Home Work #4

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1 Question 1

1.1 Part a

Satellite is in 600 km altitude circular orbit. Sun-synchronous orbit is desired. Find the inclination of the orbit.
Solution:

$$i = \cos^{-1}\left(\frac{-2}{3}\frac{a^{7/2}\Delta\Omega(1-e^2)^2}{R^2 J_2\sqrt{\mu}}\right) = \cos -1\left(\frac{-2}{3}\frac{(6978.14)^{7/2}0.9856(1-0.0000)^2}{(6398.14)^2 0.00108263\sqrt{398600.4415}}\right) = 97.788^\circ \quad (1)$$

1.2 Part b

Satellite is in 600 km altitude elliptical orbit. Sun-synchronous orbit is desired. Find the inclination of the orbit with e = 0.1.
Solution:

$$i = \cos^{-1}\left(\frac{-2}{3}\frac{a^{7/2}\Delta\Omega(1-e^2)^2}{R^2 J_2\sqrt{\mu}}\right) = \cos^{-1}\left(\frac{-2}{3}\frac{(6978.14)^{7/2}0.9856(1-0.1)^2}{(6398.14)^2 0.00108263\sqrt{398600.4415}}\right) = 97.632^\circ \quad (2)$$

1.3 Part c

Here is 3D chart indicating the relation between inclination, eccen- tricity, and semi major axis of the orbit such that the orbit is Sun-Synchronous.

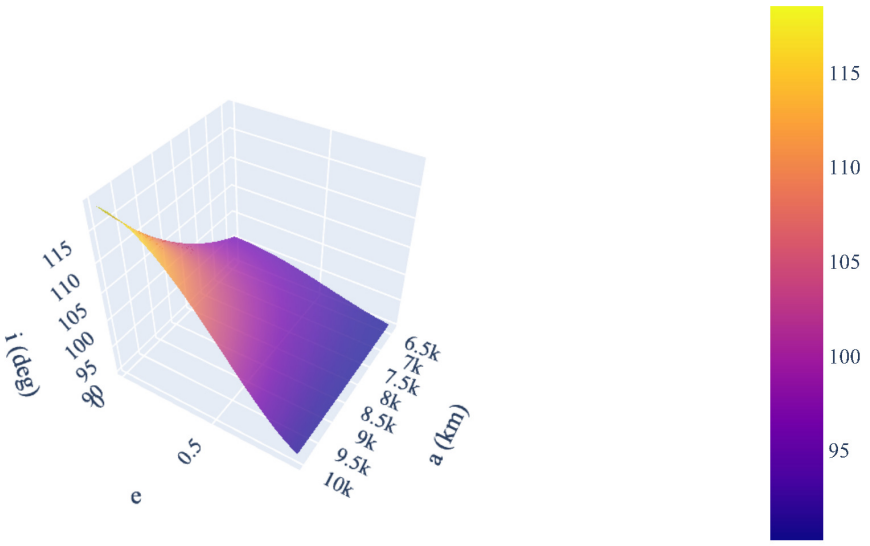

Figure 1: 3D plot of inclination, eccentricity and semi major axis

1.4 Part d

Here is the result for venus orbit.

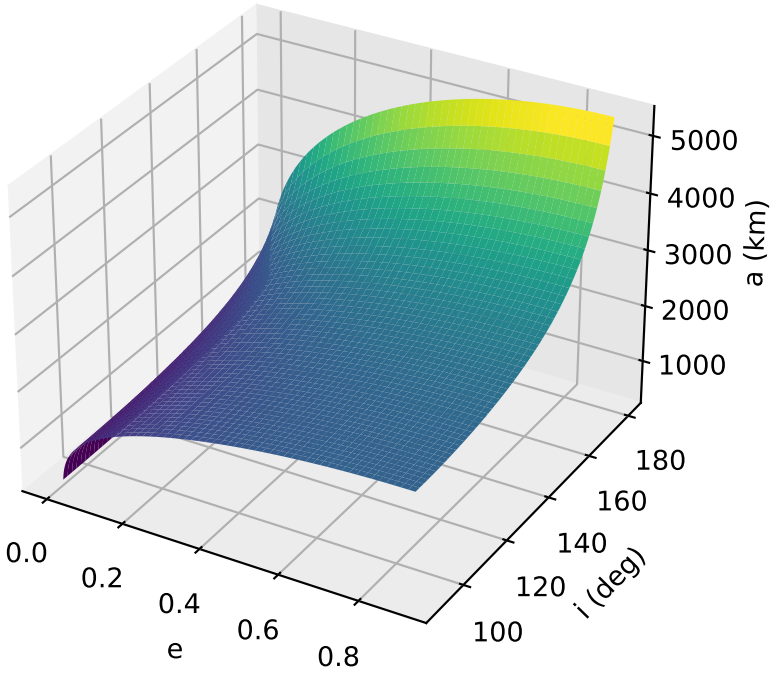

Figure 2: 3D plot of inclination, eccentricity and semi major axis for venus

and here is result for pregee of orbits and venus orbit.

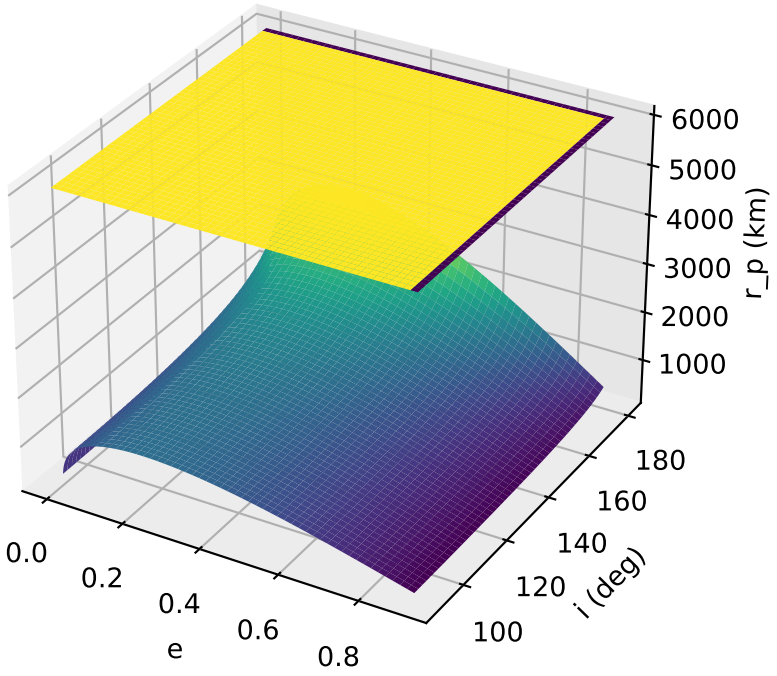

Figure 3: 3D plot of inclination, eccentricity and perigee with venus radius surface

As we can see from above fig is that perigee of orbits are less than venus radius, so it is impossible to have sun-synchronous orbit around venus.

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