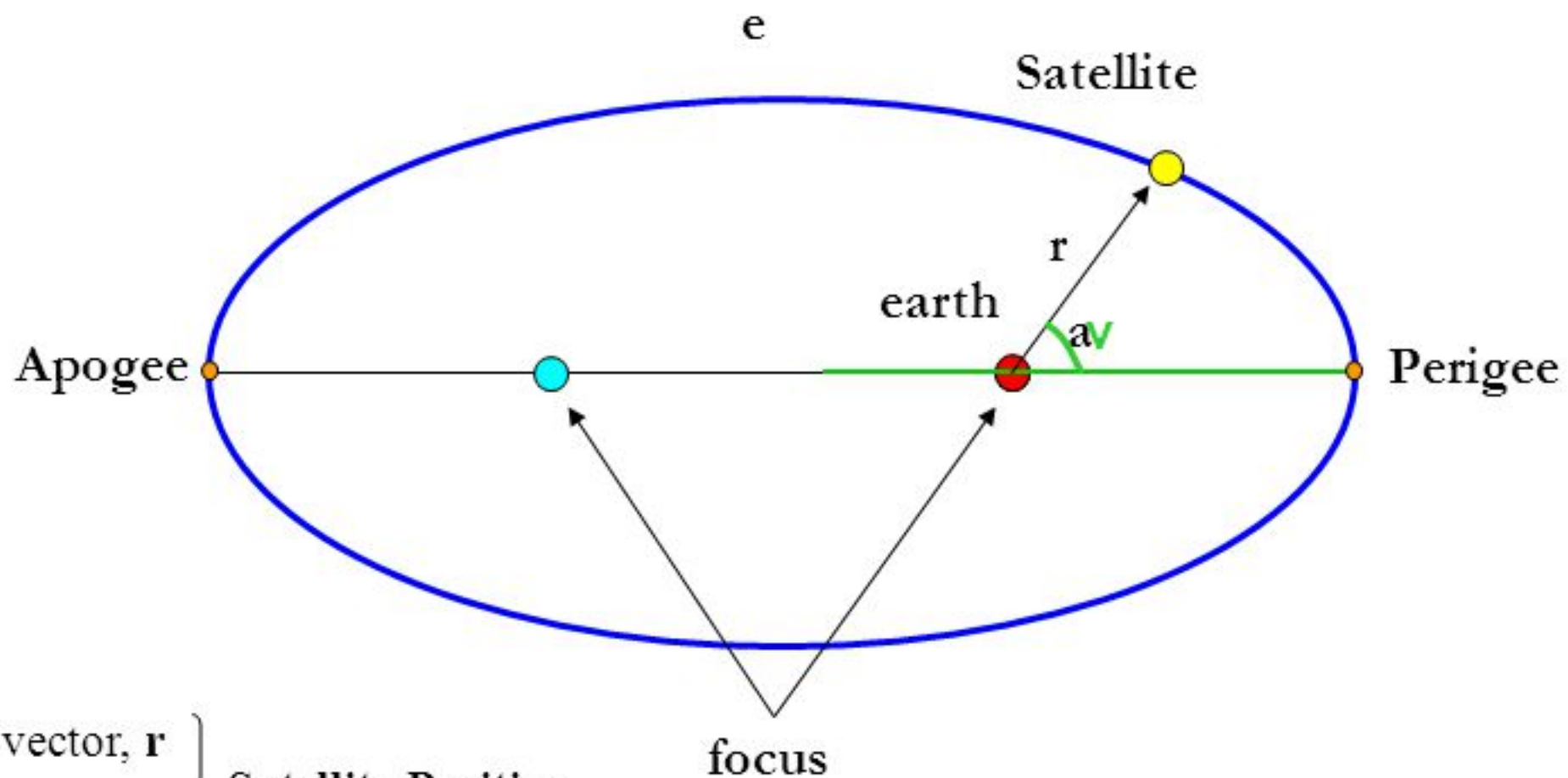
e Eccentricity

I Inclination of the orbit

Ω Right ascension of the ascending node

ω Argument of perigee

Navigation File: Satellite Orbit

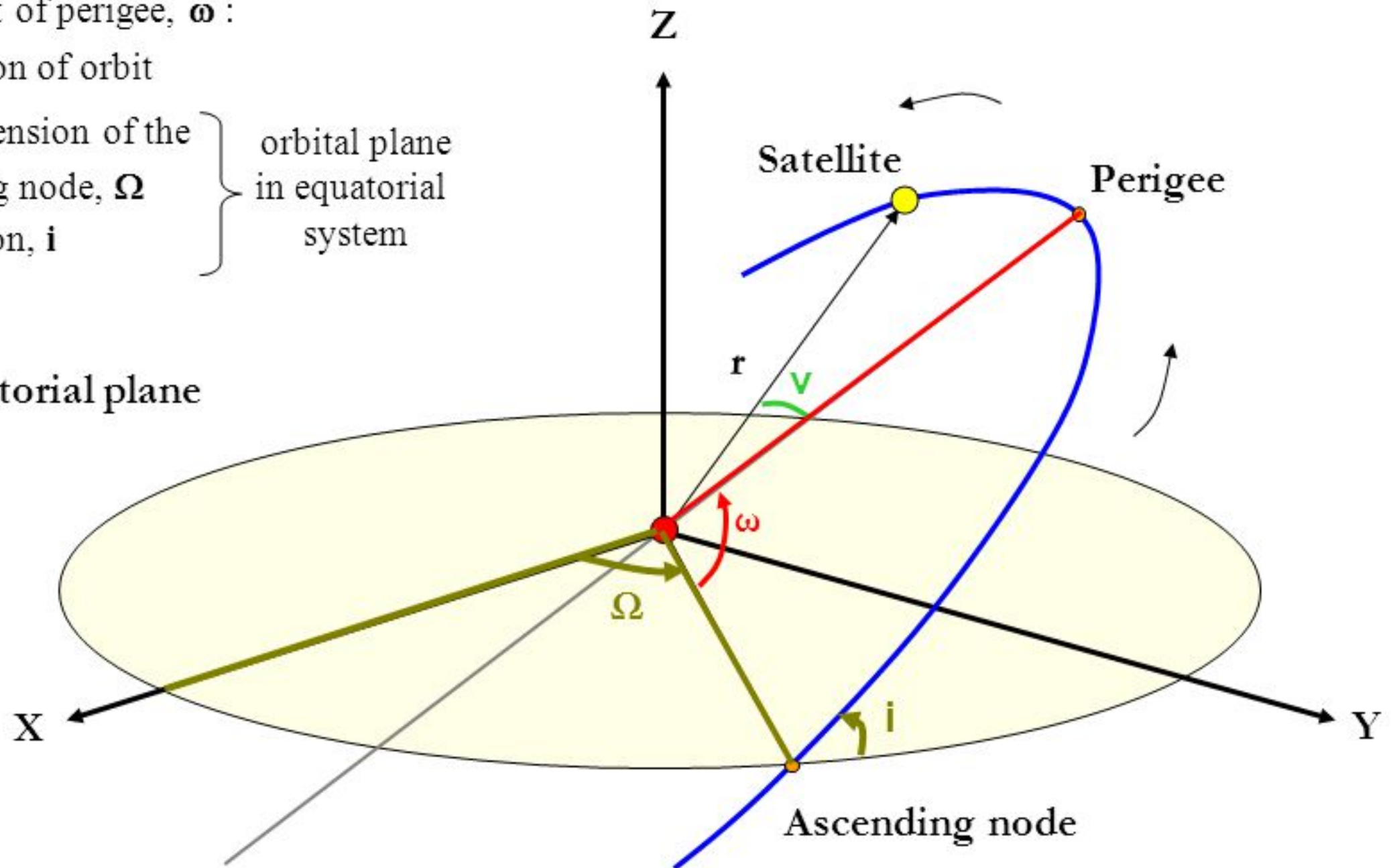


- position vector, \mathbf{r}
 - true anomaly, ν
- } **Satellite Position**
- semi-major axis, a : **Size of Orbit**
 - eccentricity, e : **Shape of Orbit**

Navigation File: Satellite Position

- argument of perigee, ω :
orientation of orbit
 - right ascension of the
ascending node, Ω
 - inclination, i
- } orbital plane
in equatorial
system

