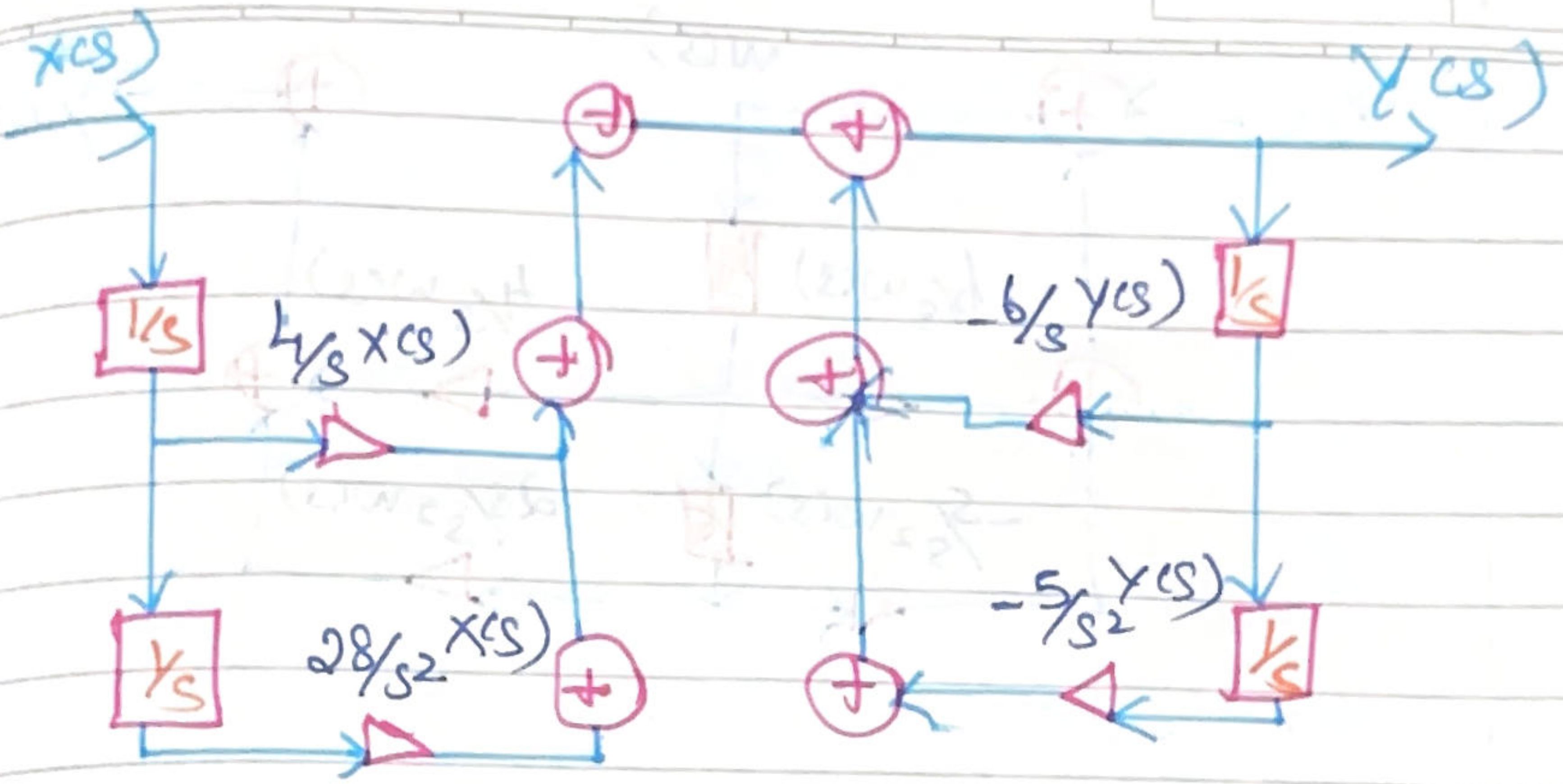




Direct form - II

from (1)

