CO2 ASSIGNMENT

Name - omkar
R.No - 2310040111

(1) (a) pulse analog modulation techniques are methods of transmitting analog signal using pulses.

(i) pulse Amplitude modulation :- A modulation technique where the amplitude of each pulses varies according to the instaneous value of analog signal.

(ii) pulse width modulation:- A modulation technique where the width of each pulse changes based on the amplitude of the analog signal.

(iii) pulse poistion modulation:- A modulation technique where the poisition of each pulse is varied in proportion to the amplitude of analog signal.

(2) The matched filter is a linear filter designed to maximize the Signal-to-Noise ratio (SNR). It is significant in signal processing & communication system due to following reasons:-

(1) Maxmizes SNR:- It optimally detects signal in the presences of noise by maximizing the output SNR.

(2) Efficent signal detection:- It enhances detection of week signal by aligning with the known signal shape

(3) Minimize probablity of error:- It reduces the chances of incorrect signal detection, improving system reliability.

(4) Application in Radar & sonar: Helps identify targets by matching required. recieved signals with known templates.

The matched filter has the following key properties;

i) maximum SQNR - It maximizes the output SQNR, making it optimal filter for detecting signals in the presence of noise.

ii) Optimal detection:- minimizes detection errors, in the communication systems

iii) Linearity - Ensures a porportional response to i/p signal

iv) Impulse response matching:- Matches the transmitted signal shape for efficent detection.

v) used in noisy envlornments:- Enhances weak signals in radar, sonar & envlornment.

3) Equialazation is the technqiue used in communication systems to counteract the effects of signal distortion & ISI caused by channel impairements. The process involves:-

i) channel estimation: Analyzes the channel to identify disortion to effect:

ii) filter design:- creates an equalizer to counteract signal impairements.

(iii) Signal processing:- Applies the equalizer to correct the recived signal.

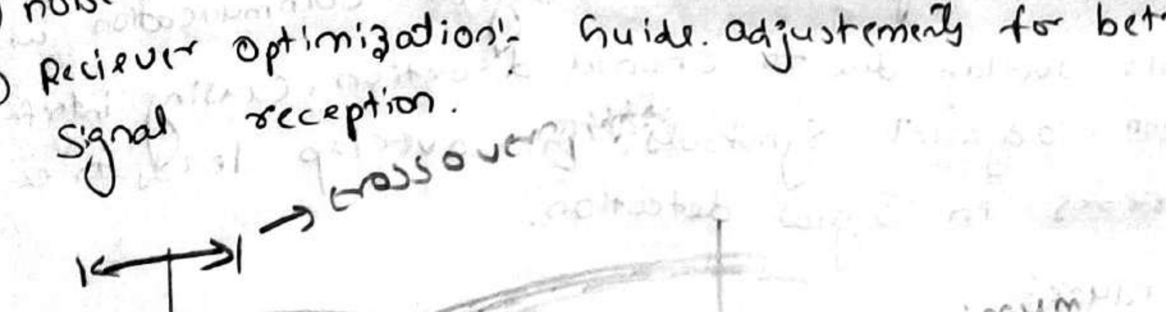
(iv) Error minimization:- use adaptive algorthims to optimize equalization.

(v) Recovered signal o/p:- produces a clearer signal with reduced disortion.

(6) Eye pattern:- An eye pattern is a graphical representation of a digital signal in a communication system, obtained by overlaying multiple signal waveforms over one another within a specific time period.

Importance:-

(i) Signal quality: wide eye = good quality, closed eye = poor quality
(ii) ISI Detection: shows intersymbol interference when transactions overlap.
(iii) Timing Jitter:- Reveals timing variation in signal.
(iv) noise level:- vertical closure indicates noise interference
(v) Reciever optimization:- Guide adjustements for better signal reception.



(7) process of equilization to minimize ISI:-

In a communication system, ISI occur when pulses overlap due to channel disortion, leading to error in detecting transmitted symbols. Equilization is used to reverse the ~~process~~ disortion caused by the channel & minimize.

process:

(i) channel estimation: understanding how the channel disorts the signal.

(ii) Equalizer design:- creating a filter to reverse the disortion

(iii) Signal processing:- passing the recived signal thorough the equalizer to reduce ISI.

(iv) Adaptive Adjustements:- continously udpating the filter to track channel changes

(8) ISI is a phenomenon in digital communication where symbols overlap due to channel disortion, causing interfercing betn adjacent symbols. This overlap leads to ~~occur~~ errors in signal detection.

procedure:-

(i) channel estimation:- Analyze channel disortion.

(ii) Nquist criteria:- use pulse shaping to ensure no overlap at sampling instants.

(iii) pulse shaping:- Apply filters like the raised cosine filter to limit bandwidth & reduce ISI.

(iv) Equilization:- use equillazer to correct channel disortion.

(v) proper sampling:- Sample at the right moment to overlap.

(5) By nquist filter

$$H(f) = \sum_{-\infty}^{\infty} H(f - n/T)$$

where.

H(f) is the overall System frequency response.

T is the Symbol period.

→ Overall impulse response h(t) satisfies the nquist creation which implies

$$h(t) = \delta(t - nT)$$

One common Solution is to use a raised cosine filters.

$$H(f) = \begin{cases} T, & |f| \le \frac{1-\beta}{2T} \\ \frac{T}{2}\left(1+\cos\left(\frac{\pi T}{\beta}\left(|f| - \frac{1-\beta}{2T}\right)\right)\right), & \frac{1-\beta}{2T} < |f| \le \frac{1+\beta}{2T} \\ 0, & \text{otherwise} \end{cases}$$

where β is roll off factor.

Time domain impulse respons is :

$$\boxed{h(t) = \frac{\sin(\pi t/T)}{\pi t/T} \cdot \frac{\cos(\pi \beta t/T)}{1-(2\beta t/T)^2}}$$

(9)

Feature	Correaltion	matched filter
function	Measure Similarity betn two signals by computing their correlation	A filter designed to maximize SNR
purpose.	used to detect the presence of a known signal by comparing it with a reference signal.	Optimally detects a signal in the presence of noise matching it with a time reversed version of the expected signal.
Signal processing	Computes the correaltion betn the i/p signal & a reference signal.	Applies a filter whose impulse response is the time reversed & conjugated version of the expected signal.
Application	used in both signal detection & pattern recognition	primarly used in communication system to detect weak signals & reduce noise

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