⑤ ⑧

$$\hat{y}(n) = \frac{1}{M}\sum_{l=1}^{M} y^{(l)}(n) \qquad y^{(l)}(n) = y\big(n+(l-1)N_p\big)$$

$$\downarrow$$

$$\hat{Y}(k) \Longrightarrow \left[\hat{G}_{ML}(j\omega_k) = \frac{\hat{Y}(k)}{\hat{U}(k)}\right]$$

MAXIMUM LIKELIHOOD SOLUTION FOR GAUSSIAN DISTURBANCES IF THE REPEATED MEASUREMENTS INDEPENDENT OVER l

- $\underset{M\to\infty}{\text{a.s.}\lim}\ \hat{G}_{ML} = \dfrac{\text{a.s.}\lim \hat{Y}}{\text{a.s.}\lim \hat{U}} = \dfrac{Y_0}{U_0} = G_0$
- $\hat{G}_{ML}(j\omega_k) = G_0(j\omega_k) + \underbrace{O\left(\frac{1}{\sqrt{M}}\right)}_{\text{ATTENUATED NOISE}} \sim N\left(G_0, \sigma^2_{\hat{G}_{ML}}\right)$

$$U^{(l)}(k) = DFT\left(u^{(l)}(n)\right) \ \dots \qquad \left[\hat{G}_{ML}(j\omega_k) = \frac{\hat{Y}(k)}{\hat{U}(k)}\right] \ \text{(FREQUENCY-DOMAIN)}$$

$$\hat{U}(k) = \frac{1}{M}\sum U^{(l)}(k) \ \dots$$

$$\hat{\sigma}_U^2(k) = \frac{1}{M-1}\sum \left|U^{(l)}(k) - \hat{U}(k)\right|^2$$

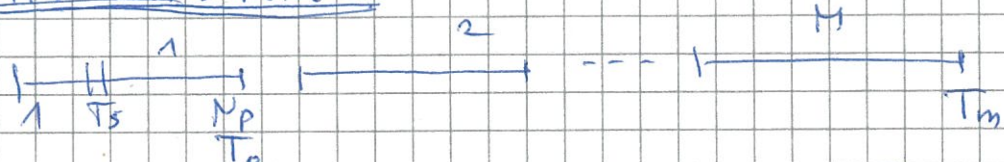
$$\hat{\sigma}_Y^2(k) = \frac{1}{M-1}\sum \left|Y^{(l)}(k) - \hat{Y}(k)\right|^2$$

(UNBIASED ESTIMATES)

$$\hat{\sigma}_{YU}^2(k) = \frac{1}{M-1}\sum \left(Y^{(l)}(k) - \hat{Y}(k)\right)\overline{\left(U^{(l)}(k) - \hat{U}(k)\right)}$$

$$\hat{\sigma}_G^2(k) = \frac{\left|\hat{G}_{ML}(k)\right|^2}{M}\left(\frac{\hat{\sigma}_U^2}{|\hat{U}(k)|^2} + \frac{\hat{\sigma}_Y^2}{|\hat{Y}(k)|^2} - 2\,\mathrm{Re}\left(\frac{\hat{\sigma}_{YU}^2(k)}{\hat{Y}(k)\,\overline{\hat{U}(k)}}\right)\right)$$

DESIGNING MEASUREMENT



$$f_0 = \frac{1}{T_0} \qquad M\cdot N_p T_s = T_m$$

$$T_0 = N_p\cdot T_s \qquad f_0 = f_s/N_p$$

$$\boxed{\underbrace{M}_{\substack{\text{BLOCKS}\\ \text{VARIANCE}}} = \underbrace{T_m}_{\text{MEASUREMENT TIME}}\cdot \underbrace{f_0}_{\text{RESOLUTION}}}$$