$$\frac{Y(s)}{W(s)} = \frac{4}{s} + \frac{28}{s^2}$$

$$Y(s) = \frac{4}{s} W(s) + \frac{28}{s^2} W(s)$$

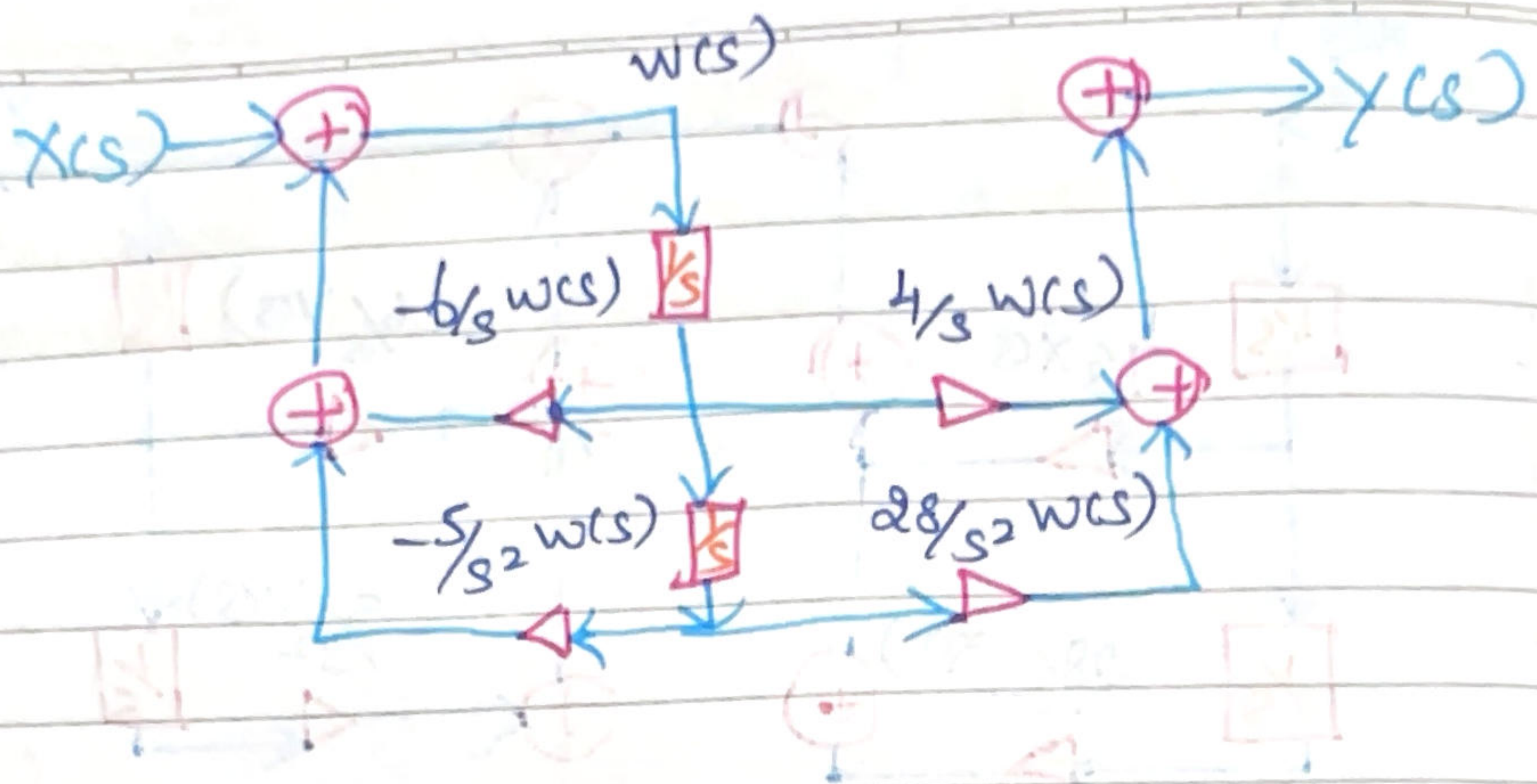
or

$$\frac{W(s)}{X(s)} = \frac{1}{1 + \frac{6}{s} + \frac{5}{s^2}}$$

$$W(s) \left[ 1 + \frac{6}{s} + \frac{5}{s^2} \right] = X(s)$$

$$W(s) + \frac{6}{s} W(s) + \frac{5}{s^2} W(s) = X(s)$$

$$W(s) = X(s) - \frac{6}{s} W(s) - \frac{5}{s^2} W(s)$$



- ② Obtain the direct form - I & direct form II, Cascade & parallel structure of CT-LTI system governed by the eqn:

$$\frac{d^2 y(t)}{dt^2} + 3 \frac{dy(t)}{dt} + 2y(t) = x(t)$$

Soln:

