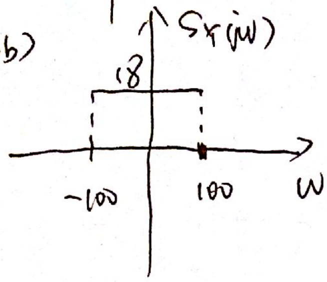
ECE 581

9-1.(a). $S_Y(j\omega) = S_X(j\omega)|H(j\omega)|^2$

$= 2\cdot 9 = 18.$, $\omega \in [-100, 100] \Rightarrow \begin{cases} 18, & \omega\in[-100,100] \\ 0, & \text{else} \end{cases}$

(b)



band limited white ~~random process~~ noise.

9-2 (a). $E[Y(t)] = \eta_X(t) * h(t)$

又 ∵ $X(t)$: white random process :

∴ $\eta_X(t) = 0$

$\Rightarrow \eta_Y(t) = E[Y(t)] = 0$

(b). $E[Y^2(t)] - E[Y(t)]^2$ = variance

$= E[Y^2(t)] = R_Y(0)$

~~$R_Y(\tau) = R$~~

$S_Y(j\omega) = S_X(j\omega)\cdot|H(j\omega)|^2$

$= 16 \cdot \left|\frac{3}{2+j\omega}\right|^2$

$= 16 \cdot \frac{9}{4+\omega^2} = 36 \cdot \frac{4}{4+\omega^2}$

∴ $R_Y(t) = 36 \cdot e^{-2|t|}$, $t\in(-\infty, +\infty)$

∴ Variance $= R_Y(0) = 36$

(c). the system is LTI system,

the input signal is Gaussian R.P

∴ Output is also a Gaussian R.P.

又 ∵ (a), (b) $Y(t) = \frac{1}{\sqrt{2\pi}\,6} e^{-\frac{(y-0)^2}{2\cdot 36}} = \frac{1}{6\sqrt{2\pi}} e^{-\frac{y^2}{72}}$

, $y\in(-\infty, +\infty)$

9-3. (a) $S_Y(j\omega)$

$= S_X(j\omega)\,|H(j\omega)|^2$

$= \frac{N_0}{2} \cdot \left|\frac{1}{a+j\omega}\right|^2$

$= \frac{N_0}{2} \cdot \frac{1}{a^2+\omega^2} = \frac{N_0}{4a} \cdot \frac{2a}{a^2+\omega^2}$

∴ $R_Y(t) = \frac{N_0}{4a} \cdot e^{-a|t|}$, $t\in(-\infty, +\infty)$

(b). $S_X(j\omega) = \frac{N_0}{2}$

(c). $S_Y(j\omega) = \frac{N_0}{2} \frac{1}{a^2+\omega^2}$, $\omega\in(-\infty, +\infty)$

(d) $R_Y(0)$ = average power

$= \frac{N_0}{4a}$.