Equatorial plane



Navigation File

```

2.10      NAVIGATION DATA      RINEX VERSION / TYPE
SPIDER U2,0,0,2133      2006 06 06 00:04      PGM / RUN BY / DATE
6.5193D-09 2.2352D-08 -5.9605D-08 -1.1921D-07      ION ALPHA
8.6016D+04 9.8304D+04 -6.5536D+04 -5.2429D+05      ION BETA
5.587935447693D-09 1.598721155460D-14 319488 1378 DELTA-UTC: A0,A1,T,W
14      LEAP SECONDS
      END OF HEADER

1 06 06 04 16 00 0.0 5.727214738727D-05 2.501110429876D-12 0.000000000000D+00
4.200000000000D+01 1.412500000000D+01 3.978379847780D-09 4.955239025481D-01
7.934868335724D-07 6.164086284116D-03 7.648020982742D-06 5.153695802689D+03
5.760000000000D+04 -6.332993507385D-08 2.316258030610D+00 3.725290298462D-08
9.878682565181D-01 2.488750000000D+02 -1.735244248619D+00 -7.943902424756D-09
6.107397226840D-11 1.000000000000D+00 1.378000000000D+03 0.000000000000D+00
2.800000000000D+00 0.000000000000D+00 -3.259629011154D-09 4.200000000000D+01
5.760000000000D+04 0.000000000000D+00

2 06 06 05 00 00 0.0 2.374406903982D-06 2.955857780762D-12 0.000000000000D+00
2.400000000000D+01 3.512500000000D+01 4.850916557331D-09 -2.243202916805D-01
1.898035407066D-06 9.033586829901D-03 5.619600415230D-06 5.153686506271D+03
8.640000000000D+04 -1.359730958939D-07 1.792582557630D-01 -1.601874828339D-07
9.504802411915D-01 2.697187500000D+02 2.073989704647D+00 -8.402849971390D-09
2.464388415557D-11 1.000000000000D+00 1.378000000000D+03 0.000000000000D+00
2.800000000000D+00 0.000000000000D+00 -1.722946763039D-08 2.800000000000D+02
8.640000000000D+04 0.000000000000D+00

3 06 06 04 17 59 44.0 1.041260547936D-04 3.069544618484D-12 0.000000000000D+00
  
```

Navigation File of HKSC on 5 June 2006 from UTC Time 3:00 to 4:00

Navigation File: Data section

Satellite Number	Epoch	ao	a1	a2
IOD		Crs	Δn	Mo t0e
Cus		e	Cus	\sqrt{a}
t0e		Cic	Ω	Cis
I		Crc	ω	Ω dot
I dot		L2	GPS Week	L2 P code
Satellite accuracy		Satellite health	TGD	IODC
Transmission Time		Spare		

Mo t0e: Mean Anomaly

- Mathematical Abstraction of True Anomaly v

Navigation File: Data Section

HKSC_200606050300_200606050400 - 記事本

檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

2.10 NAVIGATION DATA				RINEX VERSION / TYPE	
SPIDER U2,0,0,2133				PGM / RUN BY / DATE	
2006 06 06 00:04				ION ALPHA	
6.5193D-09 2.2352D-08 -5.9605D-08 -1.1921D-07				ION BETA	
8.6016D+04 9.8304D+04 -6.5536D+04 -5.2429D+05				DELTA-UTC: A0,A1,T,W	
5.587935447693D-09 1.598721155460D-14 319488 1378				LEAP SECONDS	
14				END OF HEADER	
1	06 06 04 16 00	0.0 5.727214738727D-05	2.501110429876D-12	0.000000000000D+00	
	4.200000000000D+01	1.412500000000D+01	3.978379847780D-09	4.955239025481D-01	v (mean)
	7.934868335724D-07	6.164086284116D-03	7.648020082742D-06	5.153695802689D+03	\sqrt{a}
	5.760000000000D+04	-6.332993507385D-08	2.316258030610D+00	3.725290298462D-08	
i	9.878682565181D-01	2.488750000000D+02	-1.735244248619D+00	-7.943902424756D-09	
	6.107397226840D-11	1.000000000000D+00	1.378000000000D+03	0.000000000000D+00	
	2.800000000000D+00	0.000000000000D+00	-3.259629011154D-09	4.200000000000D+01	
	5.760000000000D+04	0.000000000000D+00			

Annotations: e , Ω , ω

Navigation File of HKSC on 5 June 2006 from UTC Time 3:00 to 4:00

Reference

- PowerPoint - RINEX Computation by CW Lau
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