M is no of symbol.

n is no bit in symbol.

in PSK M = 2, and n = 1

in QPSK M = 4 and n = 2

or

4 PSK.

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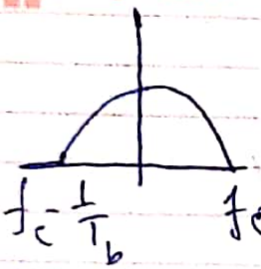
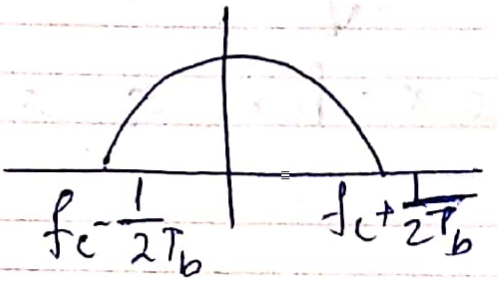
Bandwidth in M-ary PSK

$$= \frac{2}{\log_2 M} f_b$$



PSK BW = $2 f_b$



QPSK, BW = f_b

* Phase shift for M-ary PSK

Consecutive Symbol = $\frac{2\pi}{M}$

* and Symbol duration $T = nT_b$

Notes:

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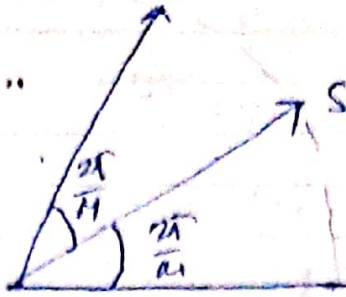
Saturday

28

Week 5 / Day 28

General signal space diagram



$= \sqrt{\frac{2}{T_b}} \cos \omega t$

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Sunday

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Week 5 / Day 29

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Notes:

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Monday 30

Week 6 / Day 30

Continuous Phase Frequency Shift keying (CPFSK)

is memory base Modulation Scheme, where Phase to be continuous.

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Discontinuity in Phase in QPSK During Symbol change., which generate large spectral side lobe outside of main spectral band.

Here we define CPFSK signal

$$s(t) = \sqrt{\frac{2E_b}{T_b}} \cos\left[2\pi f_1 t + \theta(0)\right] \rightarrow '1' \quad (1)$$

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$$= \sqrt{\frac{2E_b}{T_b}} \cos(2\pi f_2 t + \theta(0)] \rightarrow '0' \quad (2)$$

$\theta(0)$ is the value of Phase at $t=0$ (based on Past history)

Another way we may write

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$$s(t) = \sqrt{\frac{2E_b}{T_b}} \cos\left(2\pi f_c t + \theta(t)\right] \quad (3)$$

where $\theta(t) = \theta(0) \pm \frac{\pi h t}{T_b} \quad 0 \le t \le T_b$

+ for '1' sending

- for '0' sending

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as $\theta(t)$ is continuous $\forall t$

$s(t)$ is continuous at all time.

including inflection switching times.

Notes:

$\therefore s(t) = \sqrt{\frac{2E_b}{T_b}} \cos\left[2\pi f_c t \pm \frac{\pi h t}{T_b} + \theta(0)\right]$ — (4)

Compare with eq (1.4.4) and (2.4.4), we get

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$f_c + \frac{h}{2T_b} = f_1$ for Symbol '1'

$f_c - \frac{h}{2T_b} = f_2$ for Symbol '0'

$\therefore f_c = \frac{f_1 + f_2}{2}$

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$h = T_b(f_1 - f_2) = \frac{f_1 - f_2}{\frac{1}{T_b}} = f_b$

know as deviation ration

(normalised freq diff.)

Now, $0 \le t \le T_b$

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$\theta(t) = \theta(0) \pm \frac{\pi h t}{T_b}$ — (5)

at $t = T_b$ $\theta(T_b) = \theta(0) \pm \frac{\pi h \theta}{T_b}$

$\therefore \theta(T_b) - \theta(0) = \pm \pi h$ — (6)

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for $T_b \le t \le 2T_b$ $\theta(t) = \theta(T_b) \pm \frac{\pi h}{T_b} t$.

