

Rigorous Global Optimization of Impulsive Planet to Planet Transfers

R. Armellin and P. Dilizia

Dipartimento di Ingegneria Aerospaziale
Politecnico di Milano
Via La masa 34, 20156 Milano, Italy

K. Makino and M. Berz

Department of Physics and Astronomy
Michigan State University
East Lansing, Michigan, 48824, USA

Abstract. The rigorous solution of a generic impulsive planet-to-planet transfer by means of a Taylor Model based global optimizer is presented. Although a planet-to-planet transfer represents the simplest case of interplanetary transfer, its formulation and solution is a challenging task as far as the rigorous global optimum is sought. A customized ephemeris function is derived from JPL DE405 to allow the Taylor Model evaluation of planets' positions and velocities. Furthermore, the validated solution of Lambert's problem is addressed for the rigorous computation of transfer fuel consumption. The optimization problem, which consists in finding the optimal launch and transfer times in order to minimize the required fuel mass, is complex due to the abundance of local minima and relatively high search space dimension. Its rigorous solution by means of COSY-GO is presented considering Earth–Mars and Earth–Venus transfers as test cases.