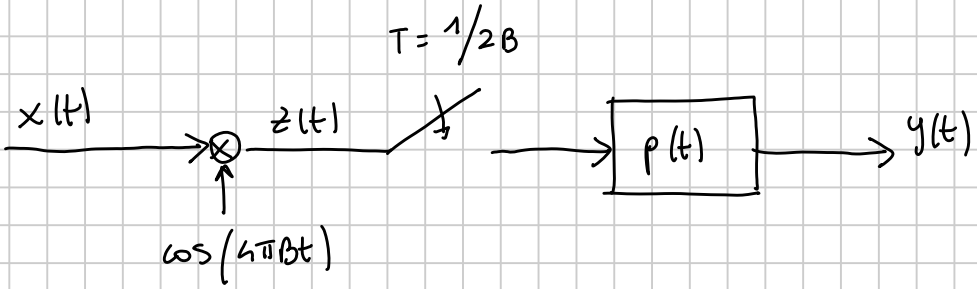
FILA A



$$p(t) = 2B\,\mathrm{sinc}(2Bt)$$

$$P(f) = \mathrm{rect}\left(\frac{f}{2B}\right)$$

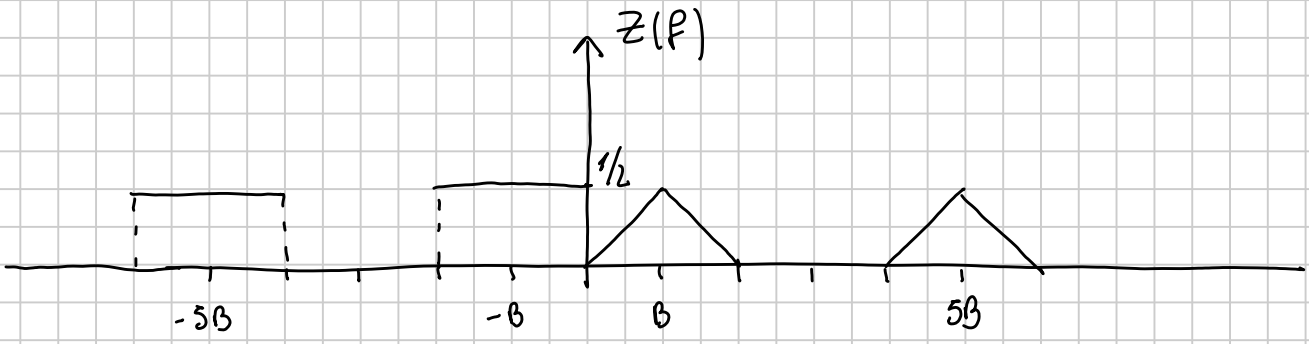
$$z(t) = x(t)\cdot\cos(4\pi Bt) = x(t)\cdot\left(\frac{e^{j4\pi Bt} + e^{-j4\pi Bt}}{2}\right) =$$

$$= B\,\mathrm{sinc}(2Bt)\,e^{-j2\pi Bt} + B\,\mathrm{sinc}(2Bt)\,e^{-j10\pi Bt} +$$

$$\frac{B}{2}\,\mathrm{sinc}^2(Bt)\,e^{j10\pi Bt} + \frac{B}{2}\,\mathrm{sinc}^2(Bt)\,e^{j2\pi Bt}$$

$$Z(f) = \frac{1}{2}\,\mathrm{rect}\left(\frac{f+B}{2B}\right) + \frac{1}{2}\,\mathrm{rect}\left(\frac{f+5B}{2B}\right) +$$

