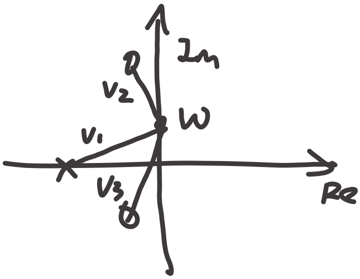
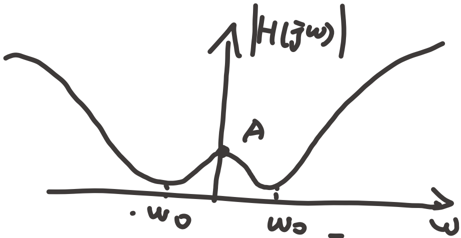
9.25 $|H(jw)| = \frac{V_2 V_3}{V_1}$

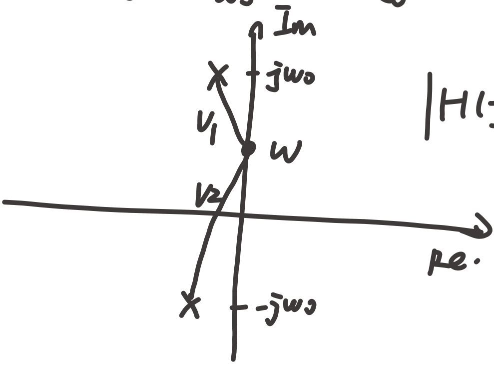
当 $w \to \infty$，$V_2 \approx V_1$

$V_3 \to \infty$ ∴ 结果趋于无穷





(b)

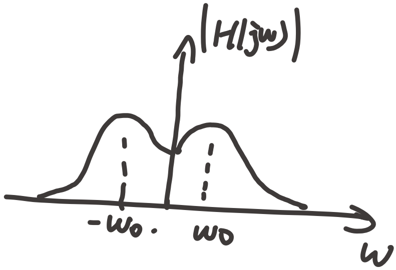


$|H(jw)| = \frac{1}{V_1 \cdot V_2}$

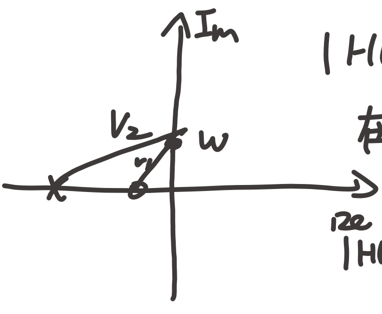
趋于$\pm jw_0$，$|H(jw)|$最大

趋于∞ $|H(jw)|$趋于0

在$s=0$点，有某常值



(c)



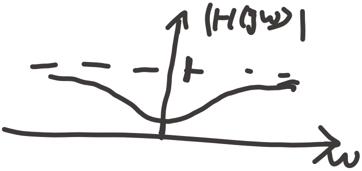
$|H(jw)| = \frac{V_1}{V_2}$.

在$s=0$处，趋于数值之比(大于1)

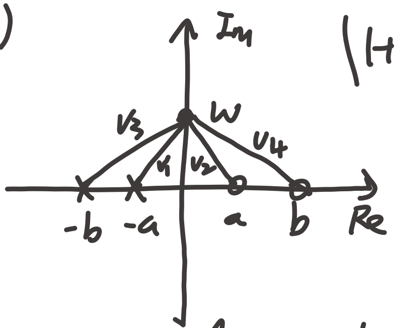
在$w \Rightarrow \infty$时

$|H(jw)| \approx 1$.

∴幅频



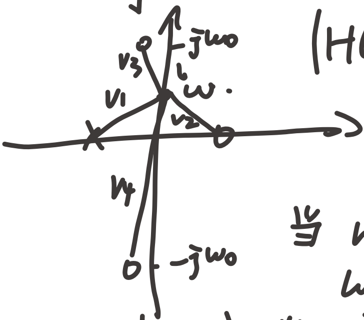
(d)



$$|H(jw)| = \frac{V_2 V_4}{V_1 V_3} = 1$$

是全通系统.

