|22-02-2002|

1

$$E_x = \int_{-\infty}^{+\infty} |x(t)|^2 dt = \int_{-\frac{T}{2}}^{0} V^2 dt + \int_{0}^{\frac{T}{2}} V^2 dt = V^2 \int_{-\frac{T}{2}}^{\frac{T}{2}} dt = V^2 T$$

2

$$X(\omega) = \int_{-\infty}^{+\infty} x(t) e^{-j\omega t} dt = \int_{-\frac{T}{2}}^{0} V e^{-j\omega t} dt - \int_{0}^{\frac{T}{2}} V e^{-j\omega t} dt$$

$$= V\left[\frac{e^{-j\omega t}}{-j\omega}\right]_{-\frac{T}{2}}^{0} - V\left[\frac{e^{-j\omega t}}{-j\omega}\right]_{0}^{\frac{T}{2}} =$$

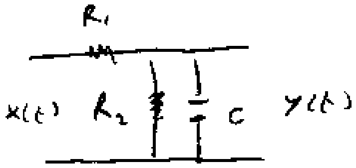
$$= V\left[\frac{1 - e^{j\omega\frac{T}{2}}}{-j\omega}\right] - V\left[\frac{e^{-j\omega\frac{T}{2}} - 1}{-j\omega}\right] =$$

$$= \frac{V}{\omega}\left[1 - e^{+j\omega\frac{T}{2}} - e^{-j\omega\frac{T}{2}} + 1\right] j = \frac{V}{\omega}\left[2 - 2\cos\left(\omega\frac{T}{2}\right)\right] j$$

$$|X(\omega)|^2 = \frac{V^2}{\omega^2}\left[2 - 2\cos\left(\omega\frac{T}{2}\right)\right]^2$$

$$E_{b,c} = \frac{|X(\omega)|^2}{2\pi} = \frac{V^2}{\omega^2}\,\frac{\left[2 - 2\cos\left(\omega\frac{T}{2}\right)\right]^2}{\pi}$$

③



$$y(t) = \frac{Z_2 \parallel Z_3}{Z_1 + Z_2 \parallel Z_3}\, x(t)$$

$$\Downarrow$$

$$H(\omega) = \frac{\dfrac{R_2 \cdot \frac{1}{j\omega C}}{R_2 + \frac{1}{j\omega C}}}{R_1 + \dfrac{R_2 \cdot \frac{1}{j\omega C}}{R_2 + \frac{1}{j\omega C}}} =$$

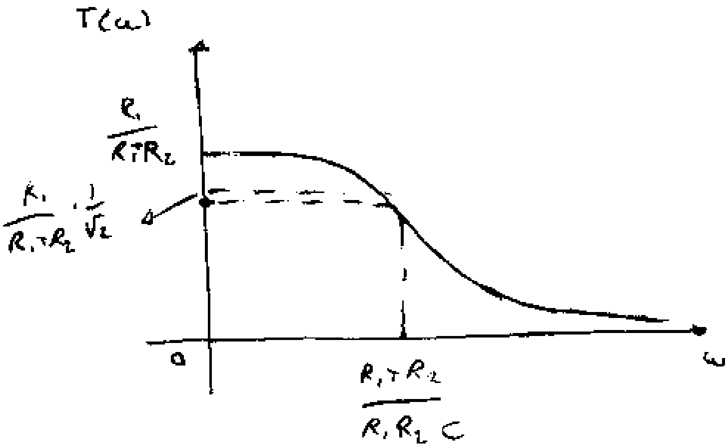
$$= \frac{R_2}{R_1 + R_2} \cdot \frac{1}{1 + j\omega C \dfrac{R_1 R_2}{R_1 + R_2}}$$

$$T(\omega) = |H(\omega)| = \frac{R_2}{\sqrt{(R_1 + R_2)^2 + (\omega R_1 R_2 C)^2}}$$

$$\beta(\omega) = -\arg\{H(\omega)\} = \arctan\left(\omega C \frac{R_1 R_1}{R_1 + R_2}\right)$$

$$T(\omega)\Big|_{\omega=0} = \frac{R_1}{R_1 + R_2} \qquad T(\omega)\Big|_{\omega = \frac{R_1 + R_2}{R_1 R_2 C}} = \frac{R_1}{R_2 + R} \cdot \frac{1}{\sqrt{2}} \qquad T(\omega)\Big|_{\omega \to \infty} = 0$$

