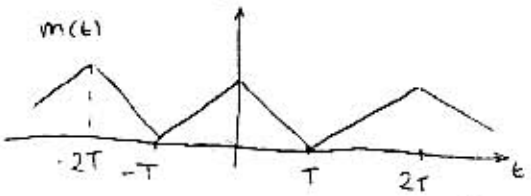
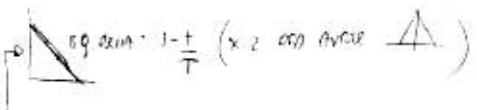
Ex 2 del 30/09/05





1) $P_{Rx} = \frac{V_0^2}{2}\frac{\overline{m^2(t)}}{L} = \frac{1}{2}\frac{\overline{m^2(t)}}{10^4}$



$\overline{m^2(t)} = \frac{1}{T}\int_{-T}^{T} m^2(t)dt = \frac{2}{T}\int_0^T \left(1-\frac{t}{T}\right)^2 dt = \frac{2}{T}\int_0^T \left(1+\frac{t^2}{T^2}-\frac{2t}{T}\right)dt = \frac{2}{T}\left(t+\frac{t^3}{3T^2}-\frac{t^2}{T}\right)\Big|_0^T =$

potenza media

$\frac{2}{T}\left(T+\frac{T^3}{3T^2}-\frac{T^2}{T}\right) = \frac{2}{3}$

$P_{Rx} = \frac{1}{3}\cdot 10^{-4}\ W$

2) Canale non ideale

$M(f) = M_{2T}(f)\cdot\frac{1}{2T}\sum \delta\left(f-\frac{n}{2T}\right) = \frac{1}{2}\sum_n \text{sinc}\left(\frac{n}{2}\right)\delta\left(f-\frac{n}{2T}\right)$



spettro a righe distanziate di $\frac{1}{2T} = 50K$

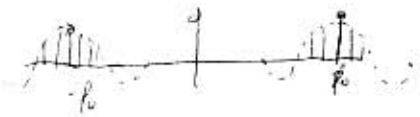
Trasformata del triangolo

$\text{triang}\left(\frac{t}{2T}\right) = \frac{1}{T}\text{rect}\left(\frac{t}{T}\right)\otimes\text{rect}\left(\frac{t}{T}\right)$

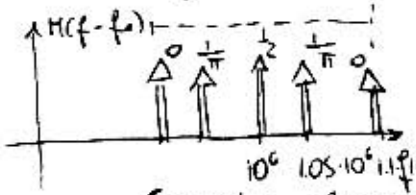
$\Downarrow$

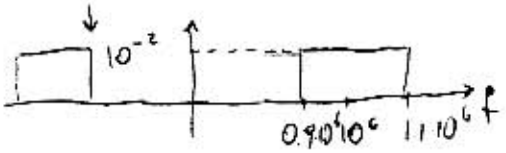
$\frac{1}{T}\left(T\,\text{sinc}(Tf)\right)^2 = T\,\text{sinc}(Tf)$

$Y(f) = \frac{V_0}{2}\left(M(f-f_0)+M(f+f_0)\right)$



$Y_{Ric}(f) = \frac{V_0}{2}\left(M(f-f_0)+M(f+f_0)\right)H(f)$





$\text{sinc}(x) = \begin{cases} 1 & x=0 \\ \frac{\sin(x)}{x} & x\neq 0 \end{cases}$

Considero il segnale modulato nella sola banda di H(f)

$M(f)*H(f) = \frac{1}{2}\left[\underset{m=0}{\text{sinc}(0)}, \underset{m=1}{\text{sinc}\left(\frac{1}{2}\right)}, \underset{m=2}{\text{sinc}(1)}\right] = \frac{1}{2}\left[1, \frac{2}{\pi}, 0\right] = \left[\frac{1}{2}, \frac{1}{\pi}, 0\right]$

$Y_{Ric}(f) = \frac{1}{2}\cdot 10^{-2}\left(\frac{1}{2}\delta(f-1M) + \frac{1}{\pi}\left(\delta(f-1.05M)+\delta(f-0.95M)\right)\right) + \text{freq. negative}$

$P_{Ric} = 2\left(\frac{1}{16}+\frac{2}{4\pi^2}\right)10^{-4} = 2\left(\frac{\pi^2+8}{8\cdot 16\,\pi^2}\right)10^{-4} = 0.22\cdot 10^{-4}$

F8

$$m = \frac{B_t - 2f_m}{2f_m} = \frac{B_t}{2f_m} - 1 = \frac{120\cdot 10^3}{10\cdot 10^3} - 1 = 5$$

$$B_t = 2mf_m \Rightarrow \quad m = \frac{B_t}{2f_m} = 6$$

$$J_0^2(5) + 2J_1^2(5) + 2J_2^2(5) + 2J_3^2(5) + 2J_4^2(5) + 2J_5^2(5) + 2J_6^2(5) =$$

$$9178^2 + 2(0,328)^2 + 2\cdot(0,047)^2 + 2(0,365)^2 + 2(9391)^2 + 2(9251)^2 + 2(9131)^2 =$$

$$= 0,03168 + 0,21517 + 0,00442 + 0,2664 + 9,3064 + 0,13624 + 0,03432 = 9,994046 \Rightarrow 99,4\ \%$$

$$SNR_u = \frac{3}{2} m^2 SNR_i = \frac{3}{2} m^2 \frac{P_{tx}}{K(T_0 + T_{eq})f_m}$$

$F_m = 15,74\ dB$

$$T_{eq} = T_0(L-1) = 290\left(10^{\frac{5,0}{10}} - 1\right)$$

$$SNR_u = \frac{3}{2}\cdot 25 \cdot \frac{P_{tx}}{K(290\cdot 10^5)\cdot 10^4} = 10^7$$

$$P_{tx} = \frac{10^7 \cdot 1,38\cdot 10^{-23} \cdot 290\cdot 10^5 \cdot 10^4 \cdot 2}{3\cdot 25} = 1,07\ \mu W$$

70 −278 74,6 40

$$= \frac{SNR_u \cdot K\, T_{sist} f_m}{F_m}$$

$-59,14$