Notes:

Notes

$h = \frac{1}{2}$

Now, consider, $\theta(0) = 0$,

eq (6) $\Rightarrow$, $\theta(T_b) - \theta(0) = \pm \frac{\pi}{2}$ $\begin{cases} +\frac{\pi}{2} \leftrightarrow '1' \\ -\pi/2 \leftrightarrow '0' \end{cases}$

Phase change

Now, t is even multiple of T_b

then

for $d = 0$ $\quad \pm \frac{\pi}{2T_b} t \Rightarrow 0$

$\hookrightarrow \pm\pi$

for $t = 2T_b$

$\hookrightarrow \pm 2\pi = 0$

$t = 4T_b$

So, incremented angle is 0 or $\pm\pi$.

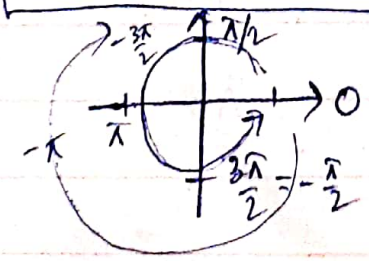
Now t is odd multiple of T_b

then

for $t = T_b$, $\pm \frac{\pi}{2T_b} t = \pm \frac{\pi}{2}$

$t = 3T_b$. $\hookrightarrow = \pm \frac{3\pi}{2} =$

So incremented angle is $\pm \frac{\pi}{2}$



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Goals

Phase trellis diagram

Consider $\theta(0) = 0$

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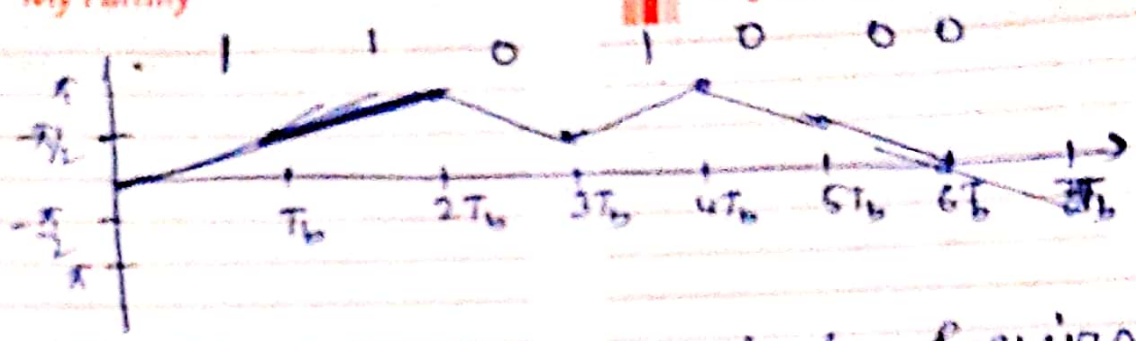

from here we conclude previous ~~Theorem~~ Statement.

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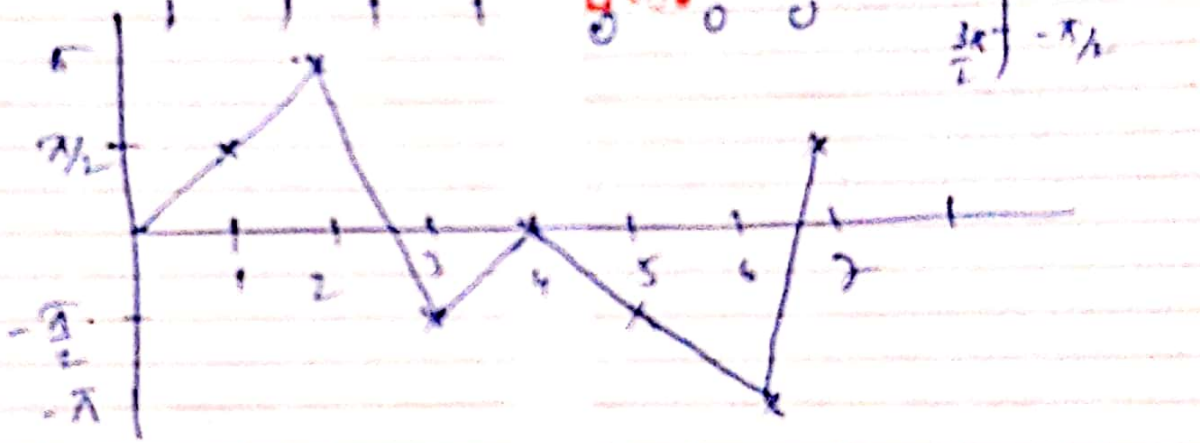

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My Notes