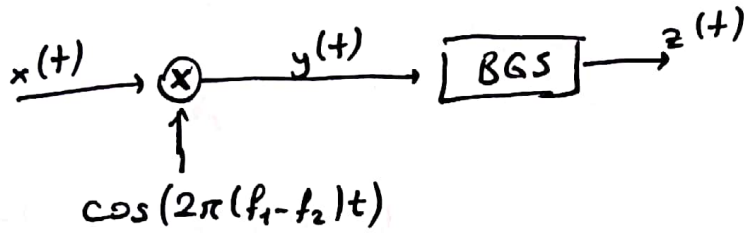


10/12/2020
Uygulama
③

EHB 351
Analog Haberleşme

1) $x(t) = \cos(2\pi f_1 t + \theta)$ işareti şekildeki devrenin girişine uygulanıyor. BGS'in kazancı 2, band genişliği B merkez frekansı f_2 'dir.



a) $x(t)$ işaretinin Fourier dönüşümünü bulunuz.
Genlik ve faz spektrumunu çiziniz.

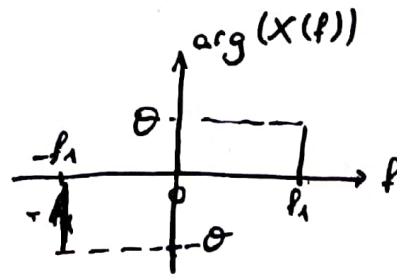
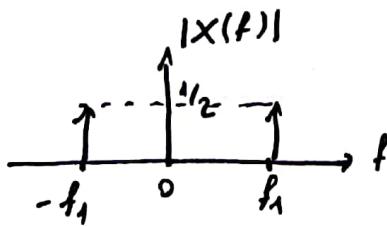
b) $y(t)$ işaretinin genlik ve faz spektrumunu çiziniz.

c) $B < 4|f_1 - f_2|$ ise $z(t)$ işaretini ve Fourier dönüşümünü bulunuz. $z(t)$ işaretini $x(t)$ ile karşılaştırarak bu devrenin hangi işlevi gördüğünü (ne devresi olduğunu) yazınız.

Cevap:

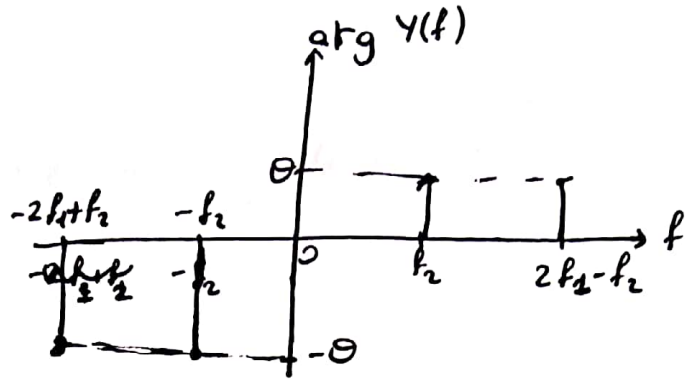
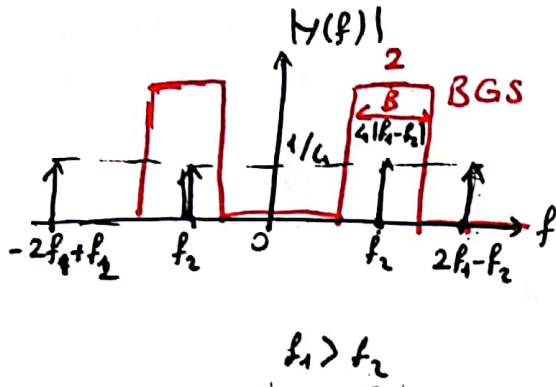
a) $x(t) = \frac{1}{2} e^{j2\pi f_1 t + j\theta} + \frac{1}{2} e^{-j2\pi f_1 t - j\theta}$

$$X(f) = \frac{1}{2} e^{j\theta} \delta(f - f_1) + \frac{1}{2} e^{-j\theta} \delta(f + f_1)$$



b) $y(t) = \cos(2\pi f_1 t + \theta) \cos(2\pi(f_1 - f_2)t)$

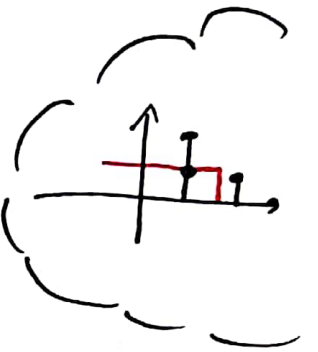
$$y(t) = \frac{1}{2} \cos(2\pi(2f_1 - f_2)t + \theta) + \frac{1}{2} \cos(2\pi f_2 t + \theta)$$



c) $z(t) = \cos(2\pi f_2 t + \theta)$ BGS karancı 2

$$z(f) = \frac{1}{2} e^{j\theta} \delta(f - f_2) + \frac{1}{2} e^{-j\theta} \delta(f + f_2)$$

