Numerical mean elements for asteroid orbits

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The calculation of proper elements for asteroid orbits refers presently to two different computations; a powerful analytical theory, developed by Milani and Knežević (1990, 1992, 1994) and a semi-numerical approach due to Lemaitre and Morbidelli (1994). The analytical theory, based on series expansions in eccentricity and inclination, is particularly suitable for low inclination and low eccentricity orbits, while the semi-numerical one refers to orbits with either large eccentricities or large inclinations. The superposition region has been tested and is situated about 17° in inclination.

Up to now even the semi-numerical approach has used the analytical mean elements as initial conditions for the computation of the proper elements; those mean elemnts, also obtained by series expansions by Milani and Knežević, could be sources of errors in the calculation of the proper ones for highly inclined or eccentric orbits. The purpose of this paper is to compare, for the numbered asteroids, the analytical mean elements with a complete set of numerical mean ones. For significative differences in the results, proper elements are then recalculated with the numerical initial conditions and compared to their previous values. Consequences on the presence of new high inclination families of asteroids are analyzed.