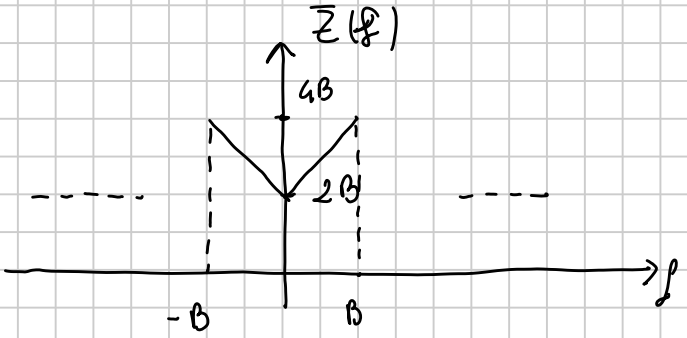
$$+ \frac{1}{2}\left(1 - \frac{|f-5B|}{B}\right)\mathrm{rect}\left(\frac{f-5B}{2B}\right) + \frac{1}{2}\left(1 - \frac{|f-B|}{B}\right)\mathrm{rect}\left(\frac{f}{2B}\right)$$



$$\bar{Z}(f) = 2B \sum_k z(f - k2B)$$

Nell'intervallo $-B \div B$ cadono le repliche di $z(f)$ per

$k=0$ $k = \pm 1$ $k = \pm 2$ e $k = \pm 3$



$$Y(f) = \bar{Z}(f) \cdot P(f) = 4B \, \text{rect}\left(\frac{f}{2B}\right) - 2B\left(1 - \frac{|f|}{B}\right) \text{rect}\left(\frac{f}{2B}\right)$$

$$y(t) = 8B^2 \, \text{sinc}\left(t\,2B\right) - 2B^2 \, \text{sinc}^2\left(t\,B\right)$$

Segnale ad energia finita e potenza nulla

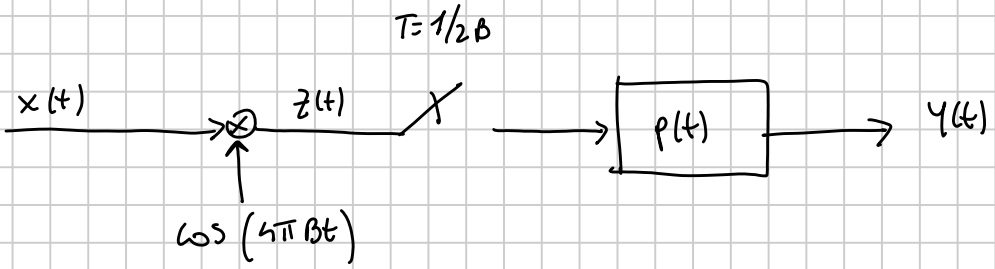
$E_y < +\infty$

$P_y = 0$

$$E_y = 2 \int_0^B (2t + 2B)^2 \, dt = 2 \int_0^B (4t^2 + 4B^2 + 8Bt) \, dt =$$

$$= 2\left[\frac{4}{3}t^3 + 4B^2t + \frac{8}{2}Bt^2\right]_0^B = 2\left[\frac{4}{3}B^3 + 4B^3 + 4B^3\right] = 2B^3\left[\frac{4+24}{3}\right] = \frac{56}{3}B^3$$

FILA B



$$x(t) = 2B\,\mathrm{sinc}(2Bt)\,e^{-j6\pi Bt} + \left[2B\,\mathrm{sinc}(2Bt) - B\,\mathrm{sinc}^2(Bt)\right]e^{j6\pi Bt} =$$