(e)

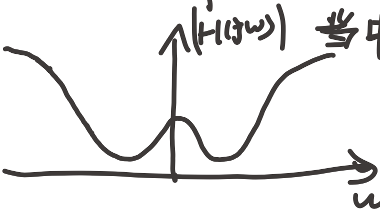


$$|H(jw)| = \frac{V_3 \cdot V_4 \cdot V_2}{V_1}$$

$$= V_3 V_4$$

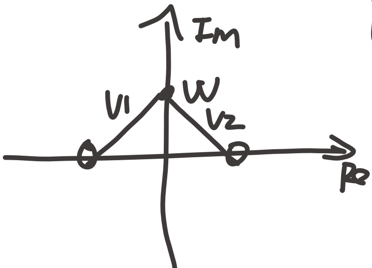
当 $w \to +\infty$ $|H(jw)| \to \infty$

$w \to -\infty$ $|H(jw)| \to \infty$

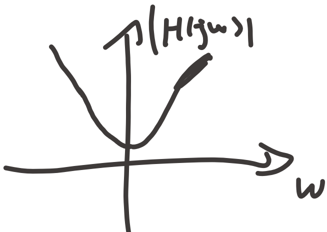


当中存在某点 使 $|H(jw)|$ 最小
2个

(f).

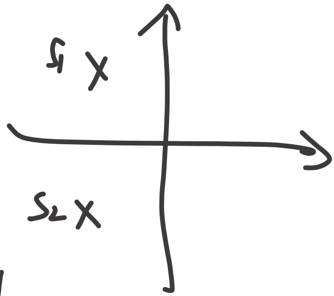


$$|H(jw)| = V_1 V_2.$$



9.27 由共轭对称. $s_1=-1+j$ 则另一个极点为

$s_2=-1-j$ 没有零点



∵ $e^{2t}x(t) \xrightarrow{\mathcal{L}} X(s-2)$

非绝对可积

$X(s-2)$ 收敛域不含 $j\omega$ 轴.

$e^{2t}x(t)$ 是不稳定的.

$X(s)$ 收敛域为 $Re\{s\}>-1$ 而非 $Re\{s\}<-1$

(否则 $X(s-2)$ 包含 $j\omega$ 轴)

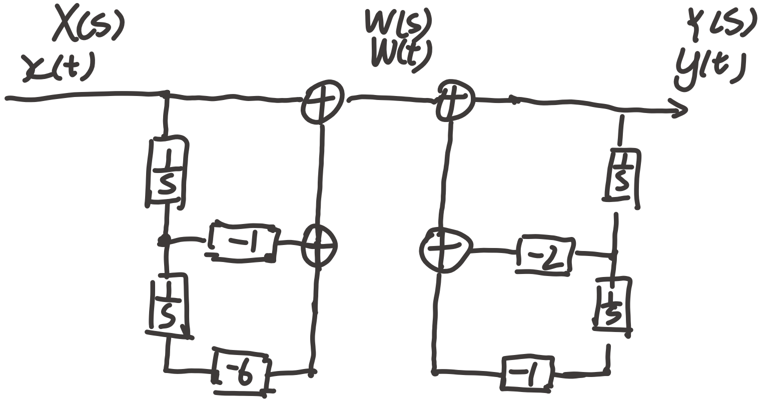
$$X_1(s)=\frac{A}{(s-(-1+j))(s-(-1-j))}=\frac{A}{s^2+2s+2}.$$

有 $X(0)=\dfrac{A}{2}=8$ $A=16$.

∴ 可确定出 $X(s)=\dfrac{16}{s^2+2s+2}$ $Re\{s\}>-1$

35 (a). 对图 P9.35 进行一些转换.

使其方便看出反馈.