④



12

(5)

$$\frac{|Y(\omega)|^2}{2\pi} = |H(\omega)|^2 \frac{|X(\omega)|^2}{2\pi} \Rightarrow$$

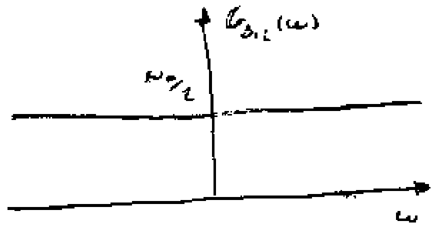
$$G_y(\omega) = \frac{R_2^2}{(R_1+R_2)^2 + (\omega R_1 R_2 C)^2} \cdot \frac{V^2}{\omega^2} \frac{\left[1-\cos\left(\omega \frac{T}{2}\right)\right]^2}{\pi}$$

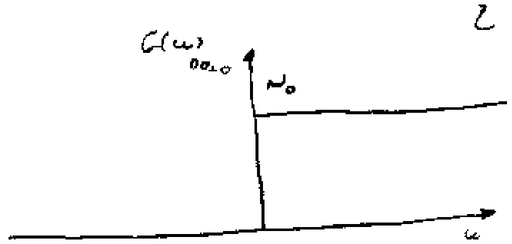
|19-03-2002|

(1)

$$C(\tau) = \pi N_0 \delta(\tau)$$

$$G_{xBil}(\omega) = \frac{F[C(\tau)]}{2\pi} = \frac{1}{2\pi}\int_{-\infty}^{+\infty} \pi N_0 \delta(\tau) e^{-j\omega t} d\tau = \frac{N_0}{2}$$



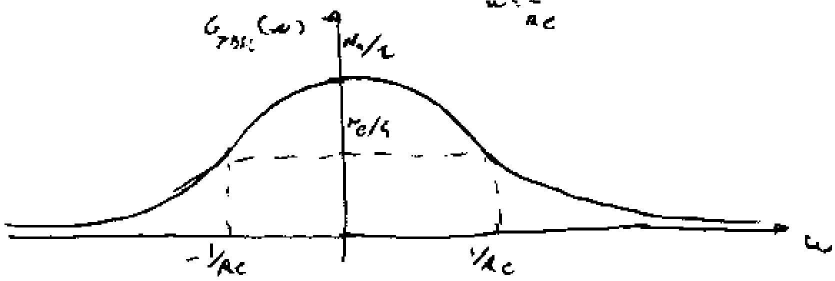


(4)

F.D.T FILTRO RC $\Rightarrow$ $H(\omega) = \frac{1}{1+j\omega RC}$

$$G_{yBil}(\omega) = |H(\omega)|^2 G_{xBil}(\omega) = \frac{1}{1+(\omega RC)^2} \cdot \frac{N_0}{2}$$

$$G_{yBil}(\omega)\Big|_{\omega=0} = \frac{N_0}{2} \qquad G_{yBil}(\omega)\Big|_{\omega=\frac{1}{RC}} = \frac{N_0}{4} \qquad G_{yBil}(\omega)\Big|_{\omega\to\infty} = 0$$



(4)

$$G_{Y_{BIL}}(\omega) = \frac{F[C_Y(\tau)]}{2\pi} \Rightarrow F[C_Y(\tau)] = 2\pi\, G_{Y_{BIL}}(\omega) \Rightarrow$$

$$C_Y(\tau) = F^{-1}[2\pi\, G_{Y_{BIL}}(\omega)]$$

$$C_Y(\tau) = \frac{1}{\cancel{2\pi}} \int_{-\infty}^{+\infty} \cancel{2\pi} \frac{1}{1+(\omega RC)^2} \frac{N_0}{2} e^{j\omega\tau} d\omega = \frac{N_0}{2} \int_{-\infty}^{+\infty} \frac{e^{j\omega\tau}}{1+(\omega RC)^2} d\tau$$

(5)

$$P_Y = C_Y(0)$$