

Quiz 3 solution EE406

① $w(n) = z^{-1} [x(n) + w(n) - \frac{1}{4} v(n)]$

$v(n) = z^{-1} [x(n) + 5w(n) - v(n)]$

$z^{-1} X(z) = W(z) [z^{-1} + 1] + \frac{z^{-1}}{4} V(z)$

$z^{-1} X(z) = V(z) [1 + z^{-1}] - 5z^{-1} W(z)$

$z^{-1} X(z) = -5z^{-1} W(z) + (1 + z^{-1}) V(z)$

$z^{-1} X(z) = (1 - z^{-1}) W(z) + \frac{1}{4} z^{-1} V(z)$

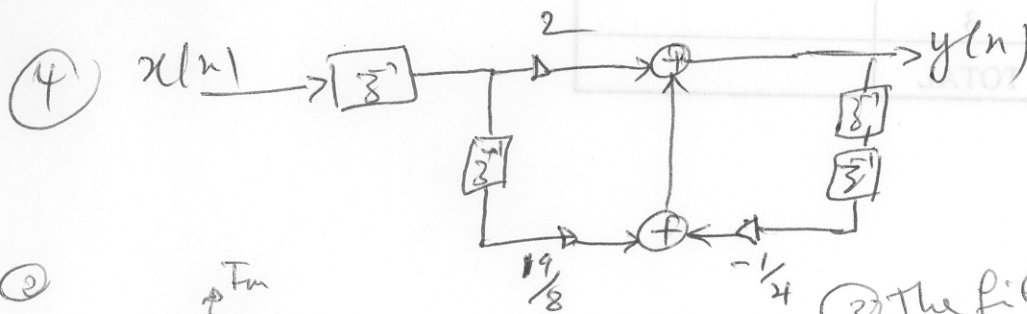
$\Delta = \begin{vmatrix} -5z^{-1} & 1+z^{-1} \\ 1-z^{-1} & \frac{1}{4}z^{-1} \end{vmatrix} = -1 - \frac{1}{4}z^{-2}$

$W(z) = \frac{\begin{vmatrix} z^{-1} & 1+z^{-1} \\ z^{-1} & \frac{1}{4}z^{-1} \end{vmatrix} X(z)}{\Delta} = \frac{\frac{1}{4}z^{-2} - z^{-1} - z^{-2}}{\Delta} = \frac{(1 + \frac{3}{4}z^{-1}) z^{-1} X(z)}{1 + \frac{1}{4}z^{-2}}$

$V(z) = \frac{\begin{vmatrix} -5z^{-1} & z^{-1} \\ 1-z^{-1} & z^{-1} \end{vmatrix} X(z)}{\Delta} = \frac{-5z^{-2} - z^{-1} + z^{-2}}{\Delta} = \frac{4(1 + 4z^{-1}) z^{-1} X(z)}{1 + \frac{1}{4}z^{-2}}$

$\frac{Y(z)}{X(z)} = \frac{2(\frac{-1}{8} + \frac{19}{8}z^{-2})}{1 + \frac{1}{4}z^{-2}}$

$Y(z) + \frac{1}{4}z^{-2} Y(z) = 2z^{-1} X(z) + \frac{19}{8}z^{-2} X(z)$



③ The filter is IIR because it has an infinite impulse response. The system is recursive.

