Pulses Having the Zero ISI Property

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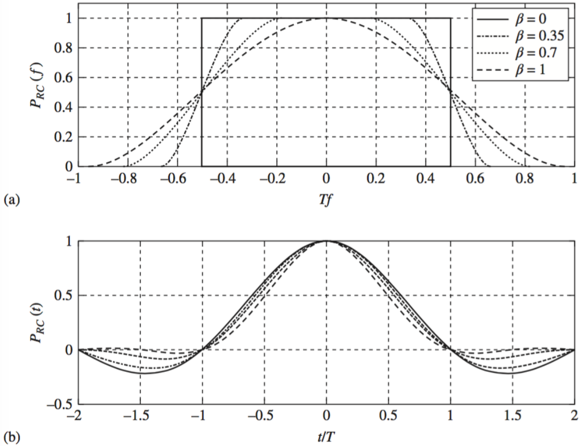
Pulse Shaping: Nyquist's Criterion For Zero ISI

- It will focus on the investigating the designs for the transmitter and receiver filters that shape the overall signal pulse-shape function
- It will eliminate interference between adjacent pulses.

Pulses Having the Zero ISI Property

- The transmission of a lowpass signal with bandwidth "W" is sending a minimum of 2W independent sps.
- The transmission of the nth piece of info through the channel at time $t = nT = n/(2W)$
- The output of the channel due to this impulse at the input is; $y_n(t){=}a_n * sinc(2 * W * (t - (n/2 * W)))$

Cosine Spectra and Corresponding Pulse Responses



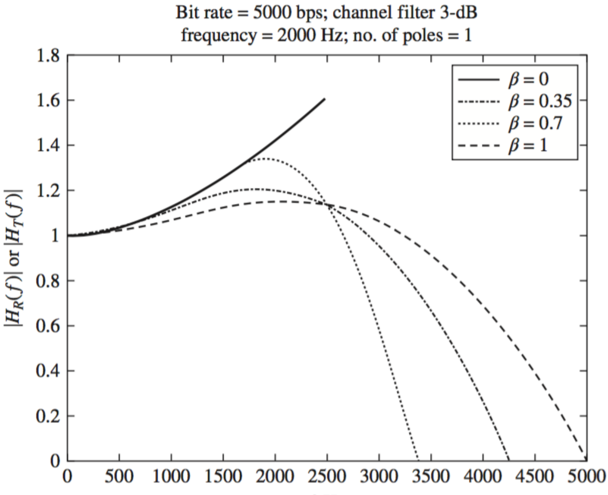
Nyquist's Pulse- Shaping Criterion

- Having a F.T of p(t), results in a pulse-shape function with sample values;
- $$p(nT) = \left\{ \begin{array}{ll} 1, & \text{for } n \leq 0 \\ 0, & \text{for } 0 \leq n \leq inf \end{array} \right\}$$

Transmitter and Receiver Filters for Zero ISI

- Considering simplified transmitter model under consideration here, k-th sample value multiplies a unit impulse occuring at time kT and this weighted impulse train is the input to a transmitter filter with impulse response $h_t(t)$ and corresponding frequency response $H_T(f)$
- We can mathematically explain by following calculations, $x_(t) = \sum_{k=-\infty}^{\infty} a_k * \delta(t - kT) * h_T(t)$
- So output of the channel will be: $y(t) = x(t) * h_c(t)$
- And the output of the receiver filter is : $v(t) = y(t) * h_r(t)$
- We want output to have the zero-ISI property and, to be specific set: $V(t) = \sum_{k=-\infty}^{\infty} a_k * a_k * A_p RC(t - kT - t_d)$

Figures


Bit rate = 5000 bps; channel filter 3-dB
frequency = 2000 Hz; no. of poles = 1
$|H_R(f)|$ or $|H_T(f)|$
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
$\beta = 0$
$\beta = 0.35$
$\beta = 0.7$
$\beta = 1$