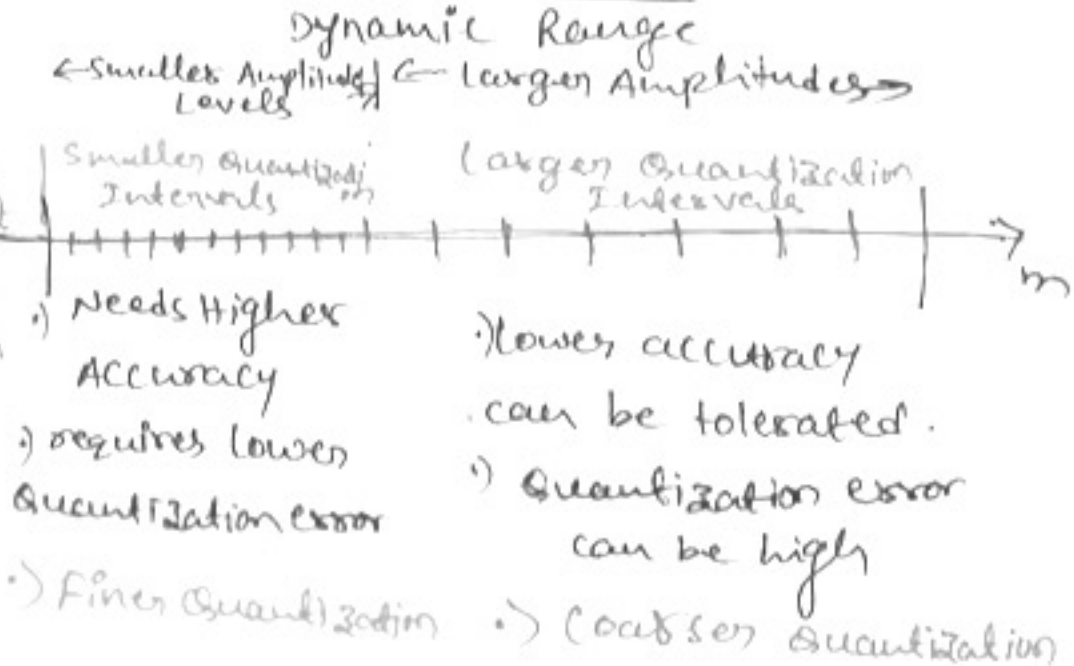
Robust Quantization

Robust Quantization also referred to as non-uniform Quantization.

A different quantization scheme called "COMPANDING" is used for non-uniform Quantization.

Need for non-Uniform Quantization :



Width of the quantization int-ervals is not uniform. Hence it is called non-uniform qua-ntization

COMPANDING Achieves Non-Uniform Quantization.

At lower amplitudes, we need lower quantization error. Hence these amplitudes are quantized with smaller quantizat-ion intervals so as to achieve higher accuracy of Reconstruction.

At larger amplitudes, we can tolerate large quantization error. Hence larger amplitudes can be quantized with larger quantization intervals, so that we can have lower accuracy of reconstruction.

Therefore, the width of the ~~signal~~ quantization inter-vals are different (not uniform). Hence it is called Non-Uniform Quantization.

"COMPANDING is a Technique to achieve non-uniform quantization."

There are Two-methods in COMPANDING:

1. μ-Law COMPRESSOR.
2. A-Law COMPRESSOR.

> COMPANDING is the process of Non-Linear mapping from the input to the output.

