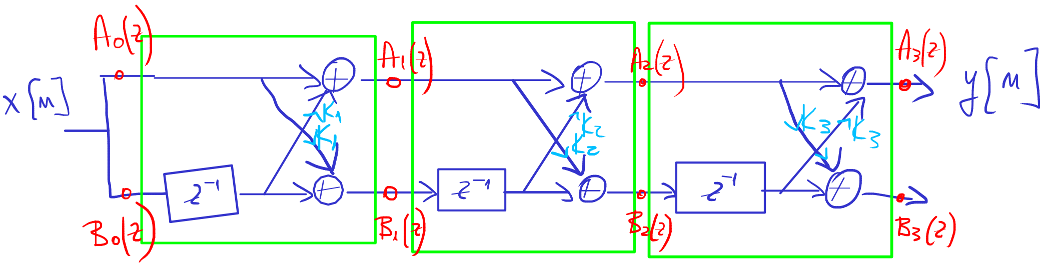

$A_0(z) = 1$ $\qquad A_m(z) = A_{m-1}(z) + K_m \cdot z^{-1} \cdot B_{m-1}(z)$

$B_0(z) = 1$ $\qquad B_m(z) = z^{-m} \cdot A_m(z^{-1})$

1) $K_1 = \boxed{1/2}$ $\quad \boxed{K_2 = 0.6}$ $\quad \boxed{K_3 = -0.7}$ $\qquad K_m =$ last coeff. of $A_m(z)$

Find filter coefficients in direct form (i.e. find $H(z)$)

$$A_0(z) = 1$$

$$B_0(z) = 1$$

$$A_1(z) = A_0(z) + K_1 \cdot z^{-1} \cdot B_0(z) = \boxed{1} + \boxed{\tfrac{1}{2}} \cdot z^{-1}$$

$$B_1(z) = z^{-1} \cdot A_1(z^{-1}) = z^{-1} \cdot \left(1 + \tfrac{1}{2} z\right) = \boxed{\tfrac{1}{2}} + \boxed{1} \cdot z^{-1}$$

$$A_2(z) = 1 + \tfrac{1}{2} z^{-1} + 0.6 \cdot z^{-1} \cdot \left(\tfrac{1}{2} + z^{-1}\right) = 1 + z^{-1}\left(\tfrac{1}{2} + 0.6 \cdot \tfrac{1}{2}\right) + z^{-2} \cdot 0.6$$

$$= 1 + 0.8 z^{-1} + \boxed{0.6}\, z^{-2}$$

$B_2(z) = A_2(z)$ inverse!

$$A_3(z) = \overbrace{1 + 0.8 z^{-1} + 0.6 z^{-2}}^{A_2(z)} - 0.7 \cdot z^{-1} \cdot \underbrace{\left(0.6 + 0.8 z^{-1} + 1 \cdot z^{-2}\right)}_{B_2(z)}$$

$$= 1 + z^{-1}(0.8 - 0.42) + z^{-2}(0.6 - 0.56) - z^{-3} \cdot 0.7$$

$$= \underbrace{\boxed{1}}_{b_0} + \underbrace{\boxed{0.38}}_{b_1} z^{-1} + \underbrace{\boxed{0.04}}_{b_2} z^{-2} \underbrace{\boxed{-0.7}}_{b_3,\ K_3} \cdot z^{-3} = H(z)$$

② $H(z) = 1 + \frac{2}{5} z^{-1} + \frac{7}{20} z^{-2} + \underbrace{\boxed{\frac{1}{2}}}_{K_3} z^{-3} = A_3(z)$

$K_1 = ?\quad K_2 = ?\quad K_3 = ?$

$$A_{m-1}(z) = \frac{A_m(z) - K_m \cdot B_m(z)}{1 - K_m^2}$$

$$A_2(z) = \frac{\overbrace{1 + \frac{2}{5} z^{-1} + \frac{7}{20} z^{-2} + \frac{1}{2} z^{-3}}^{A_3(z)} - \frac{1}{2}\overbrace{\left(\frac{1}{2} + \frac{7}{20} z^{-1} + \frac{2}{5} z^{-2} + 1 \cdot z^{-3}\right)}^{B_3(z)}}{1 - \frac{1}{2}^2}$$

$$= \frac{1 - \frac{1}{4} + z^{-1}\left(\frac{2}{5} - \frac{7}{40}\right) + z^{-2}\left(\frac{7}{20} - \frac{1}{5}\right)}{1 - \frac{1}{4}}$$

$$= \frac{3/4 + \frac{9}{40} z^{-1} + \frac{3}{20} z^{-2}}{3/4}$$

$$= 1 + \frac{3}{10} z^{-1} + \underbrace{\boxed{\frac{1}{5}}}_{K_2} z^{-2}$$

$$A_1(z) = \frac{\overbrace{1 + \frac{3}{10} z^{-1} + \frac{1}{5} z^{-2}}^{A_2(z)} - \frac{1}{5}\overbrace{\left(\frac{1}{5} + \frac{3}{10} z^{-1} + 1 \cdot z^{-2}\right)}^{B_2(z)}}{1 - \left(\frac{1}{5}\right)^2}$$

$B_2(z)$ = A_2 with coeff. in opposite order

$$= \frac{1 - 1/25 + z^{-1}\left(\frac{3}{10} - \frac{3}{50}\right)}{1 - 1/25}$$

$$= \frac{24/25 + \frac{12}{50} z^{-1}}{24/25} = 1 + \overbrace{\boxed{\frac{1}{4}}}^{K_1} z^{-1}$$