其中 $W(s)= X(s)+\frac{-1}{s}X(s)-6\frac{1}{s^2}X(s)$

$$Y(s)=\frac{1}{s}(-2)Y(s)+W(s)+\frac{-1}{s^2}Y(s)$$

$$\frac{1}{s^2}Y(s)+\frac{2}{s}Y(s)+Y(s)=X(s)-\frac{1}{s}X(s)-6\frac{1}{s^2}X(s) \quad ①$$

逆变换得微分方程.

$$\iint y(t)dt+2\int y(t)dt+y(t)=x(t)-\int x(t)dt-6\iint x(t)dt$$

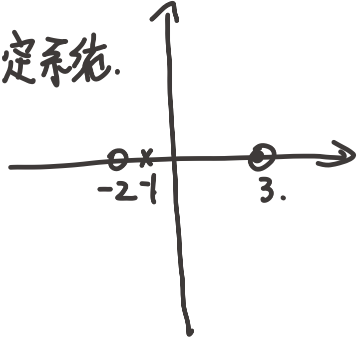
$$\frac{d^2y(t)}{dt^2}+2\frac{dy(t)}{dt}+y(t)=\frac{d^2x(t)}{dt^2}-\frac{dx(t)}{dt}-6x(t)$$

由①式. 系统函数(因果线性系统).

$$H(s)=\frac{Y(s)}{X(s)}=\frac{1-\frac{1}{s}-6\frac{1}{s^2}}{\frac{1}{s^2}+\frac{2}{s}+1}=\frac{s^2-s-6}{s^2+2s+1}$$

$$=\frac{(s-3)(s+2)}{(s+1)^2}$$ 收敛域 $Re\{s\}>-1$

包含了 $j\omega$ 轴 故是稳定系统.



9.40 (a) 对 $x(t)$ 单边 Laplace变换

$$X(s) = \frac{1}{s+4} \qquad Re\{s\} > -4$$

对微分方程, 转化为变换域

$$s^3 Y(s) + 6s^2 Y(s) + 11s Y(s) + 6Y(s) = X(s)$$

$$Y(s) = \frac{1}{(s+4)(s^3+6s^2+11s+6)}$$

$$= \frac{1}{(s+4)(s+1)(s+2)(s+3)} = \frac{+\frac{1}{6}}{s+1} + \frac{-\frac{1}{2}}{s+2} + \frac{\frac{1}{2}}{s+3} + \frac{-\frac{1}{6}}{s+4}$$

反变换为 $y(t) = \left[\frac{1}{6}e^{-t} - \frac{1}{2}e^{-2t} + \frac{1}{2}e^{-3t} - \frac{1}{6}e^{-4t}\right]u(t)$

零状态响应

$$Re(s) > -1$$

(b). 特征方程 $(s+1)(s+2)(s+3) = 0$

$$s_1 = -1 \quad s_2 = -2 \quad s_3 = -3.$$

记 $y_{zi}(t) = Ae^{-t} + Be^{-2t} + Ce^{-3t}$

$y_{zi}'(t) = -Ae^{-t} - 2Be^{-2t} + (-3)Ce^{-3t}$

$y_{zi}''(t) = +Ae^{-t} + 4Be^{-2t} + 9Ce^{-3t}$

$\because y_{zi}(0^-) = 1 \quad y_{zi}'(0^-) = -1 \quad y_{zi}''(0^-) = 1$

$\therefore \begin{cases} A+B+C=1 \\ -A-2B-3C=-1 \\ A+4B+9C=1 \end{cases}$ 得 $\begin{cases} A=1 \\ B=0 \\ C=0 \end{cases}$

$t>0^-$, $y_{zi}(t) = e^{-t}$. $\quad Y_{zi}(s) = \frac{1}{s+1} \quad Re\{s\} > -1$