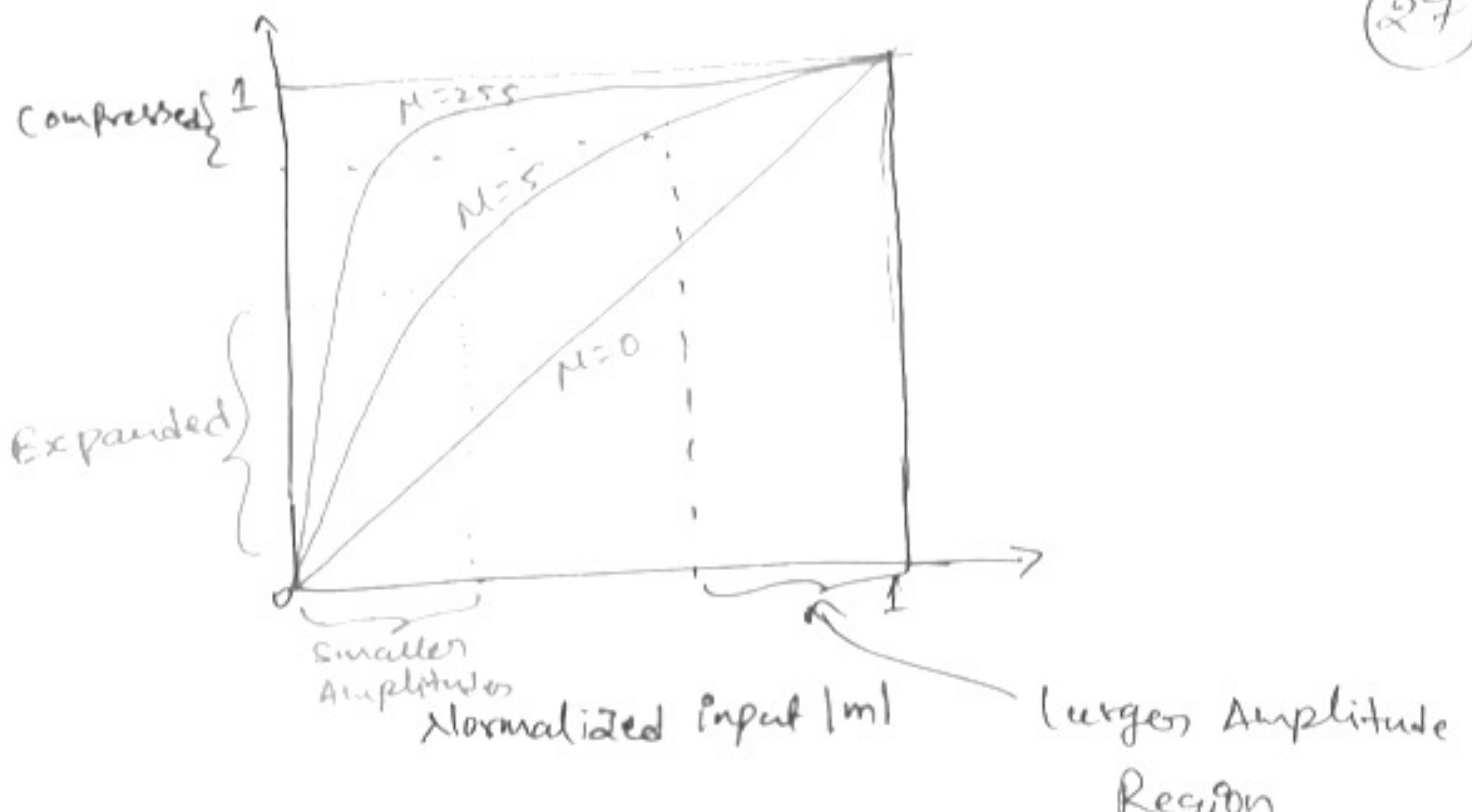
μ-Law Compressor : or: μ-law COMPANDING:

In the μ-law Companding, the compressor characteristics $c(m)$ is continuous, approximating a linear dependence on m for low input levels and a logarithmic one for high input levels.

The transfer characteristics of μ-law compressor is given as

$$\boxed{c(m) = \frac{\log(1+\mu|m|)}{\log(1+\mu)} \qquad \begin{array}{c} 0 \le |m| \le 1 \\ -1 \le m \le 1 \end{array}} \rightarrow (1)$$

The dynamic range of m is normalized to 0 to 1.



smaller amplitude values are expanded so that those sample values can be quantized finely.

The larger amplitude values are compressed so that those samples can be quantized roughly (coarsely).

further, In μ-law transfer characteristics in (1) as μ approaches to zero.

$$c(m) = \lim_{\mu \to 0} \frac{\log(1+\mu|m|)}{\log(1+\mu)}$$

$$\therefore \lim_{\mu \to 0} \frac{\mu|m|}{\mu} = |m|$$

$\boxed{\lim_{x \to 0} \log(1+x) \simeq x.}$

This implies the linear characteristics for $\mu=0$. as μ increases the characteristics becomes more and more concave. (logarithmic)

as $\mu\uparrow$, COMPANDING $\uparrow$

More COMPANDING
⇒ More compression of large amplitude Region
⇒ More expansion of region