Given  $\frac{d^2 y(t)}{dt^2} + 3 \frac{dy(t)}{dt} + 2y(t) = x(t)$

LT on both sides  $\Rightarrow$

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

$$Y(s) [s^2 + 3s + 2] = X(s) \quad \text{--- (1)}$$

$$\frac{Y(s)}{X(s)} = \frac{1}{s^2 + 3s + 2} \quad \text{--- (2)}$$

Direct form - I :-

Divide  $s^2$  in eqn (1)  $\Rightarrow$

$$Y(s) \left[ 1 + \frac{3}{s} + \frac{2}{s^2} \right] = \frac{X(s)}{s^2}$$

$$Y(s) = \frac{X(s)}{s^2} - \frac{3}{s} Y(s) - \frac{2}{s^2} Y(s)$$



To find A. Sub  $s = -2$

$$A = \frac{1}{(s+2)(s+1)}$$

$$A(s+1) + B(s+2) = 1$$

$$\Rightarrow A(-1) = 1$$

$$\boxed{A = -1}$$

Sub  $s = -1$

$$B(-1+2) = 1$$

$$\boxed{B = 1}$$

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

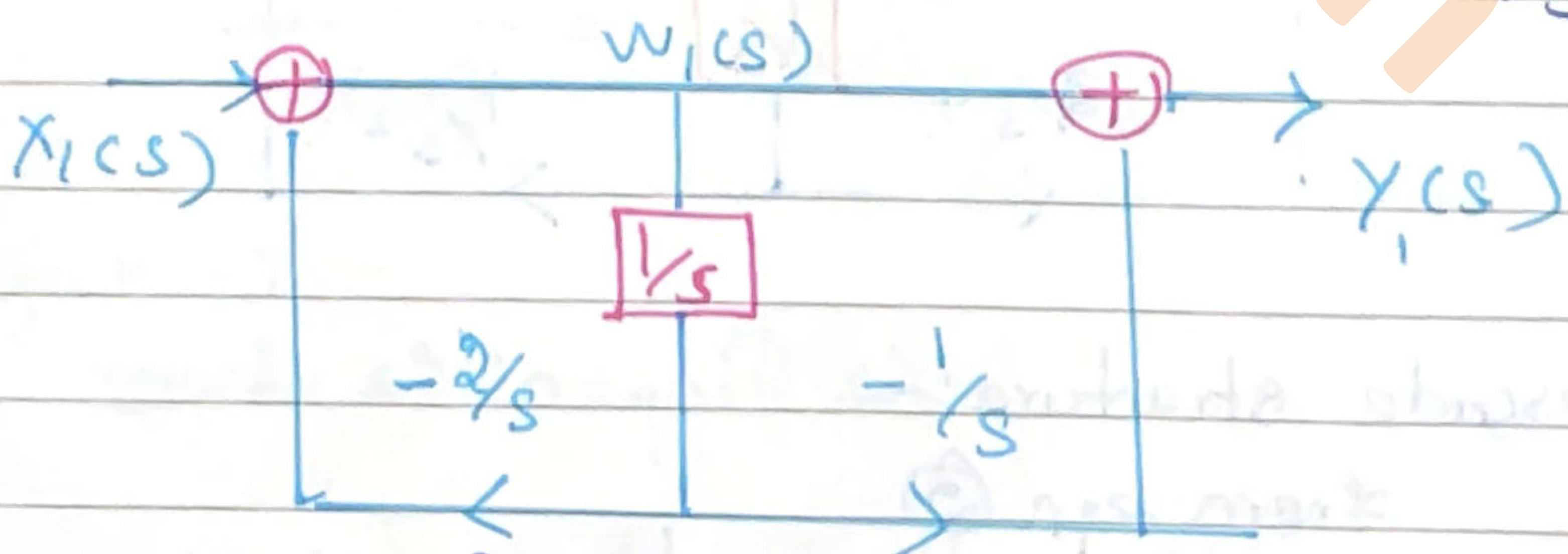
$$\Rightarrow H(s) = H_1(s) + H_2(s)$$

Realization of  $H_1(s)$

$$H_1(s) = \frac{-1}{s+2} = \frac{-1/s}{1 + 2/s}$$

