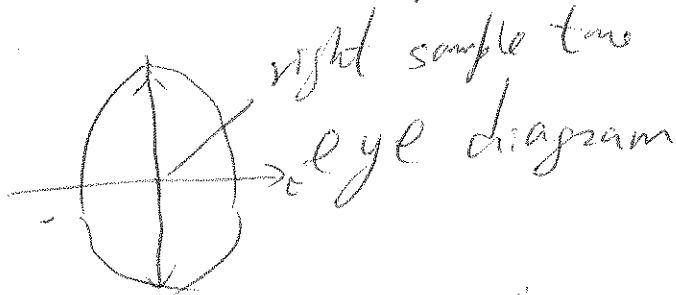


5.6 Synchronization & phase recovery.

Q1: when to sample



Q2: how the receiver know the carrier ^{phase / frequency}

5.6.1 Receiver structure with phase & timing recovery

draw Figure 5.28

$$r(t) = s(t; \psi) + n(t)$$

where $\psi = (\phi, \tau)$: ϕ is phase, τ is delay.

Maximum a posteriori (MAP) criteria

$$\max_{\hat{\psi}} P(\hat{\psi} | r(t)) = \frac{P(r(t) | \hat{\psi}) P(\hat{\psi})}{P(r(t))}$$

likelihood function

$$\Lambda(\psi) = \exp \left[-\frac{1}{4N_0} \int_{T_0} [r(t) - s(t; \psi)]^2 dt \right]$$

5.6.2 maximum likelihood phase estimation

PLL slides

Figure 5.29

5.6.3 maximum likelihood timing estimation

Figure 5.30

$$S_I(t; \tau) = \sum S_I(k) g(t - kT_s - \tau)$$

$$\Lambda'(\tau) = \int_{T_0} r(t) S_I(t; \tau) dt$$

$$= \sum S_I(k) \int_{T_0} r(t) g(t - kT_s - \tau) dt$$

$$= \sum S_I(k) z_k(\tau)$$

$$\sum S_I(k) \frac{d}{d\tau} z_k(\tau) = 0$$

Figure 5.31