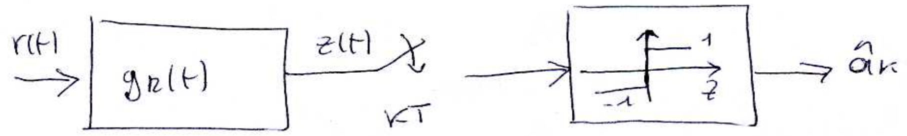
26/05/2008



$r(t) = \sum_i a_i \, g_T(t - iT) + w(t)$

$w(t)$ AWGN cos $S_w(f) = \frac{N_0}{2}$

$a_i \in \{-1, +1\}$ indipendenti ed equiprobabili.

$g_T(t) = e^{-|t|/T} \, \mathrm{rect}\left(\frac{t}{T}\right)$

$g_R(t) = g_T(t)$

1) Energia media del segnale $r(t)$ riferita alla componente di segnale utile

2) Si verifichi assenza di ISI

3) la potenza media di rumore all'uscita di $g_R(t)$

4) la BER, ovvero la probabilità di errore sul bit

1) $E_S = E\left\{ \int_0^T s^2(t)\, dt \right\}$

$$E\{a_i \cdot a_{i+m}\} = \begin{cases} E\{a_i^2\} & m = 0 \\ E\{a_i\} \cdot E\{a_{i+m}\} & m \neq 0 \end{cases} = \begin{cases} 1 & m = 0 \\ 0 & \text{altrove} \end{cases}$$

$$E\left\{ \int_0^T \sum_i a_i \, g_T(t - iT) \sum_k a_k \, g_T(t - kT) \, dt \right\} =$$

$$= \int_0^T \sum_i \sum_k E\{a_i \cdot a_k\} \, g_T(t-iT) \, g_T(t-kT) \, dt =$$

$$= \sum_i \int_0^T g_T^2(t-iT) \, dt = \int_{-\infty}^{+\infty} g_T^2(t) \, dt = \int_{-T/2}^{T/2} e^{-|t|/T} \, dt =$$

$$= 2 \int_0^{T/2} e^{-t/T} \, dt = 2 \cdot \left(-\frac{1}{T}\right) e^{-t/T} \Big|_0^{T/2} =$$

$$= -\frac{2}{T} \left(e^{-1/2} - 1 \right) = \frac{2}{T} \left(1 - \frac{1}{e^{1/2}}\right) = \frac{2}{T} \left(1 - \frac{1}{\sqrt{e}}\right)$$

2) $z(t) = r(t) \otimes g_R(t) =$ ~~$\sum_i a_i g_T(t-iT) \otimes g_R(t)$~~

$$= \sum_i a_i \, g(t-iT) + n(t)$$

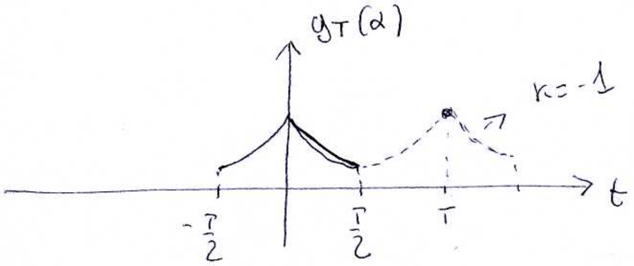
$g(t) = g_T(t) \otimes g_R(t)$

$n(t) = w(t) \otimes g_R(t)$

Deve essere che $g(kT) = \begin{cases} 1 & k=0 \\ 0 & k \neq 0 \end{cases}$

$$g(t) = \int_{-\infty}^{+\infty} g_T(\alpha) \, g_T(t-\alpha) \, d\alpha \Rightarrow \quad g(0) = \int_{-\infty}^{+\infty} g_T(t) \cdot g_T(t) \, dt = \int_{-\infty}^{+\infty} g_T^2(t) \, dt$$

$$g(kT) = \int_{-\infty}^{+\infty} g_T(\alpha)\, g_T(kT-\alpha)\, d\alpha = 0$$



NON C'E' INTERFERZA INTERSIMBOLICA

3) $$\sigma_n^2 = \frac{N_0}{2} \int_{-\infty}^{+\infty} |g_R(f)|^2 df = \frac{N_0}{2} g(0)$$

4)

$$z_k = a_k \cdot g(0) + n_k$$

$$P(e) = \frac{1}{2} Pr\{-g(0) + n_k > 0 \,|\, a_k = -1\} + \frac{1}{2} Pr\{g(0) + n_k < 0 \,|\, a_k = 1\} =$$

$$= Pr\{g(0) + n_k < 0 \,|\, a_k = 1\} = Q\left(\frac{g(0)}{\sqrt{\frac{N_0 g(0)}{2}}}\right) = Q\left(\sqrt{\frac{2E_S}{N_0}}\right)$$