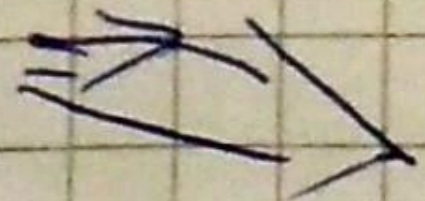


1.3 system identification

Since $K=1$, we can write the matrix product: $\underline{y}[k] = \underline{\hat{H}} \cdot \underline{x}[k] + \underline{w}[k]$, or
 for every k , we get: $\underline{y} = \underline{\hat{H}} \underline{x} + \underline{w} \Rightarrow \underline{x}_{\text{est}} = (\underline{\hat{H}}^T \underline{C}^{-1} \underline{\hat{H}})^{-1} \underline{\hat{H}}^T \underline{C}^{-1} \underline{y}$, where
 $\underline{C} = \begin{cases} 1, i=j \\ 0, i \neq j \end{cases}$ For MMSE we used the ~~same~~ computationally efficient formula: $\sigma_{\text{MMSE}} = \sigma_w^2 + (\underline{H}^T \underline{C}_{xx} \underline{H} + \underline{C}_{yy})^{-1} \underline{H}^T \underline{C}_{xy} (\underline{x} - \underline{H} \underline{m}_x)$.
 $\underline{C} = \begin{cases} 1, i=j \\ 0, i \neq j \end{cases}$ For MMSE we used the ~~same~~ computationally efficient formula: $\sigma_{\text{MMSE}} = \sigma_w^2 + (\underline{H}^T \underline{C}_{xx} \underline{H} + \underline{C}_{yy})^{-1} \underline{H}^T \underline{C}_{xy} (\underline{x} - \underline{H} \underline{m}_x)$.

METRIC: reasoning: If we use P to estimate channel - zero efficiency.
 • SNR $\uparrow \Rightarrow$ MSE \downarrow , $Q \uparrow \Rightarrow$ MBSE \downarrow



a) $\Downarrow \left(1 - \frac{Q}{P}\right) \Leftarrow$ the lower the Q , the more ~~data~~ we transmit \Rightarrow higher ~~collected~~
 • If $Q = P$ (all to estimate) \Rightarrow zero error

b) $\log_2 \left(1 + \frac{1}{\text{MSE}} \cdot \text{SNR}\right) \Leftarrow$ SNR $\uparrow \Rightarrow$ MSE \downarrow
 MSE is in the denominator
 scaling factor
 for a high SNR and ~~bad~~ improvement (small value)
 for a small SNR and ~~bad~~ performance (high value) for a small SNR