Numerical behavior of the Keplerian Integral methods for initial orbit determination

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Abstract

In this talk we explore the numerical behaviour of two recent methods presented in [1, 2] for the computation of preliminary orbits. These methods are based on the conservation laws of Kepler's problem, and enable the linkage of very short arcs of optical observations even when they are separated in time by a few years. Our analysis is performed using both synthetic and real data of 822 main belt asteroids. The differences between computed and true orbital elements have been analysed for the true linkages, as well as the occurrence of alternative solutions. Some metrics have been introduced to quantify the results, with the aim of discarding as many of the false linkages as possible and keeping the vast majority of true ones. These numerical experiments provide thresholds for the metrics which take advantage of the knowledge of the *ground truth*: the values of these thresholds can be used in normal operation mode, when we do not know the correct values of the orbital elements and whether the linkages are true or false.

References

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[2] Gronchi, G. F., Baù, G., and Milani, A. (2017) "Keplerian integrals, elimination theory and identification of very short arcs in a large database of optical observations". *Cel. Mech. Dyn. Ast.* 127/2, pp. 211–232

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