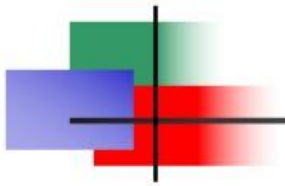


Chapter 5

Digital transmission through the AWGN channel

—— by Prof. XIAOFENG LI

SICE, UESTC

Contents 16 Hrs

- Introduction
- Geometric rep. of the sig waveforms
- Pulse amplitude modulation
- 2-d signal waveforms
- M-d signal waveforms
- Opt. reception for the sig. In AWGN
- Optimal receivers and probs of err

Binary

Baseband: BPAM (antipodal, unipolar), Orthogonal signaling;

Passband: BPSK, OOK or BASK, BFSK (Orthogonal)

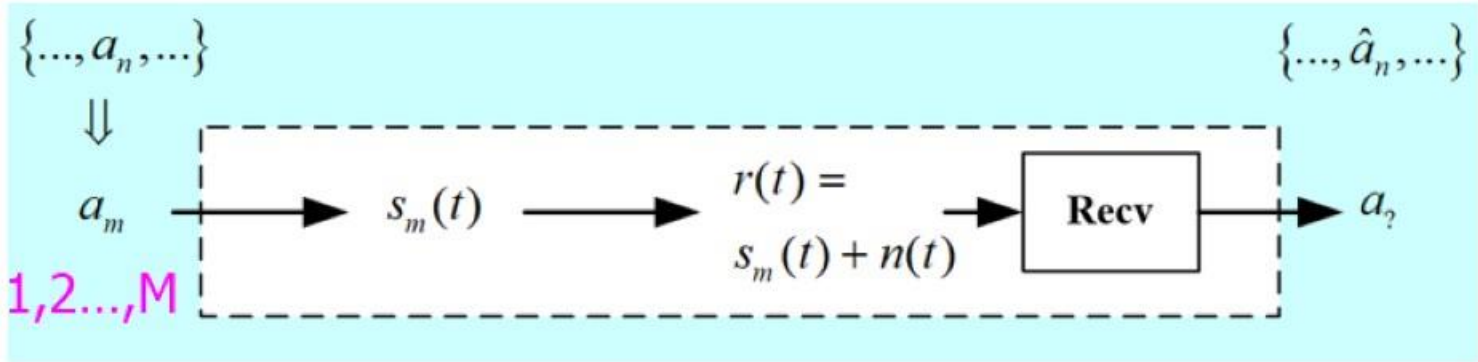
M-ary, 1-D signaling

Baseband: MPAM

Passband: MASK

5.6.2 MPAM

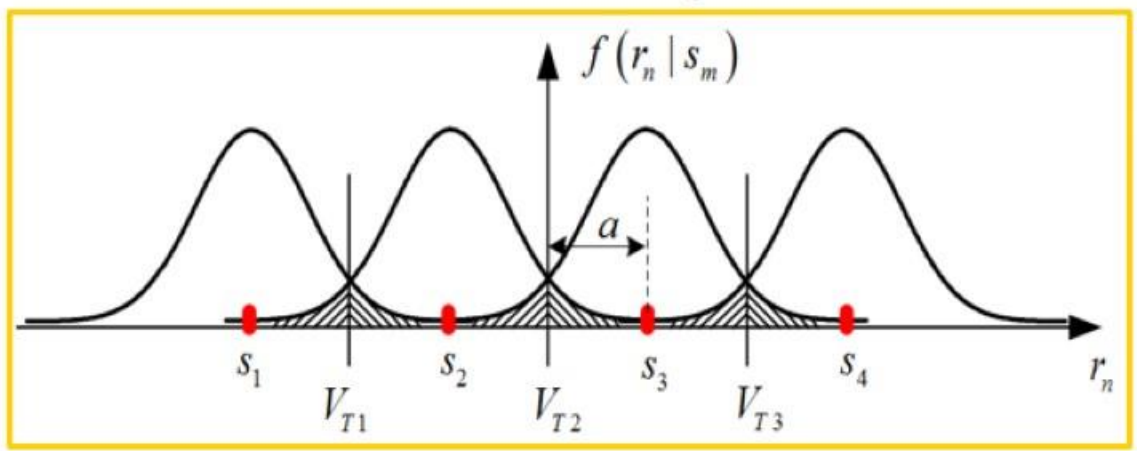
MPAM
(Baseband)



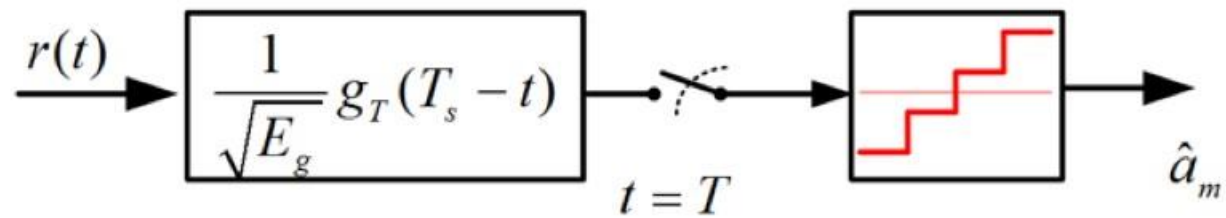
The signals: $s_m(t) = A_m g_T(t)$

(Often, $A_m = \pm 1, \pm 3, \ldots$)

