Automatic transfer between resonance orbits in the CR3BP using surfaces of section

Stage topic Description

Employing invariant manifolds and resonant flybys to mission analysis enables the design of previously unknown trajectory strategies and could potentially reduces the cost of a mission. Resonant orbits have some interesting properties, such as their periodic nature or their availability of free transfers between them that may be used for future missions.

Candidate's tasks

The purpose of this stage is to compute an automatic search process for transfers between resonant orbits. The resonant orbits are generated in the Circular Restricted Three-Body Problem (CR3BP). The use of surfaces of sections such as Poincare maps will be used to display the manifold structure that corresponds to the orbits and determine some potentiel heteroclinic connection between resonances. The stagiaire will have to program an algorithm that determine transitions between some given resonant orbits.

The ideal candidate

Strong programming skills (C/C++ and/or Fortran, Matlab).

Knowledge of the Circular Restricted-Three Body Problem.

References

Lo, M.W., and Parker, J.S., 'Unstable Resonant Orbits near Earth and Their Applications in Planetary Missions,' AIAA/AAS Astrodynamics Specialist Conference, Providence, Rhode Island, August 16-19 2004, Paper AIAA 2004-22819.

Vaquero, M., and Howell, K.C., 'Design of Transfer Trajectories Between Resonant Orbits in the Restricted Three-Body Problem with Application to the Earth-Moon System,' 1ST IAA/AAS Conference on the Dynamics and Control of Space Systems, Porto, Portugal, March 19-21, 2012.