



The free-core-nutation of triaxial Earth

W.-J. Wang (1), W.B. Shen (2)

(1)School of Surveying and Land Information, Henan Polytechnic University, (2) Department of Geophysics/Key Lab. of Geospace Environment and Geodesy, School of Geodesy and Geomatics, Wuhan University, China (wbshen@sgg.whu.edu.cn; wwj@asch.whigg.ac.cn)

Earth's principal moments of inertia possess no biaxiality with the difference of A to B only 1/150 of that of A to C. And that of the fluid core is 1/5.3. So the former Earth rotation theory treats the rotation according to biaxial Earth ignoring the difference of A to B. Some of the works considered the effects of the difference on the free normal modes of Chandler wobble and Free-Core-Nutation (FCN). Those works discovered that the approximations had high enough accuracy. However, the former Earth rotation theory can hardly explain many mechanisms of terms of long period polar motion. In this study, following the theorem that the solution of rotation for triaxial body may be decomposed as straight product of three single pendulums with two positively hung and one inversely set, and the result that the rotation may have two stable elliptic trajectories and one instable saddle point for the case of single plane inverted pendulum, we obtain from Poincaré's core-mantle coupling model twin free polar motions and twin FCNs. Except free Chandler wobble of period 435 d and FCN of period 460 d, there are also twin free polar motion of period 14.6 yr and twin FCN of period 1488.55d or 4.0755 yr for triaxial Earth. The nearly diurnal free nutation respect to the latter second free core nutation is of frequency -0.9993282053 cpd or the second nearly diurnal free wobble resonant at -1.000672246311 sidereal day= -0.99793995244 d= -23.95055885857 h= $23^h57^m2.01189^s$. The third solution for the FCN is the secular wander for the CMB that yields the tumbling of the CMB for the reversal of the geomagnetic polarity. The relative motion of the mantle with respect to the liquid core is specified as about 698 times faster than the tumbling velocity of the mantle so that the reversal velocity of the CMB may be 698×3.5 mas/yr and the reversal timescale of the CMB as reversal of the geomagnetic polarity may be 185 Myr/ $698=0.264$ Myr almost identical to the record reversal timescale of 0.268 Myr.