INTRODUCTION TO COMMUNICATION ENGINEERING - S&SY14

HOMEWORK - 1 DUE : 06/09/23

1) Raised Cosine Pulse

We know: Roll off factor (β) = 0.3 $\longrightarrow$ ISI free Tx

BW = 1000 Hz

$$\text{Symbol rate} = \frac{2 \cdot BW}{1+\beta} \Rightarrow \text{Symbol rate} = \frac{2 \cdot 1000}{1+0.3}$$

$$\Rightarrow \boxed{\text{Symbol Rate} = 1.538.461}$$

2) We know: $g(t) = \operatorname{sinc}\left(\frac{t}{T}\right) \dfrac{\cos(\pi \alpha t/T)}{1 - 4\alpha^2 t^2/T^2}$

Assume: $\alpha = 1$

$$g(t) = \operatorname{sinc}\left(\frac{t}{T}\right) \frac{\cos(\pi t/T)}{1 - 4t^2/T^2}$$

We can consider $\frac{t}{T}$ as x

$$\Rightarrow g(t) = \operatorname{sinc}(x) \frac{(\cos \pi x)}{1 - 4x^2} = \frac{\sin x}{x} \cdot \frac{\cos \pi x}{1 - 4x^2}$$

On further expansion, we get —

$$g(t) = \operatorname{sinc} 2x + \frac{1}{2} \operatorname{sinc}(2x+1) + \frac{1}{2} \sin(2x-1)$$

Given hint: $g(t) = \text{Sinc}\,(2t/T) + 0.5\,\text{sinc}\,(2t/T + 1) + 0.5\,\text{Sinc}\,(2t/T - 1)$

$$G(f) = \int_{-\infty}^{\infty} g(t)\, e^{-j2\pi f dt}\, dt$$

$$= \int_{-\infty}^{\infty}\left[\text{Sinc}\left(\frac{2t}{T}\right) + \frac{1}{2}\text{Sinc}\left(\frac{2t}{T}+1\right) + \frac{1}{2}\text{Sinc}\left(\frac{2t}{T}-1\right)\right] e^{-j2\pi f dt}\, dt$$

$$= \int_{-\infty}^{\infty} \text{Sinc}\left(\frac{2t}{T}\right) e^{-j2\pi f t}\, dt + \frac{1}{2}\int_{-\infty}^{\infty} \text{sinc}\left(\frac{2t}{T}+1\right) e^{-j2\pi f t}\, dt$$

$$+ \frac{1}{2}\int_{-\infty}^{\infty} \text{Sinc}\left(\frac{2t}{T}-1\right) e^{-j2\pi f t}\, dt$$

⇐ Fourier Transform of a Sinc (x) will give a rectangle / a block with $\omega = 0$.

So the above equation can be written as:

$$G(f) = \frac{1}{\left(\frac{2}{T}\right)}\,\text{rectangle}\left(f/(2/T)\right) + \frac{1}{2}\cdot\frac{1}{\left(\frac{2}{T}\right)}\,\text{rectangle}\left(f/(2/T)\right)$$

$$- \frac{1}{2}\,\frac{1}{\left(\frac{2}{T}\right)}\,\text{rectangle}\left(f/(2/T)\right)$$

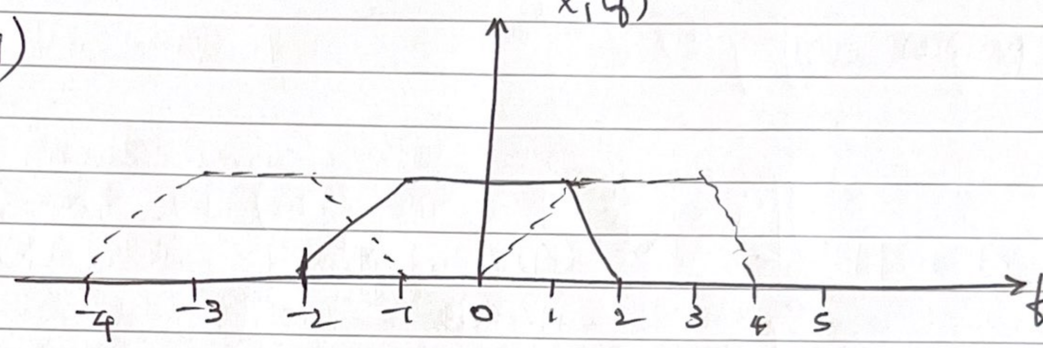
$$+ C$$

Here C - is a constant that we get after fourier transform

$$\therefore \boxed{G(f) = \frac{T}{2}\,\text{rectangle}\left(\frac{fT}{2}\right) + C}$$

3) $X_1(f) \xrightarrow{R_1 = 4MHz}$ Nyquist

1)



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