Advanced Orbital Mechanics: Homework #5

Deadline: 31 Khordad 1402

Instructor: Dr. Maryam Kiani

(35 points) Problem 1

Trojan asteroids occupy L_4 and L_5 Lagrange points of the Sun-Jupiter system.

a) (15 points) Why the Trojan asteroids are not drifted away from these Lagrange points during the time (Mathematical proof is required)?

b) (20 points) Plot the Regions of $x - y$ motion for the Jupiter-Sun system (You can use figure 12-14 of Valado as your reference). This plot should consist of the following parts:

- The Sun.
- The Jupiter.
- Regions around the Lagrange points with their C values

(75 points) Problem 2

Consider the following values 1.

Variable	Value
x	0.82411
y	0
z	0.05821
$\dot{x}$	$423km$
$\dot{y}$	0
$\dot{z}$	0.16883
T	2.76301

Table 1: Time and initial values (The values are relative and ready to be used in the code).

a) (30 points) Iterate on the values to reach initial values of a Halo orbit. (You are free to use the attached 'CRTBPmodel.m' file for the simulation).

b) (25 points) Simulate the final result for the given time and plot the following diagrams.

- $x - y$ diagram.
- $x - z$ diagram.
- $y - z$ diagram.
- $x - y - z$ diagram.

c) (20 points) By adding a small perturbation to the initial values, evaluate the stability of the Halo orbit.

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.