
DIGITAL COMMUNICATION LAB
Electrical Engineering Department

**Experiment 7: Implementation and Analysis of
Intersymbol Interference (ISI)
and Reduction Using Raised Cosine Filtering in
MATLAB**

AIM: To implement and analyze Intersymbol Interference (ISI) and Reduction Using Raised Cosine Filtering in MATLAB.

Theory

Intersymbol interference refers to the phenomenon in communication systems where closely spaced transitions interfere with each other, resulting in a linear combination of overlapping transition responses. This interference causes the magnitude of crowded peaks to be smaller and their positions to shift away from the center of the transition.

To proceed with the study of intersymbol interference, consider a baseband binary PAM system. The term baseband refers to an information-bearing signal whose spectrum extends from (or near) zero up to some finite value for positive frequencies. Thus, with the input data stream being a baseband signal, the

data-transmission system is said to be a baseband system. Consequently, there is no carrier modulation in the transmitter and, therefore, no carrier demodulation in the receiver to be considered. This residual effect due to the occurrence of pulses before and after the sampling instant is called intersymbol interference (ISI) [1].

Raised-Cosine Spectrum We may overcome the practical difficulties encountered with the ideal Nyquist pulse by extending the bandwidth from the minimum value

$$W = \frac{R_b}{2}$$

to an adjustable value between W and $2W$. In effect, we are trading off increased channel bandwidth for a more robust signal design that is tolerant of timing errors. Specifically, the overall frequency response $P(f)$ is designed to satisfy a condition more stringent than that for the ideal Nyquist pulse. The raised cosine pulse given by:

$$P(f) = \begin{cases} 1, & |f| < \frac{1}{2}f_b - f_x \\ \frac{1}{2} \left[1 - \sin \left(\pi \frac{|f| - \frac{1}{2}f_b}{2f_x} \right) \right], & ||f| - \frac{1}{2}f_b| < f_x \\ 0, & |f| > \frac{1}{2}f_b + f_x \end{cases}$$

Task: Implement and analyze Intersymbol Interference (ISI) and Reduction Using Raised Cosine Filtering in MATLAB.

Conclusion: Study and analysis of Intersymbol Interference (ISI) using MATLAB.

- 1 S. Haykin, *Communication Systems*, 4th ed. Hoboken, NJ: Wiley, 2001.