

- Slide 6-203: “DEF” should be “DFE”.
- Slide 6-204: I replace

$$C = B \log_2(1 + \text{SNR}) \text{ bps}$$

by

$$C = B \log_2(1 + \text{SNR}) \text{ b/s} = \frac{1}{2} \log_2(1 + \text{SNR}) \text{ b/transmission.}$$

I also add the floating box of “One transmission takes $\frac{1}{2B}$ seconds.”

- Slide 6-216: Any equality sign is added before “ $\Gamma \sigma_j^2 / g_j^2 \geq K$ ”.
- Slide 6-229: Two questions regarding the uniqueness of the solution are added? Specifically, “Is the solution of the above equation unique? Is it certain that when derivative equals zero, we obtain the global maximum?”
- Slide 6-230: The curve should be “concave-like” not “convex-like”. Also, γ should be positive.
- Slide 6-232: Detailed derivation of the loop filter equation is added on top.

$$\begin{cases} \hat{\theta}[n+1] = \rho \hat{\theta}[n] + \rho a[n] \\ a[n+1] = a[n] + \gamma e[n] \end{cases} \Rightarrow \begin{cases} \hat{\theta}[n+2] = \rho \hat{\theta}[n+1] + \rho a[n+1] \\ \hat{\theta}[n+1] = \rho \hat{\theta}[n] + \rho a[n] \end{cases} \quad \begin{matrix} (1) \\ (2) \end{matrix} \Rightarrow (1)-(2)$$

- Slide 6-235: “(up to the first three steps)” is appended after “assume $\tau_0 > \tau$. An explanation is added to indicate that the fourth step is valid for both $\tau_0 > \tau$ and $\tau_0 \leq \tau$.”
- Slide 6-237: The superfluous j in the bottom displayed equation

$$\cos([\arg(\tilde{x}_k(\tau)) - \arg(a_k) - \theta])$$

is removed.

- Slide 6-238: A side box consisting of “Take the first two terms, $m = 0$ and $m = 1$ ” is added to explain the approximation.

- Slide 6-239: The misleading $\partial\hat{\tau}/\partial\tau$ is removed.
- Slide 6-244: “ideally” is inserted between “if” and “ $\alpha_n = \hat{\alpha}_n$ ”. “ $\alpha_n \neq \hat{\alpha}_n$ ” is added at the bottom with an arrow pointing to the $\pi/4$ transition. The below equations are added.

$$\ell(\tilde{\theta}) = \cos(\theta - \hat{\theta}) \quad \text{and} \quad \frac{\partial^2 \ell(\tilde{\theta})}{\partial^2 \tilde{\theta}} = -\cos(\varphi)$$

- Slide 6-247: Two colored arrows are added to clearly indicate which loop filter (black boxed one or red boxed one) the transfer function is represented.
- Slide 6-248: I add “but with smaller steady state fluctuation” in the explanation. For the vertical axis, I add the label $\varphi = \theta - \hat{\theta}[n]$. Also added is a label indicating the true phase error. On the right-bottom corner, how the parameter A is chosen is explained.
- Slide 6-250: The formulas for modified Cramér-Rao bound and $B_T T$ are added. Specifically,

$$\text{MCRB} = \frac{B_L T}{E/N_0} \quad \text{and} \quad B_L T = \frac{\gamma A}{4} = 0.02 \Rightarrow A = 1.$$