Parcial 2.

1 Punto:

$$X(\omega) = F\{x(t)\} = \int_{-\infty}^{\infty} x(t)\, e^{-j\omega t}\, \partial t$$

Espectro de señal recibida al mixer.

$$S_{rec}(t) = A_1 m(t)\cos(2\pi f_0 t + \cancel{\theta_0}^{\,0}) \quad \text{Si } \cos(\theta) = \frac{e^{j\theta} + e^{-j\theta}}{2} \text{ y } W_0 = 2\pi f_0$$

$$= A_1 m(t)\cos(W_0 t)$$

$$= A_1 m(t)\left(\frac{e^{jW_0 t} + e^{-jW_0 t}}{2}\right)$$

$$= \frac{1}{2} A_1 m(t)\left(e^{jW_0 t} + e^{-jW_0 t}\right)$$

$$\text{Si } f(t)e^{jW_0 t} \longleftrightarrow F(\omega - W_0)$$

$$S_{rec}(\omega) = F\left\{\frac{1}{2} A_1 m(t)\left(e^{jW_0 t} + e^{-jW_0 t}\right)\right\} = \frac{1}{2} A_1 F\left\{m(t)e^{jW_0 t} + m(t)e^{-jW_0 t}\right\}$$

$$= \frac{1}{2} A_1 \left(M(\omega - W_0) + M(\omega + W_0)\right)$$

Espectro de señal de salida del mixer:

$$y(t) = \frac{A_1}{2} m(t) + \frac{A_1}{2} m(t)\cos(4\pi f_0 t + 2\theta_0) \quad \text{Si } W_0 = 2\pi f_0$$

$$y(t) = \frac{A_1}{2} m(t) + \frac{A_1}{2} m(t)\cos(2W_0 t)$$

$$y(\omega) = F\left\{\frac{A_1}{2} m(t) + \frac{A_1}{2} m(t)\cos(2W_0 t)\right. = F\left\{\frac{A_1}{2} m(t)\cos(2W_0 t)\right\}$$

$$= \frac{A_1}{2} M(\omega) + F\left\{\frac{A_1}{2} m(t)\cos(2W_0 t)\right\} \quad \text{Si } \cos(\theta) = \frac{e^{j\theta} + e^{-j\theta}}{2}$$

$$= \frac{A_1}{2} M(\omega) + \frac{A_1}{4}\left(M(\omega - W_0) + M(\omega + W_0)\right)$$

Demolador coherente de AM DSB-SC/DSB-CS

Señal mensaje base: $m(t) \rightarrow M(\omega)$

Señal recibido: $S_{rec}(t) = A_1 m(t)\cos(2\pi f_0 t + \theta_0)$

A_1: Ganancia, f_0: frecuencia de la portadora

Segunda señal que entra al mixer: $\cos(2\pi f_0 t + \theta_0)$

$$W_0 = 2\pi f_0 = \frac{2\pi}{T}$$

Despues del mixer:

$$y(t) = A_1 m(t) \cos(2\pi f_0 t + \theta_0) \cdot \cos(2\pi f_0 + \theta_0)$$

$$y(t) = A_1 m(t) \cos^2(2\pi f_0 t + \theta_0) \quad ; \quad W_0 = 2\pi f_0$$

$$\text{Si } \cos^2(\theta) = \frac{1 + \cos(2\theta)}{2}$$

$$y(t) = \frac{A_1}{2} m(t) (1 + \cos[2(2\pi f_0 t + \theta_0)])$$

$$y(t) = \frac{A_1}{2} m(t) + \frac{A_1}{2} m(t) \cos(4\pi f_0 t + 2\theta_0)$$

Filtro pasa - bajas (LPF)

Entrada: $y(t)$

Salida: $y_f(t) = \frac{A_1}{2} m(t) \rightarrow Y_f(\omega) = \frac{A_1}{2} M(\omega)$

Escalador de amplitud:

Entrada: $y_f(t) = \frac{A_1}{2} m(t)$

Ganancia: $G = \frac{2}{A_1}$

Salida: $\hat{m}(t) = \frac{\cancel{A_1}}{\cancel{2}} m(t) \cdot \frac{\cancel{2}}{\cancel{A_1}} = m(t)$

Espectro de señal de salida del mixer: $H_f(\omega) = \begin{cases} 1, & |W| \leq W_c \\ 0, & |\omega| > W_c \end{cases}$

$$H_f(\omega) = \frac{Y_f(\omega)}{Y(\omega)}$$

$$y_f(t) = \frac{A_1}{2} m(t) \longrightarrow Y_f(\omega) = \frac{A_1}{2} M(\omega)$$

Espectro de señal del escalador.

$$\hat{m}(t) = \frac{A_1}{2} m(t) \cdot \frac{2}{A_1} = m(t)$$

$$\hat{m}(\omega) = \mathcal{F}\{m(t)\} = M(\omega)$$