(c) $y(t) = y_{zi}(t) + y_{zs}(t)$

$= \left(e^{-t} + \frac{1}{6}e^{-t} + (-\frac{1}{2})e^{-2t} + \frac{1}{2}e^{-3t} - \frac{1}{6}e^{-4t}\right)u(t)$

9.47(a) ① 第一种. $Y(s) = \frac{1}{s+2} \quad Re(s) > -2$

则 $H(s) = \frac{s-1}{s+1}$

$\therefore X(s) = \frac{Y(s)}{H(s)} = \frac{s+1}{(s+2)(s-1)} = \frac{\frac{1}{3}}{s+2} + \frac{\frac{2}{3}}{s-1}$

$\therefore x(t) = \left(\frac{1}{3}e^{-2t} + \frac{2}{3}e^{-t}\right)u(t) \quad Re(s) > +1$

② 将 $s = j\omega$ 代入. 收敛域应含 $j\omega$ 轴

$X(j\omega) = \frac{j\omega+1}{(j\omega+2)(j\omega-1)} = \frac{1}{2+j\omega} \; \frac{j\omega+1}{j\omega-1}$

$= \frac{1}{2+j\omega}\left(1 + \frac{2}{j\omega-1}\right)$

$$= \frac{1}{2+j\omega} + 2\,\frac{1}{2+j\omega}\,\frac{1}{j\omega-1}$$

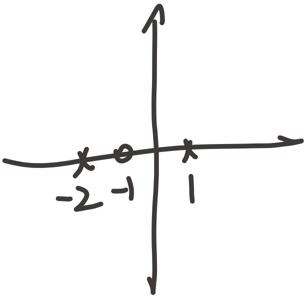
$$= e^{-2t}u(t) + \frac{2}{3}\left(\frac{1}{j\omega-1} - \frac{1}{2+j\omega}\right)$$

反 $\Rightarrow$ $\frac{1}{3}e^{-2t}u(t) - \frac{2}{3}e^{t}u(-t)$ $\quad Re(s)\in(-2,1)$

(b) 即已知 $x(t)$ 的FT存在

$X(s)$ 收敛域包含$j\omega$轴

$\because X(s) = \frac{s+1}{(s+2)(s-1)}$



则可进一步确认其收敛域为 $Re(s)\in(-2,1)$

则(a)中的 $x(t) = \left(\frac{1}{3}e^{-2t} + \frac{2}{3}e^{-t}\right)u(t)$

不成立 $\quad x(t) = \frac{1}{3}e^{-2t}u(t) - \frac{2}{3}e^{t}u(-t)$

(c) 输入 $y(t) = e^{-2t}u(t)$

输出为 $x_1(t) = \left(\frac{1}{3}e^{-2t} + \frac{2}{3}e^{-t}\right)u(t) \quad Re(s)>+1$

或 $x_2(t) = \frac{1}{3}e^{-2t}u(t) - \frac{2}{3}e^{t}u(-t) \quad -2<Re(s)<1$

系统至少是稳定的，则显然 $X(s)$ 收敛域含 $j\omega$轴 $\therefore x(t) = x_2(t)$

$$X_2(j\omega) = \frac{1}{3}\,\frac{1}{j\omega+2} - \frac{2}{3}\,\frac{-1}{j\omega-1}$$

$$Y(j\omega) = \frac{1}{j\omega+2}$$

$$\therefore H(j\omega) = \frac{X_2(j\omega)}{Y(j\omega)} = \frac{1}{3} + \frac{2}{3}\,\frac{j\omega+2}{j\omega-1}$$

$$= \frac{1}{3} + 1 + \frac{3}{j\omega-1} \quad \therefore h(t) = \frac{4}{3}\delta(t) - 3e^{t}u(-t).$$

9.50 (a) 错误，未提及因果性 也可以位于右半平面，$y(t) = e^{2t}u(-t)$，且为一个左边信号即可包含 $j\omega$ 轴

(d)，不正确. $X(s) = \frac{s-1}{s+1}$ $Re(s) > -1$

对零点无要求。