THE POLAR MOTION AND THE DRACONITIC PERIOD

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ABSTRACT. The main topic of this paper is to study how an average of the periods belonging to the circular components of the polar motion (Chandler's wobble) can be determined and its supervision through a connection with the period of the lunar precession. There is an average period of the polar circular periods, well determined, using the synodic polar periods as weights. These ones are offering to the determined medium polar period, precision and stability. There is an empirical connection between the equation of the eclipses' year (the draconitic year) and the medium circular polar period, determined on the basis of the polar synodic periods, whose accuracy is offered by the proximity of its value to 435.4 days. We propose the following equation: $1/T = 1/435.42\, z + 4/T2$ and $1/T1 = 1/435.42z + 3/T2$, derived from the equation of the draconitic year (the eclipses' year) $1/T = 1/T1 + 1/T2$.

1. GOAL, METHODS AND EXAMPLES

The goal of this paper is to determine a medium circular polar period (Chandler's wobble) stable and accurate and to supervise the circular polar periods through a connection between the medium circular polar period and the lunar precession period. For determining the medium circular period we have introduced the indirect usage as weights of the synodic periods of the circular polar periods. We are taking in consideration the following: Pi= the polar circular periods; Si= the polar synodic periods. For each polar period we can determine the synodic period related to it, adjusted to a Pm period, closed to the average: $1/Si = |\ 1/Pi \pm 1/Pm\ |$ (1).

Making determinations of synodic polar periods' sum for different Pm values, the medium circular polar period can be defined as being that Pm value for which the sum of the synodic periods is minimal. The advantages are: 1) the synodic polar periods of the extreme spires (related to the circular polar periods that are very small or very big) are going to have quite small weights as compared with the average, while the synodic polar periods of the medium spires (with small errors) are going to have quite big weights, as compared also with the average; 2) the average of the polar motion that is calculated in this way, is very stable, remaining unchanged even in the case of eliminating some terms, especially the extreme ones (because they have an insignificant share to the creation of the average). In this way, there can be diminished, without affecting the average, the circular polar periods with extreme values (and not only), bearers of the deviations with the greatest values. For the surveillance of the circular polar periods, the empirical connection between the average circular polar period and the lunar precession can be used. The known equation of the eclipses' year is: $1/T = 1/T1 + 1/T2$ (2), where: $T = 346.62$ days (the eclipses' year) $T1 = 365.24$ days (the tropical medium year) and $T2 = 18.6128 \times 365.25$ days (the period of the lunar precession). Decomposing equation (2) into two other equations (3) and (4), the value of 435.42 days close to that of the medium polar period there is underlined:

$1/T = 1/435.42\, z + 4/T2$ (3) and
$1/T1 = 1/435.42z + 3/T2$ (4).

We can observe the fact that if we decrease term by term, equation (3) and (4), we get the known equation of the eclipses' year or of the draconitic year (1). Equation (3) shows us that the eclipses' year (T) is synodic combined with the period of 435.42 days and with a quarter (1/4) from the lunar precession period. In equation (4) there can be seen that the tropical medium year (T1) is synodical combined with a period of 435.42 days and with a third (1/3) from the lunar precession period.

Making some practical determinations of the spires belonging to polar motion, having as references for the circular polar periods the EOP (IERS) C04 data, between the years of 1962-2006, it resulted a polar medium period with values between 435 and 436 days, slightly different from Chandler's wobble. There is an empirical connection between the medium circular polar period and the period of 435.42

days, because in the previous examples that medium circular polar period is closed to the period of 435.42 days. But when it is slightly different from this one, the difference is reduced by eliminating some terms that are generally related to very small circular polar periods. That is why in the example above mentioned, the average of 435.7 was diminished to 435.4 days, through the elimination of the smallest circular synodic periods. The same method was applied to other examples. It should be underlined that by eliminating these circular synodic periods with quite small weights, the deviation with quite big values is also eliminated. This leads to an improved accuracy and to a potential of using it within the field of predictability. The coincidence between the average of the polar circular components with the period of 435.42 days allows the usage of the synodic combination from equations (3) and (4).

2. REFERENCES

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