既知状態量の共分散が与えられる場合の推定

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$$\boldsymbol{x} = \begin{pmatrix} \boldsymbol{x}_{est} \\ \boldsymbol{x}_{known} \end{pmatrix}, \qquad \boldsymbol{P} = \begin{pmatrix} \boldsymbol{P}_{est} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{P}_{known} \end{pmatrix}$$

$$\boldsymbol{G} = \left.\frac{\partial g}{\partial \boldsymbol{x}}\right|_{\boldsymbol{x}_{est} = \hat{\boldsymbol{x}}_{est}^{-},\, \boldsymbol{x}_{known} = \boldsymbol{x}_{known}} = \begin{pmatrix} \dfrac{\partial g}{\partial \boldsymbol{x}_{est}} & \dfrac{\partial g}{\partial \boldsymbol{x}_{known}} \end{pmatrix} = \left(\boldsymbol{G}_{est}, \boldsymbol{G}_{known}\right)$$

$$\begin{aligned} \boldsymbol{K} &= \boldsymbol{P}^{-}\boldsymbol{G}^{T}\left(\boldsymbol{G}\boldsymbol{P}^{-}\boldsymbol{G}^{T} + \boldsymbol{R}\right)^{-1} \\ &= \begin{pmatrix} \boldsymbol{P}_{est}^{-} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{P}_{known} \end{pmatrix}\begin{pmatrix} \boldsymbol{G}_{est}^{T} \\ \boldsymbol{G}_{known}^{T} \end{pmatrix}\left(\begin{pmatrix} \boldsymbol{G}_{est} & \boldsymbol{G}_{known} \end{pmatrix}\begin{pmatrix} \boldsymbol{P}_{est}^{-} & \boldsymbol{0} \\ \boldsymbol{0} & \boldsymbol{P}_{known} \end{pmatrix}\begin{pmatrix} \boldsymbol{G}_{est}^{T} \\ \boldsymbol{G}_{known}^{T} \end{pmatrix} + \boldsymbol{R}\right)^{-1} \\ &= \begin{pmatrix} \boldsymbol{P}_{est}^{-}\boldsymbol{G}_{est}^{T} \\ \boldsymbol{P}_{known}\boldsymbol{G}_{known}^{T} \end{pmatrix}\left(\boldsymbol{G}_{est}\boldsymbol{P}_{est}^{-}\boldsymbol{G}_{est}^{T} + \boldsymbol{G}_{known}\boldsymbol{P}_{known}\boldsymbol{G}_{known}^{T} + \boldsymbol{R}\right)^{-1} \end{aligned}$$

$$\boldsymbol{K}_{est} = \boldsymbol{P}_{est}^{-}\boldsymbol{G}_{est}^{T}\left(\boldsymbol{G}_{est}\boldsymbol{P}_{est}^{-}\boldsymbol{G}_{est}^{T} + \underline{\boldsymbol{G}_{known}\boldsymbol{P}_{known}\boldsymbol{G}_{known}^{T}} + \boldsymbol{R}\right)^{-1}$$

$$\hat{\boldsymbol{x}}_{est}^{+} = \hat{\boldsymbol{x}}_{est}^{-} + \boldsymbol{K}_{est}(\boldsymbol{z} - \boldsymbol{g}(\hat{\boldsymbol{x}}_{est}^{-}, \boldsymbol{x}_{known}))$$

$$\boldsymbol{P}_{est}^{+} = \boldsymbol{P}_{est}^{-} - \boldsymbol{K}_{est}\boldsymbol{G}_{est}\boldsymbol{P}_{est}^{-}$$