Advanced Orbital Mechanics: Homework #4

Deadline: 19 Khordad 1402

Instructor: Dr. Maryam Kiani

(40 points) Problem 1

In this problem, we want to go deep into the Sun-Synchronous orbits.

a) (5 points) For a satellite with altitude of 600 km, find the inclination of the circular orbit such that the satellite is Sun-Synchronous.

b) (5 points) Consider $e = 0.1$ and repeat the previous part.

c) (15 points) Plot a 3D chart indicating the relation between inclination, eccentricity, and semi major axis of the orbit such that the orbit is Sun-Synchronous.

d) (15 points) Repeat the previous part for Venus planet (You can consider Venus J_2 is 0.4% of Earth). By analyzing this chart, explain why we can not have a Sun-Synchronous orbit around Venus.

(30 + 30 points) Problem 2

A satellite should repeat its grandtrack every 7.25 days with 115 revolutions. If the satellite has inclination of $i = 14.3^\circ$ and $e = 0.05$, find the semi major axis of the orbit.
HINT: Follow algorithm 71. Programmatic solution is recommended over manual solution.

(Bonus) Research about the acceptable groundtrack drift for this orbit and design the manuever to keep the groundtrack drift within the acceptable range.

(30 points) Problem 3

Calculate the orbital parameters needed to repeat every 6.875 days. The satellite should complete 107 revolutions during this period. Is a Sun-synchronous orbit possible at this altitude? Finally, design a repeat groundtrack-Sun synchronous orbit to accomplish these requirements. Assume a circular orbit, but consider different inclination values. How does the initial choice of inclination affect the results?

Rules

- Homeworks should be email to alavi_hassan@yahoo.com.
- Email's subject should follow this format:

  AOM HW1 - Student Number - Student Last Name

- Email should contain a zip file containing:
  - A pdf file containing the theoretical solutions.
  - A pdf file containing the computer-based results and reports (Could be combined with the previous file).
  - A folder containing all of the codes.
- Every student is allowed to deliver the homeworks with 10 days in total without penalty (During the semester).
- Every day delay would deduct 5 percent from the total score.
- After 10 days, homeworks would be accepted but at maximum, 50 percent of the score could be achieved.