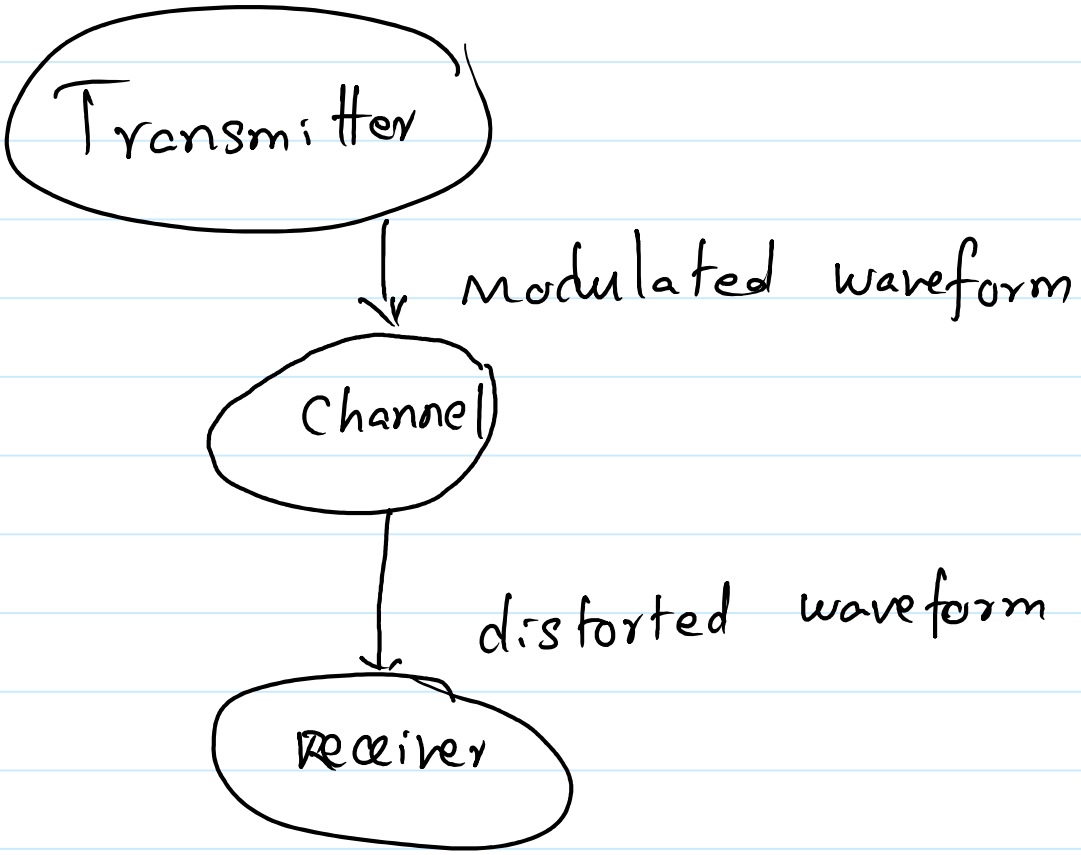
Introduction to Demodulation



Demodulation :

Recover the bits from distorted waveform

Simple Model (but widely applicable)

Additive noise model :

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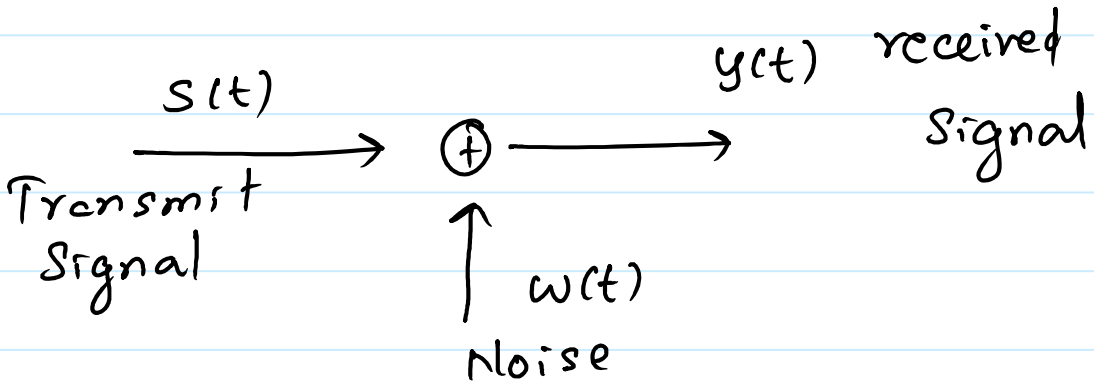


$$y(t) = s(t) + w(t)$$

s(t) may correspond to modulation of FSK or PSK or QAM symbols

From y(t), we need to recover the symbol sequence

X ——————————— X

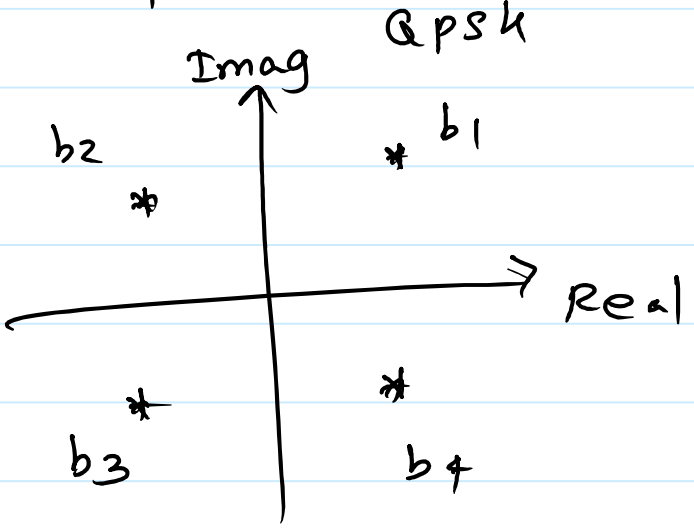
Start with Simple Problem.

→ Sending a Single Symbol
(not a sequence)

→ Symbol belongs to
M-ary Constellation
(M-QAM or M-FSK)

For QAM

Let $b_1, b_2, \ldots, b_M$ denote
Constellation points



Let $s_k(t)$ denote the
waveform corresponding to

Symbol b_k

ie) $s_k(t) = b_k\, p(t)$

where $p(t)$ is pulse for linear modulation

For FSK

Let $f_1, f_2, \ldots, f_M$ be M distinct frequencies to represent each possible symbol value

Wave form corresponding to k^{th} symbol

$s_k(t) = \cos(2\pi f_k t)\; p(t)$

Demodulator Problem :

→ Received signal

$$y(t) = s(t) + w(t)$$

→ Transmit signal $s(t)$

takes one out of M possibilities

$$s(t) \in \{ s_1(t), s_2(t), \cdots, s_M(t) \}$$

→ From $y(t)$, find out (guess) which one of the signals was sent ?

To solve this problem :

we need to go thru several steps

① Signal space concepts

(Linear Algebra)

Efficient way to represent

the signal set $\{s_1(t), \ldots, s_m(t)\}$

② Statistics of Noise $w(t)$

(Probability theory)

Gaussian noise model

③ Hypothesis Testing concepts

(Detection theory)

Framework for guessing

from noisy data

④ Digital Demodulatim

(Communication Theory)