$$\frac{Y_1(s)}{W_1(s)} = -1/s ; \frac{W_1(s)}{X_1(s)} = \frac{1}{1 + 2/s}$$

$$Y_1(s) = -1/s W_1(s) ; W_1(s) = X_1(s) - 2/s W_1(s)$$

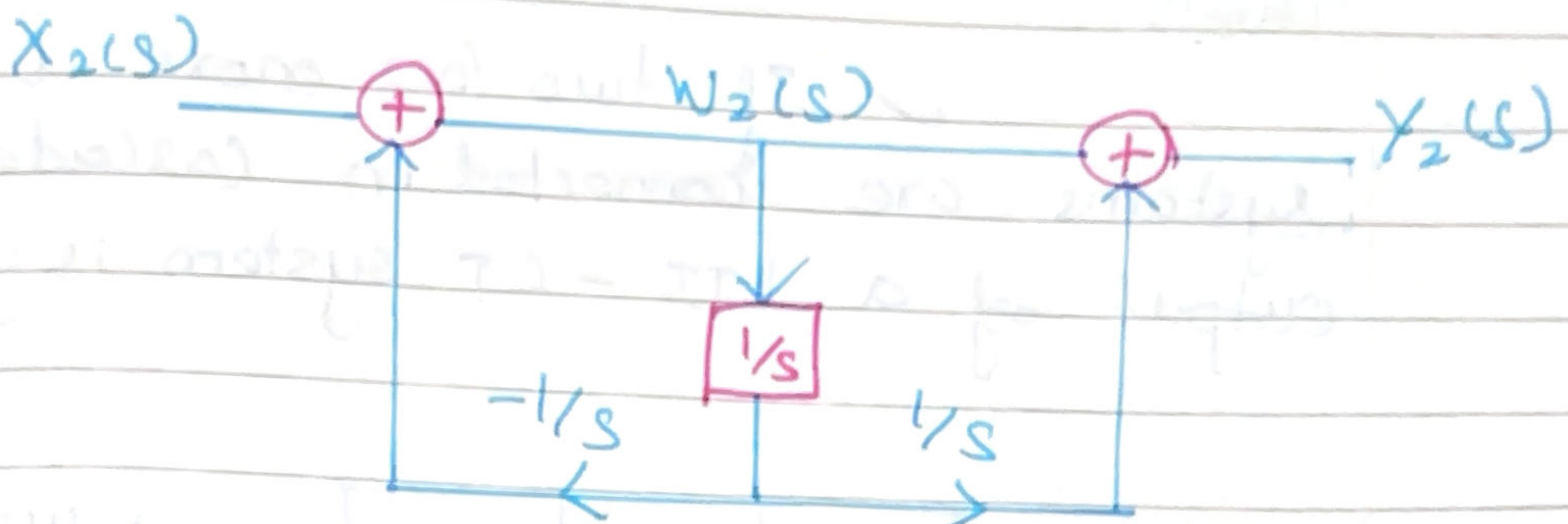


Realization of  $H_2(s)$

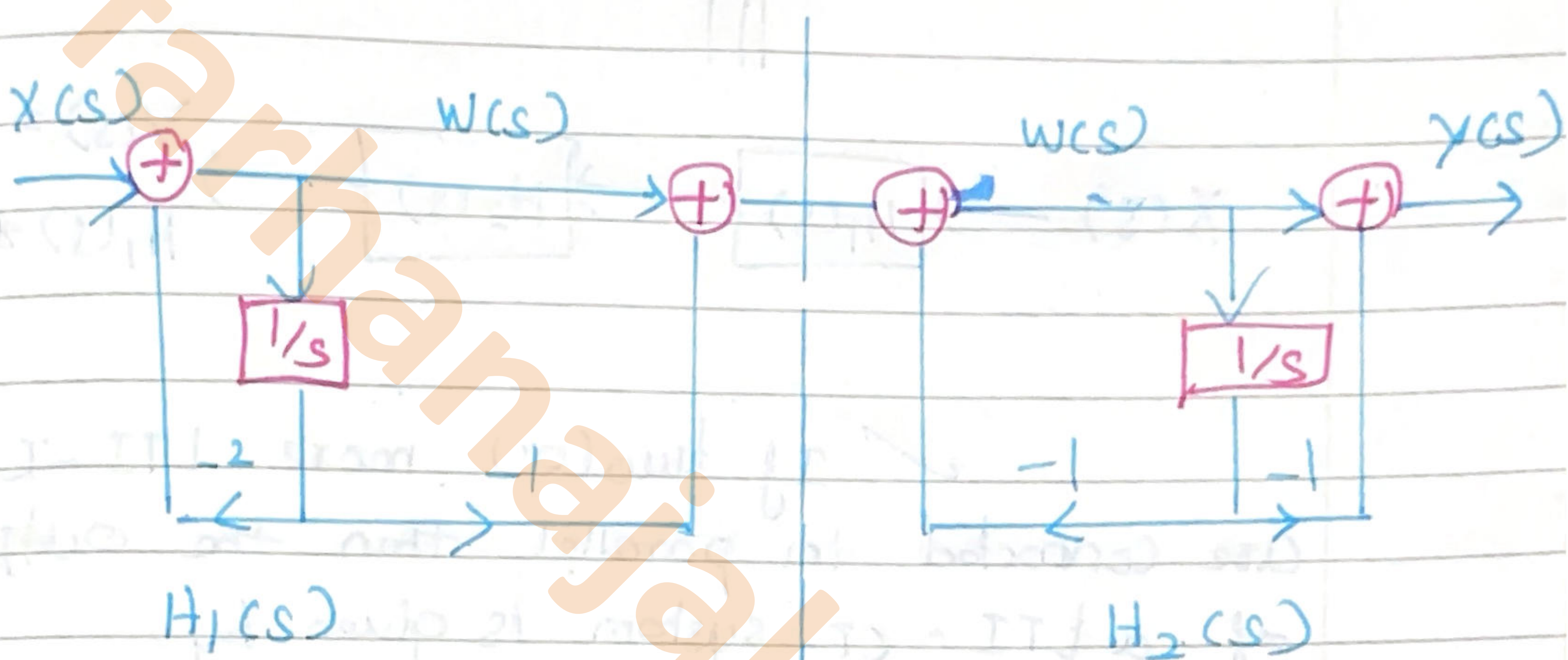
$$H_2(s) = \frac{1}{s+1} \Rightarrow \frac{1/s}{1 + 1/s}$$

$$\frac{Y_2(s)}{W_2(s)} = 1/s ; \frac{W_2(s)}{X_2(s)} = 1 + 1/s$$

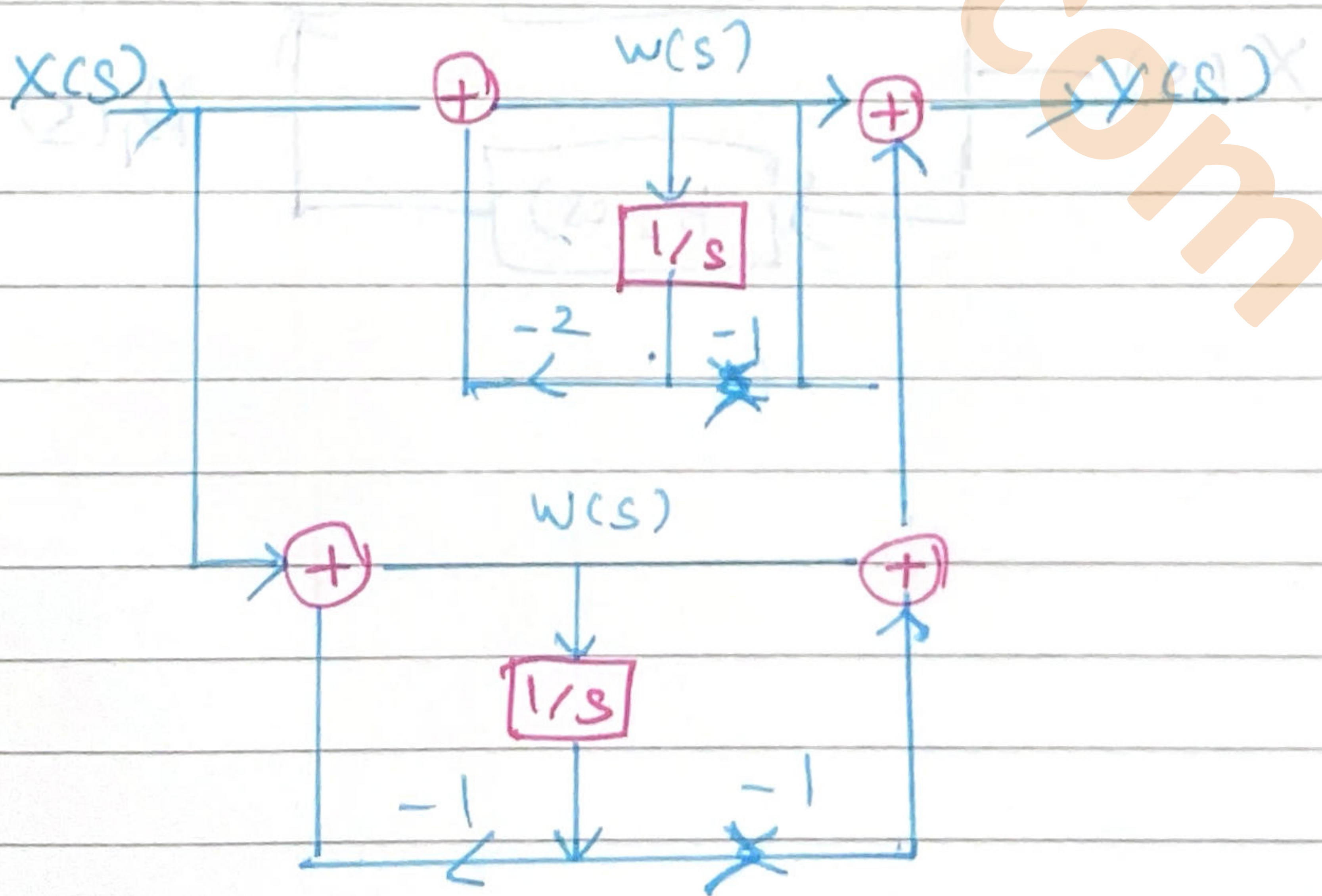
$$Y_2(s) = \frac{1}{s} W_2(s) ; W_2(s) = X_2(s) + \frac{1}{s} W_2(s)$$