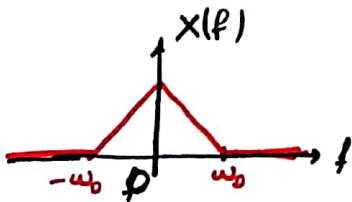
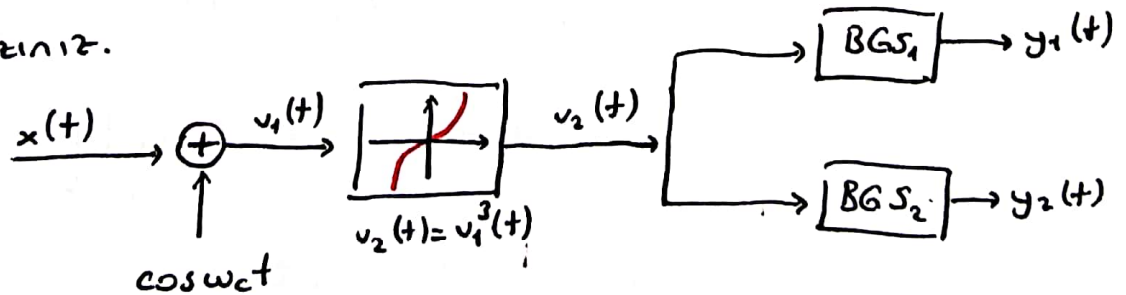
Bu devre girişine gelen işaretin frekansını değiştiren bir devredir.



2) Şekildeki sistemde $y_1(t)$ GYB ve $y_2(t)$ Üst YB modülasyonlu işaretler olduklarına göre,

a) BGS₁ ve BGS₂ süzgeçlerinin frekans karakteristikleri ne olmalıdır?

b) $y_1(t)$ ve $y_2(t)$ nin zaman domenindeki ifadelerini yazınız.



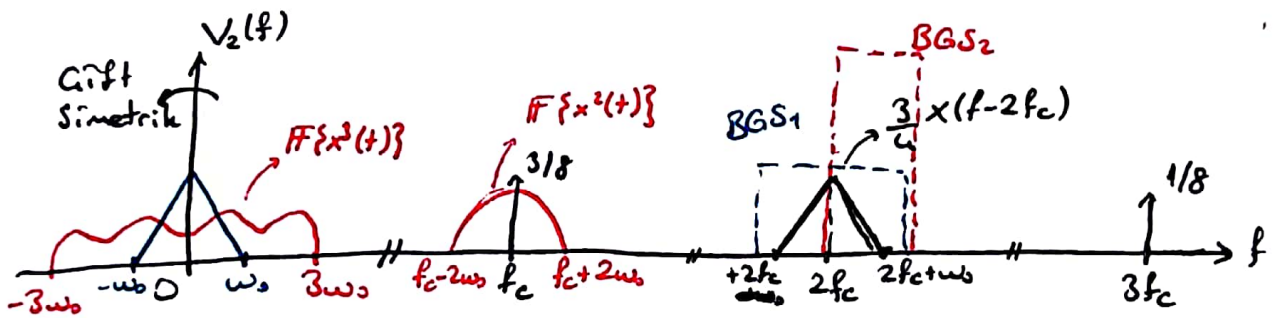
$$v_1(t) = x(t) + \cos \omega_c t$$

$$v_2(t) = (x(t) + \cos \omega_c t)^3$$

$$v_2(t) = x^3(t) + 3x^2(t)\cos \omega_c t + 3x(t)\cos^2 \omega_c t + \cos^3 \omega_c t$$

$$v_2(t) = \underbrace{x^3(t)} + \underbrace{3x^2(t)\cos \omega_c t} + \underbrace{\frac{3}{2}x(t)} + \underbrace{\frac{3}{2}x(t)\cos 2\omega_c t} + \underbrace{\frac{3}{4}\cos \omega_c t} + \underbrace{\frac{1}{4}\cos 3\omega_c t}$$

$$v_2(t) = \underbrace{x^3(t)} + \underbrace{\frac{3}{2}x(t)} + \left(3x^2(t) + \frac{3}{4}\right)\cos \omega_c t + \frac{3}{2}x(t)\cos 2\omega_c t + \frac{1}{4}\cos 3\omega_c t$$



BGS_1 , $2f_c$ merkez frekans $2\omega_0$ band genişliği.

BGS_2 , $2f_c + \frac{\omega_0}{2}$ merkez frekansı $2f_c < |f| < 2f_c + \omega_0$ geçirme bandı.

b) $y_1(t) = \frac{3}{2} \cdot x(t) \cdot \cos 2\omega_c t \rightarrow \underline{GYB} \rightarrow y_1(t) = \frac{3}{2} x(t) \cos 2\omega_c t$

$$y_2(t) = \frac{3}{2} \left[x(t) \cos 2\omega_c t - \hat{x}(t) \sin 2\omega_c t \right] \rightarrow \text{Üst Yan band}$$

$$y_2(t) = \frac{3}{2} \left[x(t) \cos 2\omega_c t - \hat{x}(t) \sin 2\omega_c t \right]$$