An efficient algorithm for approximate evaluation of Hansen coefficients

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On the basis of polynomial approximations and some special systems of recurrence formulae we develop an efficient algorithm for computation of Hansen coefficients and their derivatives in theories of motion of celestial bodies. The recurrence algorithm is constructed with the help of a special system of recurrence relations giving a connection only between Hansen coefficients included into expansion of disturbing function of satellite or planetary motion. This system of recurrence relations is obtained by means of computer algebra and gives a possibility to make recurrencies both from low to high and from high to low harmonics of disturbing function for perturbations both from external and internal bodies. Computation of initial values for recurrencies and correction of values of Hansen coefficients inside the recurrencies are made with the help of approximation of Hansen coefficients by polynomials with respect to eccentricity. We investigate in detail the numerical efficiency and some other properties of different approximating schemes: in particular, Lagrange interpolation, Taylor expansion and Chebyshev approximation. Some estimations on the accuracy of these approximations are presented in the report at the conference. Using polynomial approximations we correct the numerical values of Hansen coefficients in the recurrence process, that allows to decrease the accumulation of errors of recurrencies in computing the Hansen coefficients. The author thanks DFG (Deutsche Forschungsgemeinschaft) for the financial support of this research.