The 1-D basis: $\psi(t) = \frac{1}{\sqrt{E_g}} g_T(t)$



A MF-ML receiver is given by,



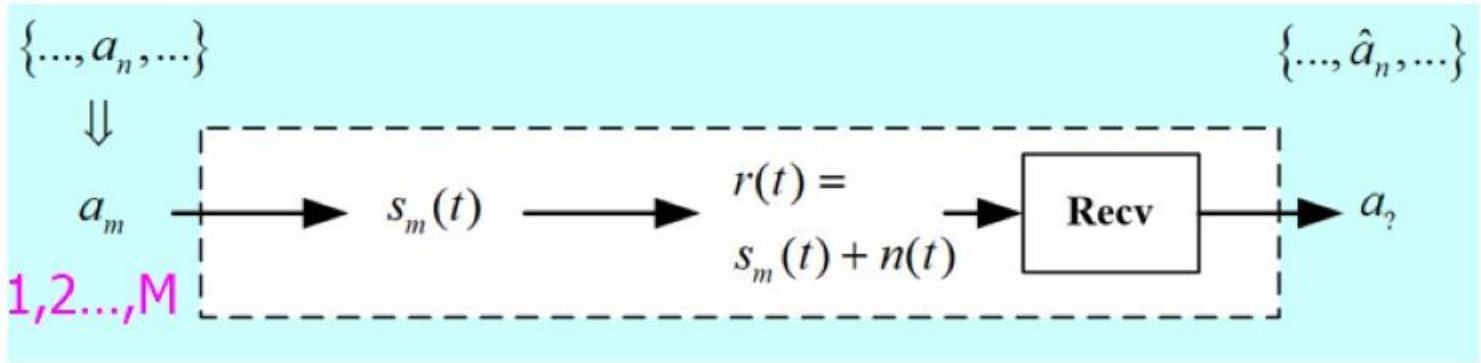
Prob of err is computed by,

$$P_e = 1 - \frac{1}{2}\int_{R_0} f(r|s_0)dr - \frac{1}{2}\int_{R_1} f(r|s_1)dr$$

where, $R_0 = (-\infty, 0]$ and $R_1 = [0, +\infty)$.

5.6.2 MPAM

MPAM
(Baseband)



The signals: $s_m(t) = A_m g_T(t)$

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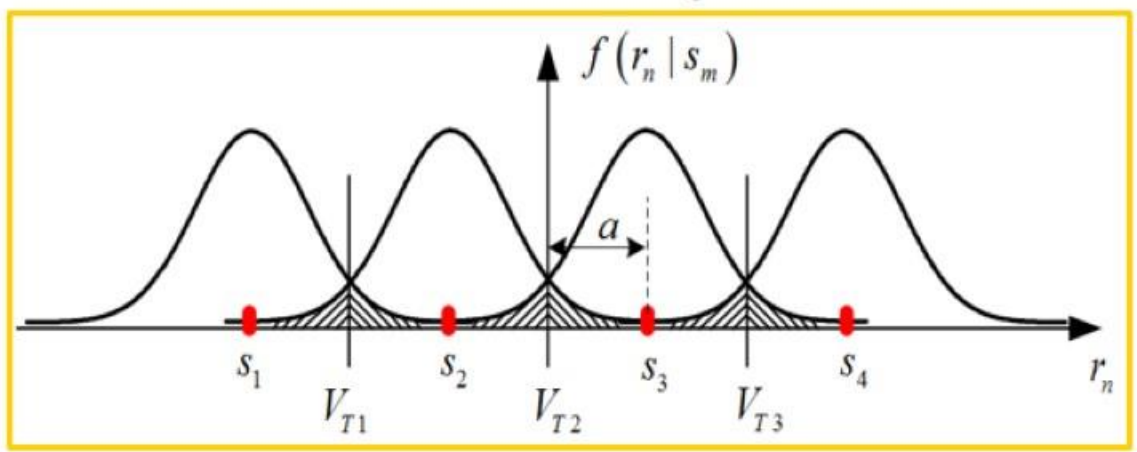

Prob of err is computed by,

$$P_e = 1 - \frac{1}{M}\sum_{k=1}^{M}\int_{R_k} f(r|s_k)dr = \frac{2(M-1)}{M} Q\left(\sqrt{\frac{2a^2}{N_0}}\right)$$

$$= \frac{2(M-1)}{M} Q\left(\sqrt{\frac{6(\log_2 M)E_b}{(M^2-1)N_0}}\right)$$

$$(\log_2 M)E_b = E_{av} = \sum_{k=1}^{M} s_k^2 = \frac{M^2-1}{3}a^2$$

See graph of Fig 5.55 on p315