Celestial Mechanics / Computational Astrodynamics

Spring 2024

HW No. 6

Due Tuesday, 28 May 2024, 24:00

1. Write a function in your preferred coding language to compute a table of fully normalized Associated Legendre Functions (fnALF's) up to maximum degree and order N. (20/100)
2. Verify that the fnALF's you computed satisfy the constraints. (5/100)
3. Write a function to compute the gravitational acceleration due to the geopotential in body-fixed axes. Make full use of the tabular values of the fnALF's you already computed in Problem 1. (30/100)
4. Write a function to Integrate the equations of motion of an Earth satellite subject to the gravitational perturbation of the geopotential. (5/100)
5. Use the initial state vector of LAGEOS 1 for April 20, 2022 at 00:00:00.00 UTC to propagate the orbit up to June 1, 2024 at 00:00:00.00 UTC. For I.C. refer to file **`LAGEOS 1 - 2022 Initial Conditions.txt`** (20/100)
6. Compute the topocentric coordinates (azimuth, elevation, range) of LAGEOS 1 for the Satellite Laser Ranging instrument at the ASI Center for Space Geodesy in Matera, Italy for the period 29-31 May 2024 every 30 s. (20/100)