Thesis plan

Abstract

1. Introduction Part
   1. Main task of the work (simulation environment in matlab for sufficiently precise orbit simulation)
   2. IRASSI mission description and motivation
   3. A few paragraphs about similar missions at L2
   4. Why L2, what advantages does it provide us with
   5. Information about halo orbits. Astrodynamical characteristics. Stability
   6. Methodology of precise orbit simulation – what is simulation, how it is carried out, factors affecting precision, what forces are usually taken into account (not only our mission specific ones), so include harmonics, drag and other irrelevant to L2 forces
2. Force model
   1. Environment
   2. Space environment around SEM L2 point
   3. Identification of forces having significant influence on our satellite movement.

Gravity of celestial bodies, SRP and thrust

Mention that magnetotail influences at L2 but affects only electronic systems which is beyond the scope of this thesis

* 1. Expected magnitudes of identified forces. Table
  2. Remark about significant cumulative influence of the celestial bodies in Solar system
  3. Threshold to ignore forces (e-13 km/s2)
  4. Modeling
     1. Gravity
        1. Restricted 3-body problem
        2. Stability of orbits
        3. equation of motion
        4. Assumptions made
        5. Vallado formula for N-body problem
        6. Provide and explain the formula
        7. SPICE kernel explanation. Main spice functions
        8. How do I get ephemeris for calculation of distance required for the formula of gravitational attraction
     2. SRP
        1. Info about solar radiation pressure
        2. Mention that I use simplified model. Why?
        3. Provide the main formula
        4. L2 -> no shadowing and eclipses
     3. Thrust forces
        1. Why do we need maneuvers (maintain HALO, not stable)
        2. How maneuvers are calculated
        3. Main principle
        4. Approximate magnitudes
     4. Relativistic correction (negligible most probably)
     5. Selection of suitable reference frame (Earth-centered)
     6. Implementation of this model in MATLAB. Description? Or code?

1. Numerical Integration

General info about main integrations schemes (one-step, multiple steps, error control)

High order vs lower order. Round off errors

A few words about 4-5 integrators and why I chose them for comparison

Methodology to compare the integrators (in my case reverse check and probably total energy check)

Matlab code?

Results for some training orbit? For further comparison. Perhaps for HALO the results would be different. Worth mentioning

Implementation.

Table with results of test. Graphs?

Results for HALO orbit. With maneuvers

Comparison and evaluation

Chosen integrator (RKV89 with error control system).

1. Orbit evaluation
   1. Astrodynamical characteristics of the obtained orbit
   2. Perhaps worth comparison of the precisely simulated orbit with the simplified model, like only SUN and Earth-Moon – restricted circular + SRP + maneuvers
   3. Conclusions about the influence of a simplified dynamics on the orbit simulation precision
2. Overall conclusion
   1. What has been done. What is the outcome, how might this outcome be used later