Skoltech

Skolkovo Institute of Science and Technology

“Space Data Processing: Making Sense of Experimental Data”

Laboratory work 12
Joint assimilation of navigation data coming from different sources

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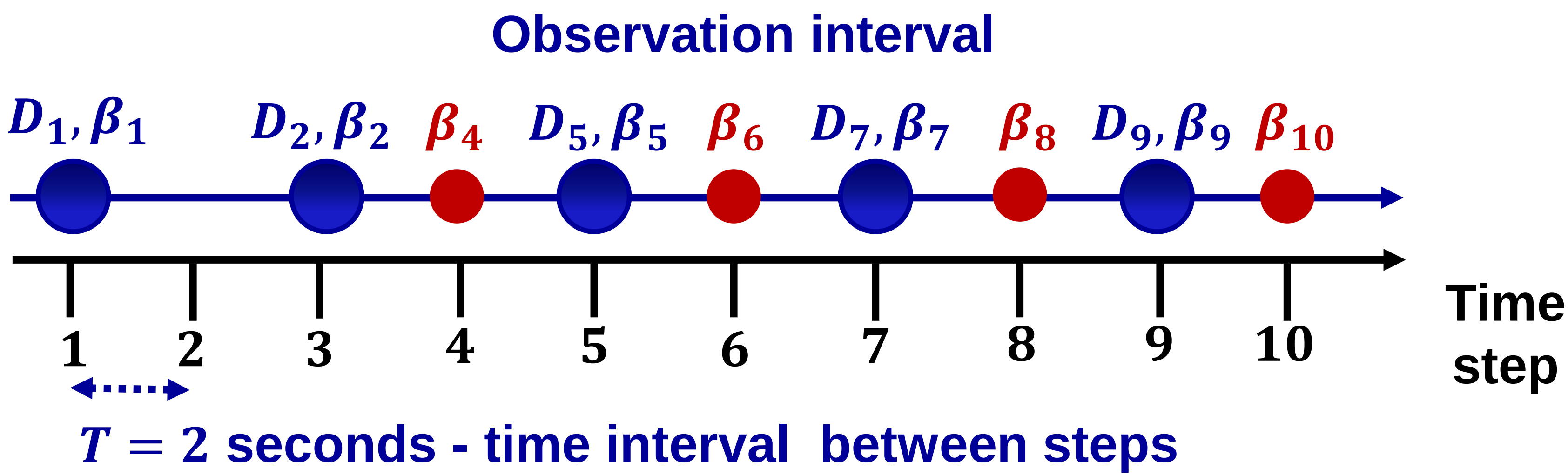
Navigation data coming from different sources



1 First observer → **Measurements of distance D and azimuth β are available every 4 seconds**

2 Second observer → **More accurate measurements of only azimuth β between measurement times of the first observer**

Measurement equation for the first observer

Measurement equation → $z_i = h(X_i) + \eta_i$

Measurement vector z_i

$$z_i = \begin{vmatrix} D_i^m \\ \beta_i^m \end{vmatrix}$$

Nonlinear function $h(X_i)$

$$h(X_i) = \begin{vmatrix} \sqrt{x_i^2 + y_i^2} \\ arctg\left(\dfrac{x_i}{y_i}\right) \end{vmatrix}$$

Observation function for the first observer

Nonlinear function $h(X_i)$

$$h(X_i) = \begin{vmatrix} \sqrt{x_i^2 + y_i^2} \\ arctg\left(\frac{x}{y}\right) \end{vmatrix}$$

Derivative with respect to X_{i+1} at point $\widehat{X}_{i+1,i}$

$$\frac{dh(\widehat{X}_{i+1,i})}{dX_{i+1}} = \begin{vmatrix} \frac{x_{i+1,i}}{\sqrt{x_{i+1,i}^2 + y_{i+1,i}^2}} & 0 & \frac{y_{i+1,i}}{\sqrt{x_{i+1,i}^2 + y_{i+1,i}^2}} & 0 \\ \frac{y_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} & 0 & -\frac{x_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} & 0 \end{vmatrix}$$

Measurement equation for the second observer

Measurement equation

$$z_i = h(X_i) + \eta_i$$

Measurement vector z_i

$$z_i = |\beta_i^m|$$

Nonlinear function $h(X_i)$

$$h(X_i) = \left| arctg\left(\frac{x_i}{y_i}\right) \right|$$

Observation function for the second observer

Nonlinear function $h(X_i)$

$$h(X_i) = \left| arctg\left(\frac{x_i}{y_i}\right) \right|$$

Derivative with respect to X_{i+1} at point $\hat{X}_{i+1,i}$

$$\frac{dh(\hat{X}_{i+1,i})}{dX_{i+1}} = \left| \frac{y_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} \quad 0 \quad -\frac{x_{i+1,i}}{x_{i+1,i}^2 + y_{i+1,i}^2} \quad 0 \right|$$