Cascade Structure .



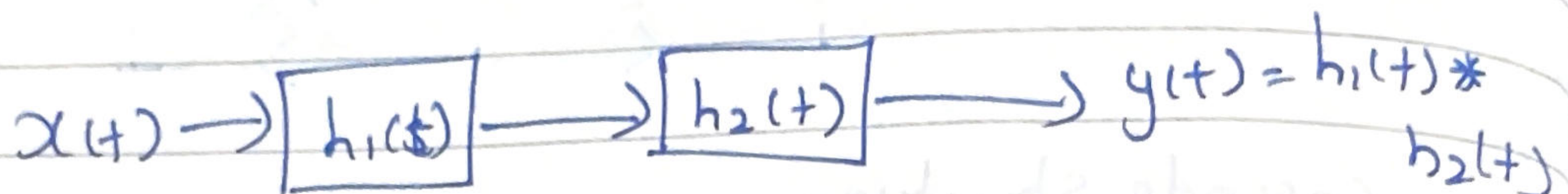
Parallel structure :-



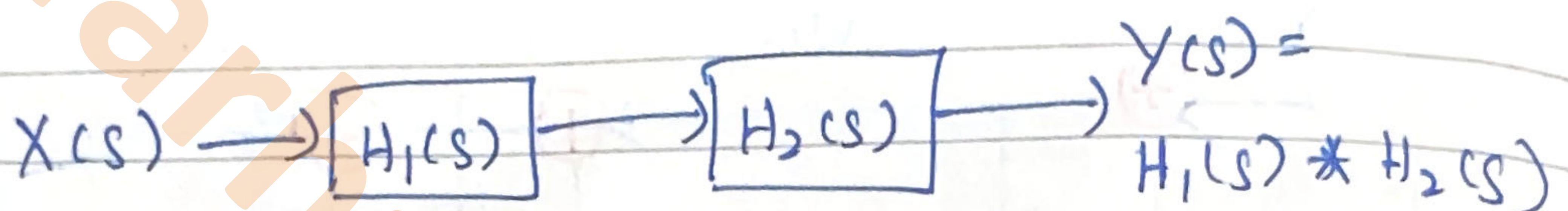
## LTI-CT system connected in series &

Parallel:

✓ If two (or) more LTI-CT systems are connected in cascaded the output of a LTI-CT system is given by



|||



✓ If two (or) more LTI-CT systems are connected in parallel then the output of a LTI-CT system is given by,

