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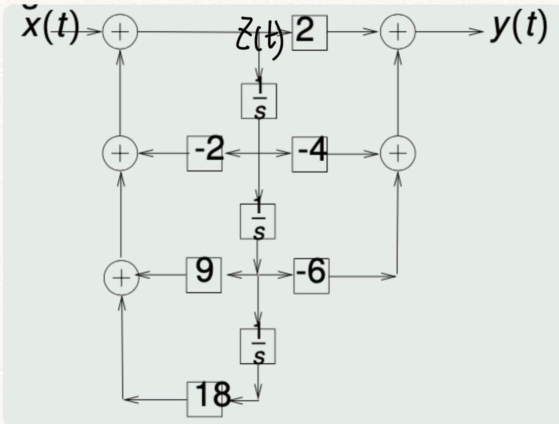
(1)



$$\begin{cases} Z(s) = X(s) + -2\frac{1}{s}Z(s) + 9\frac{1}{s^2}Z(s) + 18\frac{1}{s^3}Z(s) \\ Y(s) = 2Z(s) - 4\frac{1}{s}Z(s) - 6\frac{1}{s^2}Z(s) \end{cases}$$

Thus. $$\begin{cases} X(s) = \frac{s^3+2s^2-9s-18}{s^3} Z(s) \\ Y(s) = \frac{2s^2-4s-6}{s^2} Z(s) \end{cases}$$

Thus. $$H(s) = \frac{Y(s)}{X(s)} = \frac{2s^3-4s^2-6s}{s^3+2s^2-9s-18}$$

it has three poles at $s_1 = -3$, $s_2 = -2$, $s_3 = 3$

Since it's a casual signal, the ROC is RHP.

Thus. ROC $= \{s \mid real\{s\} > 3\}$.

But $3 > 0$, $j\omega$ is not in the ROC.

Thus. it's not stable.

(2) $$H(s) = 2 + \frac{-8s^2+12s+36}{(s+3)(s+2)(s-3)}$$

$$= 2 + \frac{A}{s+3} + \frac{B}{s+2} + \frac{C}{s-3}$$

Thus. $A(s^2-s-6)+B(s^2-6s+9)+C(s^2+5s+6)=-8s^2+12s+36$

$$\begin{cases} A+B+C=-8 \\ -A-6B+5C=12 \\ -6A+9B+6C=36 \end{cases} \Rightarrow \begin{cases} A=-\frac{36}{5} \\ B=-\frac{4}{5} \\ C=0 \end{cases}$$

Therefore, $H(s)=2-\frac{36}{5}\cdot\frac{1}{s+3}-\frac{4}{5}\cdot\frac{1}{s+2}$

$$h(t)=2\delta(t)-\frac{36}{5}e^{-3t}u(t)-\frac{4}{5}e^{-2t}u(t).$$

(3) $\frac{d^3}{dt^3}y(t)+2\frac{d^2}{dt^2}y(t)-9\frac{d}{dt}y(t)-18y(t)=2\frac{d^3}{dt^3}x(t)-4\frac{d^2}{dt^2}x(t)-6\frac{d}{dt}x(t)$