

User manual to eop_alignment

Leonid Petrov

Abstract:

This document is a brief user manual for program eop_alignment

Table of contents:

- 1 [Overview](#)
 - 2 [Usage](#)
 - 3 [Output](#)
 - 4 [Algorithm](#)
-

1 Overview

Program EOP_ALIGNMENT is for computing right hand side of NO_NET_rotation/translation constraint equations of global VLBI solutions in order to eliminate relative shift and drift of polar motion and UT1 time series with respect to IERS C04 series.

2 Usage

Usage: eop_alignment <sol-file> <nn-cons-list> <IERS-C04-file>

<sol-file> -- generic name of the output files obtained from parsing spool file with using program getpar.

<nn-cons-list> -- List of NNT-POS constraints used in solution.

This list can be found in Spool file just before the section of global parameters. Cut this list, put it into the file and feed it eop_alignment.

<IERS-C04-file> -- external EOP file in IERS C04 format as it was 2002.05.20

3 Output

eop_alignment writes right hand side of constraint equations in the screen. Just copy these lines and insert them to your Batch control file. If your previous solution had zero net-rotation, net-translation constraints, the new solution will have zero shift and drift with respect to IERS C04. Station position and velocity will be reciprocally changed with respect to the previous solution, of course.

4 Algorithm

1) Compute the difference between EOP from the Solve solution with zero right part and IERS C04. Compute weighted secular drift and the shift with respect to IERS C04 at the reference epoch for which station positions in this solution were obtained.

2) Compute the right hand side of constraint equations.

Shift and drift of EOP series with respect to a reference is equivalent to a net-translation/rotation of station positions and velocity field. It can be written as:

$$M * T = D$$

where M -- matrix of dimension 3*6

(N_pos -- total number of station position, N_vel -- total number of station velocity. If a station had an episodic motion, than its position is counted twice) in the form

$$\begin{array}{cccccc} 1 & 0 & 0 & 0 & r3 & -r2 \\ 0 & 1 & 0 & -r3 & 0 & r1 \\ 0 & 0 & 1 & r2 & -r1 & 0 \end{array}$$

... station 2, station 3 ... station N_pos

$$\begin{array}{cccccc|cccc} 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & r3 & -r2 & \backslash \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & -r3 & 0 & r1 & | \text{ Station 1} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & r2 & -r1 & 0 & / \end{array}$$

... station 2, station 3 ... station N_vel

guide eop_alignment

T -- 6-dimensional vector of transformation: translation and rotation;

D -- 3-dimensional vector of station displacements due to a transformation.

Summing over all station (if a station had an episodic motion, than its position is counted twice) we get the system of linear algebraic equations:

$$\text{Sum}_i (M_i * T = D_i)$$

LSQ solution of this problem will be in the form

$$T' = (\text{Sum}_i \text{Sum}_j M_i * M_j)^{-1} * \text{Sum}_i (M_i * D_i) \quad (j \leq i)$$

We can re-write this equation as

$$\text{Sum}_i (M_i * D_i) = (\text{Sum}_i \text{Sum}_j M_i * M_j) * T' \quad (j \leq i)$$

This is just the equation of net-rotation, net-translation constraint used in Solve. Setting the vector T' to the shift between the EOP series

$$T' = \begin{pmatrix} X_shift \\ -Y_shift \\ UT1_shit \end{pmatrix}$$

we compute the right hand-side of constraint equation for net-translation/net-rotation.

Analogously we compute right hand-side of constraint equation for net-translation/net-rotation for velocities. But in summing the stations with episodic motion are counted only once.

Caveat: the present version assumes that all stations which participated in no-net-translation constraints for positions participated in no-net-translation for velocity and no-net-rotation for both position and velocity.

Questions and comments about this guide should be sent to:

Leonid Petrov (sgdass@lists.nasa.gov)

Last update: 2002.05.20