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JET TRANSPORT PROPAGATION OF UNCERTAINTIES FOR ORBITS AROUND THE EARTH

Abstract

In this paper we present a new tool to study the non-linear propagation of uncertainties for orbits around the Earth. The tool we introduce is known as Jet Transport and allows to numerically propagate full neigbourhoods of initial states instead of a single initial state with usual integrators. The description of the image neighbourhood is obtained in a semi-analytical way by means of polynomials in 6 variables. These variables correspond to displacements in the phase space from the reference point selected in an orbit as initial condition.

The basis of the procedure is a standard numerical integrator of ordinary differential equations (such as a Runge-Kutta or a Taylor method) where the usual arithmetic is replaced by a polynomial arithmetic, in this way, the solution of the variational equations is obtained up to high order.

The method is applied to the propagation of satellite trajectories and to obtain the images, and high order nonlinear descriptions, of uncertainty ellipsoids. The procedure can be specially adapted to the determination of collision probabilities with cataloged space debris or for the end of life analysis of spacecraft in Medium Earth Orbits.