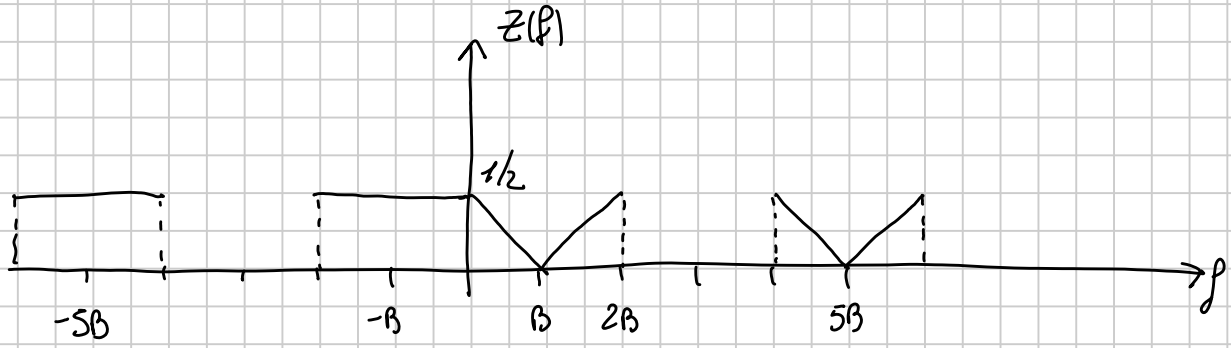
$$= x_0(t)\,e^{-j6\pi Bt} + x_1(t)\,e^{j6\pi Bt}$$

$$z(t) = x(t)\cdot\cos(4\pi Bt) =$$

$$= \frac{x_0(t)}{2}e^{-j2\pi Bt} + \frac{x_0(t)}{2}e^{-j10\pi Bt} + \frac{x_1(t)}{2}e^{j10\pi Bt} + \frac{x_1(t)}{2}e^{j2\pi Bt}$$

$$Z(f) = \frac{1}{2}X_0(f+B) + \frac{1}{2}X_0(f+5B) + \frac{1}{2}X_1(f-5B) + \frac{1}{2}X_1(f-B)$$

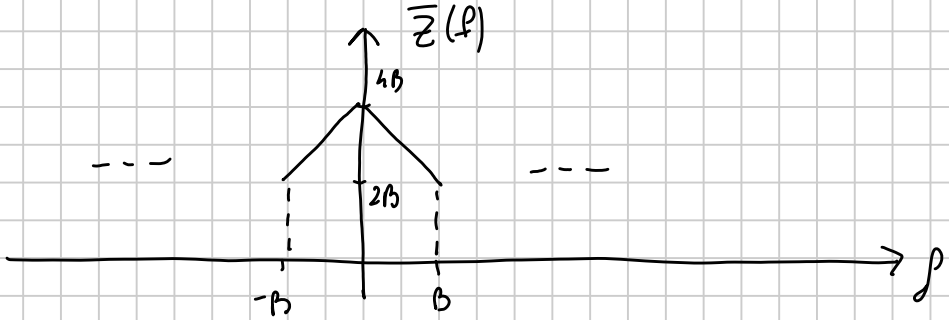
$$X_0(f) = \mathrm{rect}\left(\frac{f}{2B}\right) \qquad X_1(f) = \mathrm{rect}\left(\frac{f}{2B}\right) - \left(1-\frac{|f|}{B}\right)\mathrm{rect}\left(\frac{f}{2B}\right)$$



$$\overline{Z}(f) = 2B \sum_k Z(f - k2B)$$

Nell'intervallo $-B \div B$ si sovrappongono le repliche di $Z(f)$ per

$k=0 \quad k=\pm 1 \quad k=\pm 2 \quad k=\pm 3$



$$Y(f) = 2B \, \text{rect}\left(\frac{f}{2B}\right) + 2B\left(1 - \frac{|f|}{B}\right) \text{rect}\left(\frac{f}{2B}\right)$$

$$y(t) = 4B^2 \, \text{sinc}(t2B) + 2B^2 \, \text{sinc}^2(tB)$$

Segnale ad energia finita e potenza nulla

$E_y < +\infty$

$P_y = 0$

$$E_y = 2 \int_0^B |4B - 2t|^2 \, dt = 2 \int_0^B (16B^2 + 4t^2 - 16Bt) \, dt =$$

$$= 2\left[16B^2 t + \frac{4}{3}t^3 - \frac{16Bt^2}{2}\right]_0^B = 2\left[16B^3 + \frac{4}{3}B^3 - 8B^3\right] =$$

$$= 2B^3\left[8 + \frac{4}{3}\right] = \frac{56}{3}B^3$$