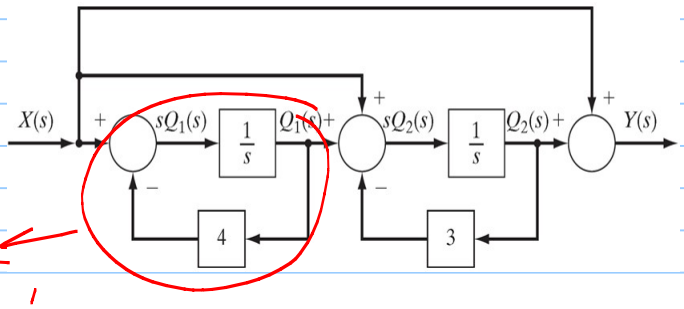
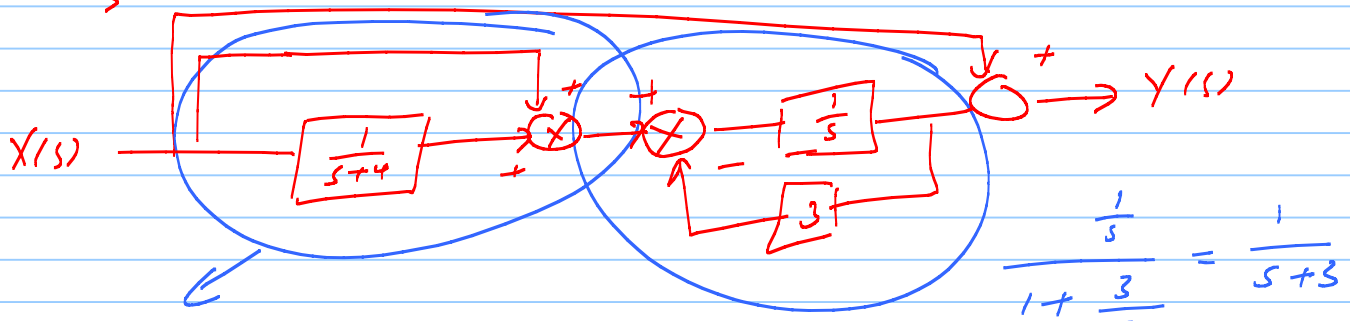
Note Title 4/25/2019

