Prediction of pole coordinates data by combination of least squares extrapolation and the weighted autoregressive prediction model

Wieslaw Kosek (1,2) and Maciej Kalarus (2)

(1) Agriculture University of Krakow, Geodesy, Environmental Engineering and Land Surveying Department,, Krakow, Poland (kosek@cbk.waw.pl), (2) Space Research Centre of the Polish Academy of Sciences, Warsaw, Poland

Real time transformation between the celestial and terrestrial reference frames needs prediction of x, y pole coordinates data, UT1-UTC data as well as precession-nutation model. This paper is focused on the pole coordinates data prediction using combination of the least-squares extrapolation and autoregressive prediction (LS+AR). The AR prediction model with Akaike's Information Criterion (AIC) applied to the LS extrapolation residuals of pole coordinates data, sampled at 1 day sampling interval, does not able to predict all frequency bands of them because it is mostly tuned to subseasonal oscillations. The wavelet spectra of the differences between the future pole coordinates data and their predictions for different prediction lengths show some power in the frequency band corresponding to prograde and retrograde irregular high frequency oscillations as well as the prograde Chandler and annual oscillations. It means that the increase of pole coordinate data prediction errors is caused by irregular high frequency variations as well as mismodelling of the Chandler and annual oscillations in the LS extrapolation model. In order to forecast the residual Chandler and annual oscillations in the LS extrapolation residuals these data were interpolated at 2, 4 and 8 days sampling intervals and the AR predictions models were computed using the same AIC. The final AR prediction of the LS extrapolation residuals is computed as the weighted mean of these AR predictions based on different sampling intervals. It enables modelling of the residual Chandler and annual oscillations in the LS extrapolation residuals and in the weighted AR prediction model.