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DSP Theory Assignment - 2

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1] Realize the following system functions using Direct form - I, Direct form - II, Cascade form and Parallel form.

$$H(z) = Z\left[1 + z^{-1} + \frac{(1+z^{-1})}{1+z^{-1}+z^{-2}}\right]$$

$$H_1(z) = Z, \quad H_2(z) = 1 + z^{-1} + \frac{1+z^{-1}}{1+z^{-1}+z^{-2}}$$

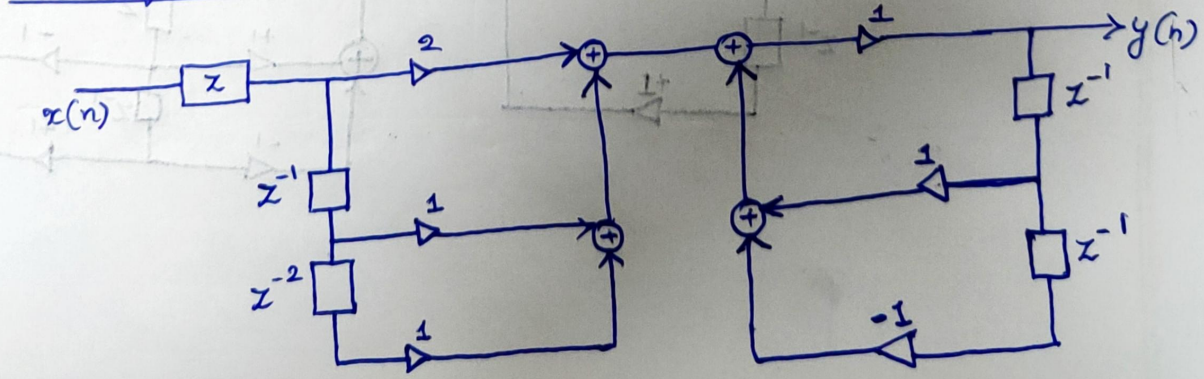
$\therefore H(z) = H_1(z) \cdot H_2(z)$

$$H_2(z) = Z\left[1 + z^{-1} + \frac{1+z^{-1}}{1-z^{-1}+z^{-2}}\right]$$

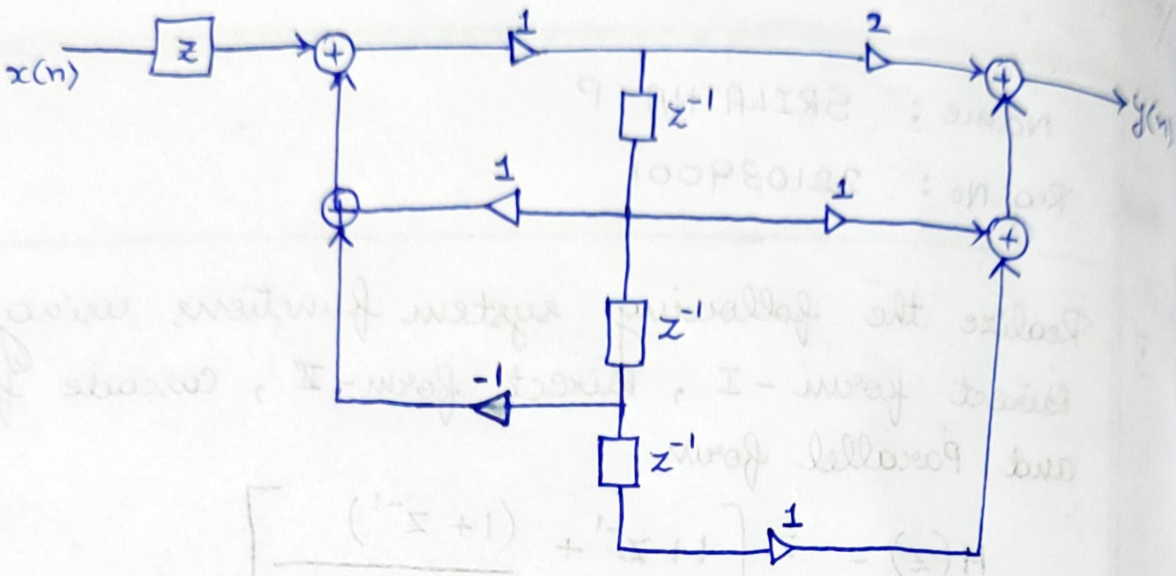
$$= Z\left[\frac{1+z^{-1}-z^{-1}-z^{-2}+z^{-3}+1+z^{-1}}{1-z^{-1}+z^{-2}}\right]$$

$$= Z\left[\frac{2+z^{-1}+z^{-3}}{1-z^{-1}+z^{-2}}\right]$$

Direct form - I :



Direct form - II :



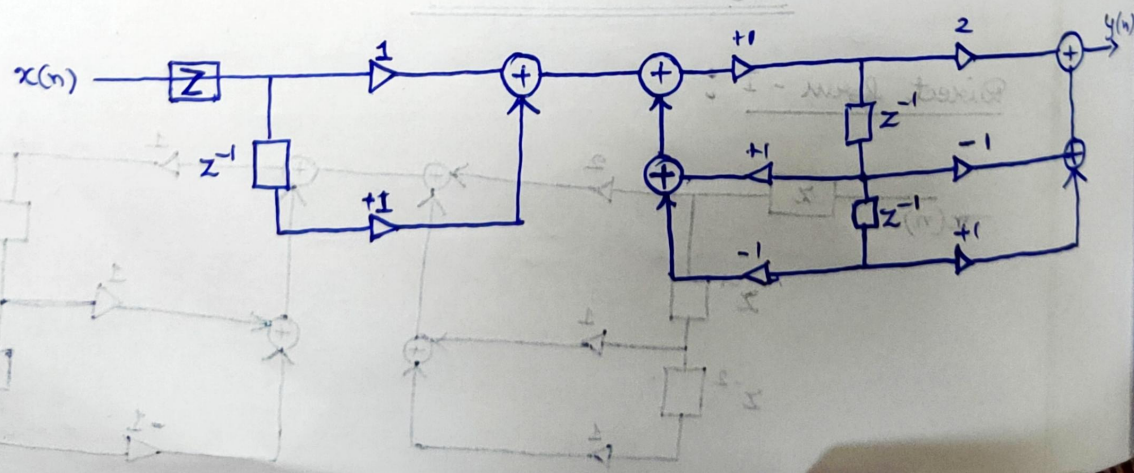
Cascade form :

Transfer function is reported as product of I & II adder factors.

$$H(z) = z\left[1 + z^{-1} + \frac{1+z^{-1}}{1-z^{-1}+z^{-2}}\right]$$

$$= z \cdot 1+z^{-1}\left[1 + \frac{1}{1-z^{-1}+z^{-2}}\right]$$

$$= z \cdot 1+z^{-1}\left[\frac{2 - z^{-1} + z^{-2}}{1 - z^{-1} + z^{-2}}\right]$$



Parallel Form :-

$$H(z) = \left[1 + z^{-1} + \frac{1 + z^{-1}}{1 - z^{-1} + z^{-2}} \right]$$

→ Since it is already represented as parallel form II order system, we directly relate it.