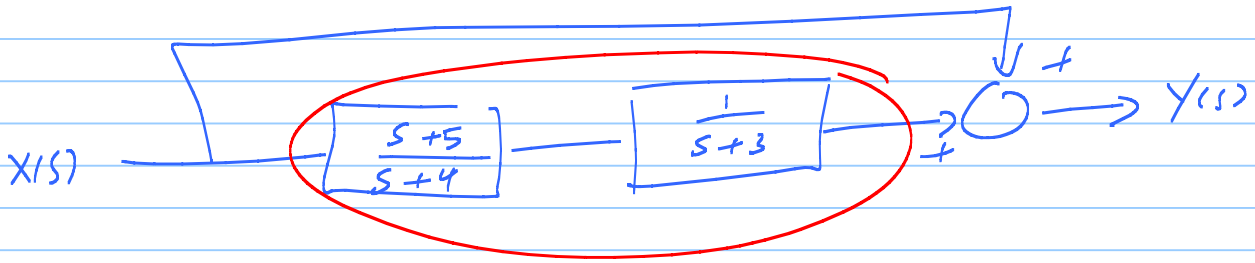


$$\frac{\frac{1}{s}}{1+\frac{4}{s}} = \frac{1}{s+4}$$

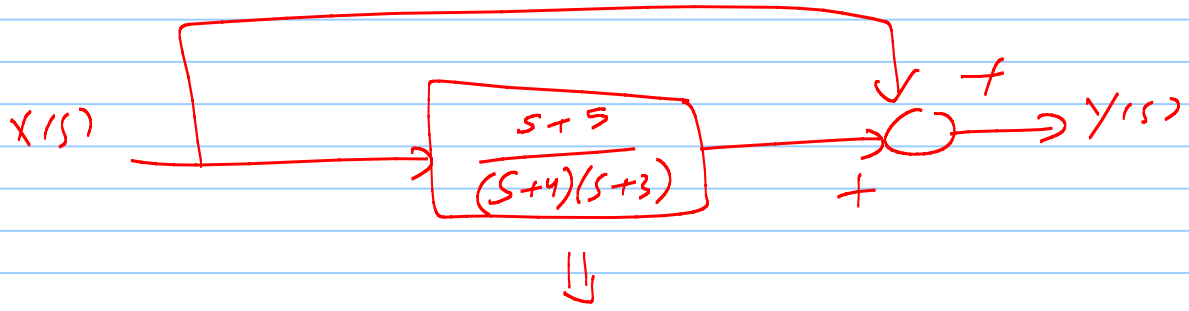


$$\frac{\frac{1}{s}}{1+\frac{3}{s}} = \frac{1}{s+3}$$

$$1+\frac{1}{s+4} = \frac{s+5}{s+4}$$



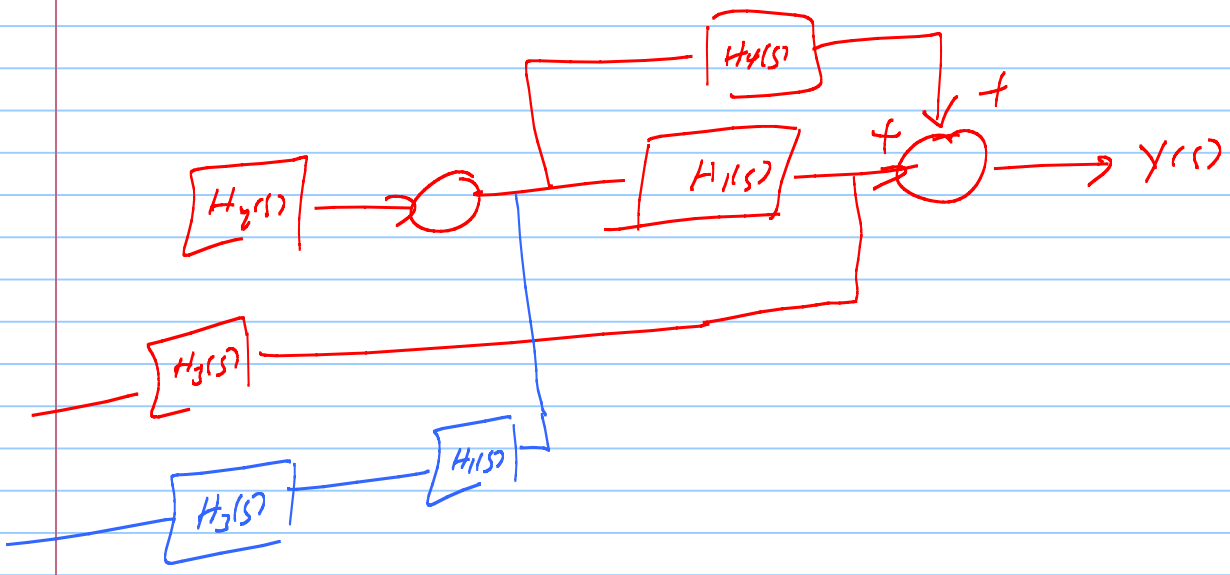
$$\frac{s+5}{(s+4)(s+3)}$$

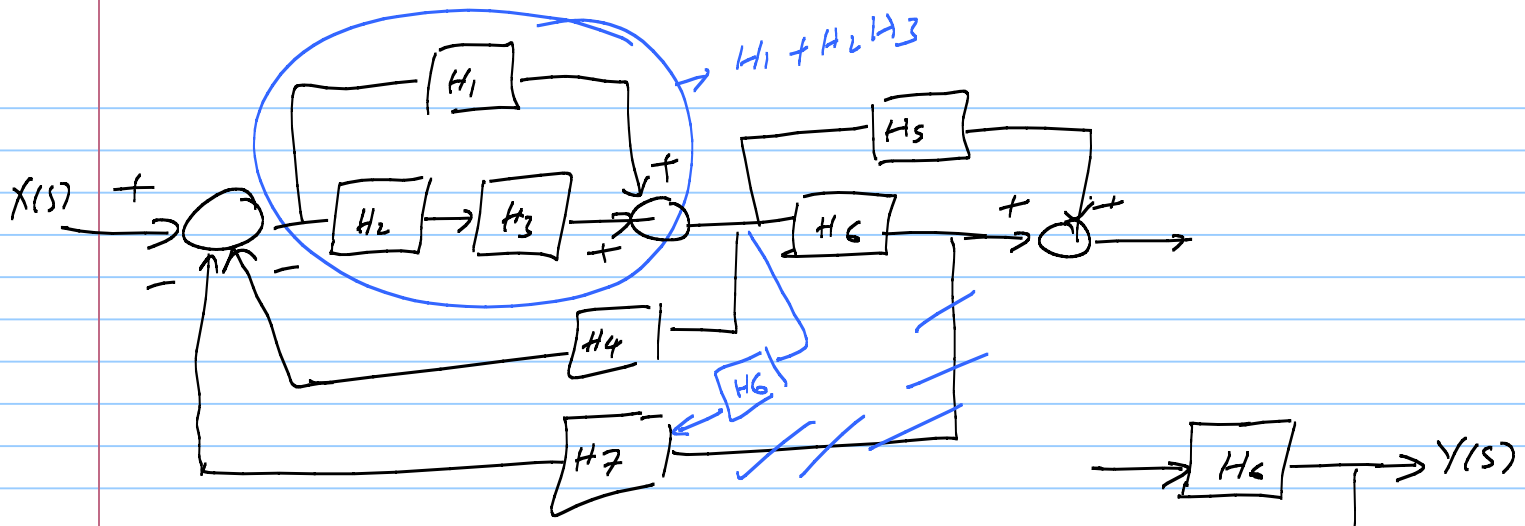


$$\frac{s+5}{(s+4)(s+3)} + 1$$

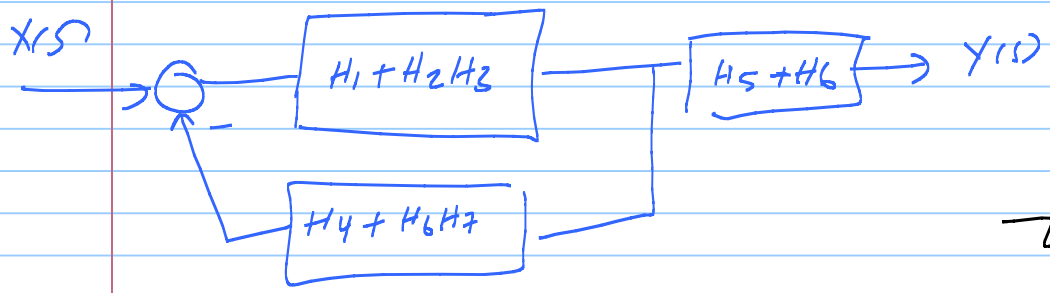
$$H(s) = \frac{(s+5)+(s+3)(s+4)}{(s+3)(s+4)}$$

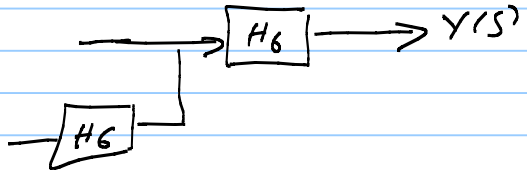
$$H(s) = \frac{s+5+s^2+7s+12}{(s+3)(s+4)} = \frac{s^2+8s+17}{(s+3)(s+4)}$$

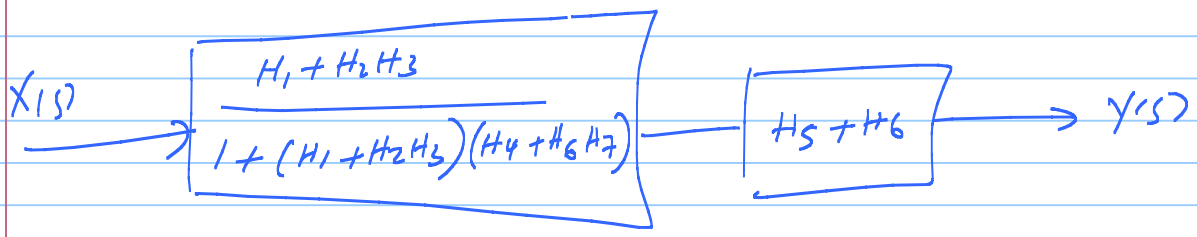




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$$H(s) = \frac{(H5+H6)(H1+H2H3)}{1+(H1+H2H3)(H4+H6H7)}$$

$$\delta[n] = \begin{cases} 1, & n = 0 \\ 0, & n \neq 0 \end{cases}$$

$$X(z) = \sum_{n=-\infty}^{\infty} x[n] z^{-n}$$

$$X(z) = \sum_{n=-\infty}^{\infty} \delta[n]\, z^{-n} = (1)\, z^{-0} = 1$$

$$\boxed{\delta[n] \Longleftrightarrow 1}$$

Ex

$$x[n] = \delta[n-3]$$

