Exam 1 Review:

Topics:

Basic 2BP relations & Conservation of $\mathcal{E}, \vec{h}$

OE's & Conversions to/from

orbit sketches

TOF

~~Open book/note~~

No internet & no friend help

~~You can refer to your matlab code, but don't run matlab~~

I will provided needed constants.

Any calculator.

You must sign the Honor Pledge.

Prob 7, HW2

a) B

b) A, B

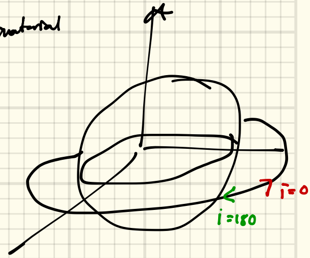
c) $\omega + \nu > 180° \Rightarrow$ A, C

d) C

e) $\omega > 180° \Rightarrow$ D

f) $\Omega = 0$ or $180° \Rightarrow$ A

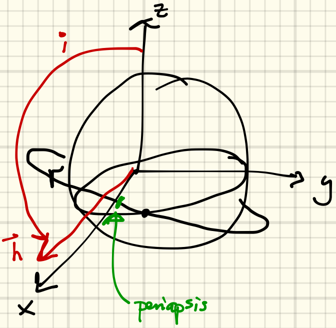
Equatorial

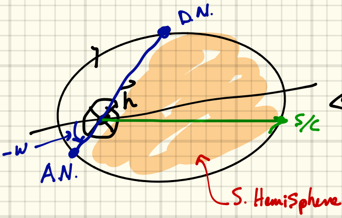


Drawing Orbits:

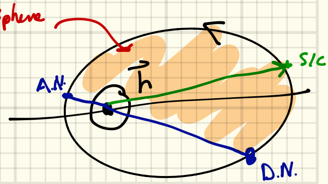
$a = 20{,}000$ km
$e = 0.3$
$i = 100°$

$\Omega = 20°$
$\omega = 10°$
$\nu = 200°$





These 2 sketches are equivalent



HW2 Prob 6:

a) 2 DU

b) e=0

c) i=180°

d) undefined

e) undefined

f) undefined

g) $\ell = 270°$

Conversion from OE to Cartesian:

Know: $a, e, i, \Omega, \omega, \nu \quad \mu$

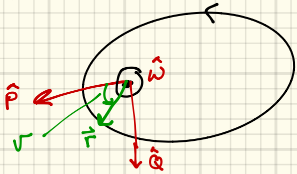
1. Express $\vec{r}, \vec{v}$ in the perifocal frame

2. Rotate from the perifocal frame to XYZ frame.

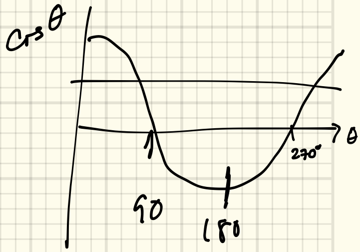
Step 1

$\vec{r} = r\cos\nu\,\hat{P} + r\sin\nu\,\hat{Q}$

$$r = \frac{p}{1+e\cos\nu} = \frac{a(1-e^2)}{1+e\cos\nu}$$



$$\vec{v} = \sqrt{\frac{\mu}{p}}\left[-\sin\nu\,\hat{P} + (e+\cos\nu)\hat{Q}\right]$$



Step 2: Rotate

$${}^{P}\vec{b} = \left[[R_{3\omega}][R_{1i}][R_{3\Omega}]\right]{}^{I}\vec{b}$$

$[R]^{-1} = [R]^T$

$${}^{I}\vec{b} = \left[[R_{3\omega}][R_{1i}][R_{3\Omega}]\right]^T {}^{P}\vec{b}$$

Time of flight:

S/C orbiting Earth. $a = 10{,}000$ km, $e = 0.3$, $i = 45°$, $\Omega = 300°$, $\omega = 0°$, $\nu_0 = 30°$

When will the S/C be @ $\nu = 60°$?

$$\boxed{t - t_0 = \sqrt{\frac{a^3}{\mu}}\left[2\pi k + (E - e\sin E) - (E_0 - e\sin E_0)\right]}$$

← Plug in a, μ, E, e, E_0 (E, E_0 in RADIANS)
$k=0$.

$$\cos(E) = \frac{e+\cos\nu}{1+e\cos\nu}$$ ← Plug in ν & ν_0 to get E & E_0

B/c ν & ν_0 are $<180°$, E & E_0 should also be less than 180°.

TOF on circular orbit:

$$TP = 2\pi\sqrt{\frac{a^3}{\mu}}, \quad a = r$$

$$t - t_0 = 2\pi\sqrt{\frac{a^3}{\mu}}\,\frac{\Delta\theta}{2\pi}$$ ← angular distance in Rad that the s/c travels