Bancroft Method

Professor : Dr. Farzaneh

St : AmirAbbas Saberi

University of Tehran

December,12,2022

Bancroft Method :

If we want to be able obtain primitve receiver's position without priori knowledge, one of the solutions is Bancroft method.

$$B^T a - B^T B M \begin{bmatrix} r \\ c\delta t \end{bmatrix} = \Lambda B^T \mathbf{1} = 0 \tag{1}$$

$$\begin{bmatrix} r \\ c\delta t \end{bmatrix} = M(B^T B)^{-}1 B^T (\Lambda \mathbf{1} + a) \tag{2}$$

$$\langle (B^T B)^{-}1 B^T \mathbf{1} \, , \, (B^T B)^{-}1 B^T \mathbf{1} \rangle \Lambda^2 + 2[\langle (B^T B)^{-}1 B^T \mathbf{1} \, , \, (B^T B)^{-}1 B^T a \rangle] \Lambda + \langle (B^T B)^{-}1 B^T a \, , \, (B^T B)^{-}1 B^T a \rangle = 0 \tag{3}$$

where :

$$B = \begin{bmatrix} x^1 & y^1 & z^1 & PR^1 \\ x^2 & y^2 & z^2 & PR^2 \\ x^3 & y^3 & z^3 & PR^3 \\ . & . & . & . \\ . & . & . & . \\ . & . & . & . \\ x^n & y^n & z^n & PR^n \end{bmatrix}, a = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ . \\ . \\ . \\ a_n \end{bmatrix}, a_j = \tfrac{1}{2} \langle \begin{bmatrix} r^j \\ PR^j \end{bmatrix} \, , \, \begin{bmatrix} r^j \\ PR^j \end{bmatrix} \rangle$$

$$\Lambda = \tfrac{1}{2} \langle \begin{bmatrix} r \\ c\delta t \end{bmatrix} \, , \, \begin{bmatrix} r \\ c\delta t \end{bmatrix} \rangle, \mathbf{1} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ . \\ . \\ . \\ 1 \end{bmatrix}$$

resualt : (n = 6 point)

$$BancroftPosittion = \begin{bmatrix} -3857164.451 \\ 3108682.818 \\ 4004057.945 \end{bmatrix}, RinexPosition = \begin{bmatrix} -3857167.648 \\ 3108694.913 \\ 4004041.687 \end{bmatrix}$$

$$\Delta P_{Bancraft,Rinex} = \begin{bmatrix} 3.196 \\ -12.094 \\ 16.258 \end{bmatrix}$$