$$X(z) = \sum_{n=-\infty}^{\infty} \delta[n-3]\, z^{-n} = (1)\, z^{-3} = z^{-3}$$

$$\therefore \boxed{\delta[n-q] \Longleftrightarrow z^{-q}} \Longleftrightarrow \frac{1}{z^q}$$

Ex

$$x[n] = u[n]$$

$$X(z) = U(z) = \sum_{n=0}^{\infty} u[n]\, z^{-n} = 1 + z^{-1} + z^{-2} + z^{-3} + z^{-4} + \cdots$$

$$(z-1)\,U(z) = (z-1)\left(1 + z^{-1} + z^{-2} + z^{-3} + z^{-4} + \cdots\right)$$

$$(z-1)U(z) = (z + 1 + z^{-1} + z^{-2} + z^{-3} + \cdots) - (1 + z^{-1} + z^{-2} + z^{-3} + z^{-4} + \cdots)$$

$$= z$$

$$U(z) = \frac{z}{z-1}$$

$$u[n] \longleftrightarrow \frac{z}{z-1}$$

Region of Convergence

$$z \neq 1$$

Ex $\quad x[n] = a^n u[n]$

$$X(z) = \sum_{n=0}^{\infty} a^n u[n] z^{-n}$$

$$= 1 + a z^{-1} + a^2 z^{-2} + a^3 z^{-3} + \cdots$$

$$(z-a)X(z) = (z-a)(1 + a z^{-1} + a^2 z^{-2} + a^3 z^{-3} + \cdots)$$

$$= (z + a + a^2 z^{-1} + a^3 z^{-2} + \cdots) - (a + a^2 z^{-1} + a^3 z^{-2} + a^4 z^{-3} + \cdots)$$

$$= z$$

$$X(z) = \frac{z}{z-a}$$

$$a^n u[n] \longleftrightarrow \frac{z}{z-a}$$

$$5^n u[n] \longleftrightarrow \frac{z}{z-5}$$