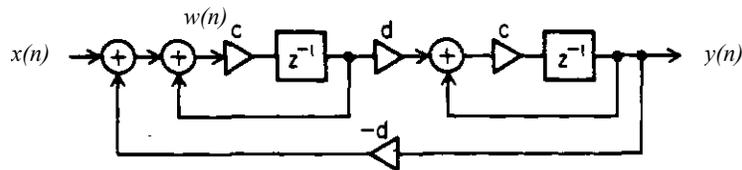


# Hw 11

1. Let

$$H(z) = \frac{1 - 2z^{-2}}{(1 - 0.8e^{j\pi/3}z^{-1})(1 - 0.8e^{-j\pi/3}z^{-1})(1 - 0.9e^{j\pi/2}z^{-1})(1 - 0.9e^{-j\pi/2}z^{-1})}$$

- (a) Draw a signal flow graph for the direct form II implementation of  $H(z)$ .
  - (b) Draw a signal flow graph implementing  $H(z)$  as a cascade of 2nd order direct form II sections using only real multipliers.
2. Let  $H(z) = a_0 + a_1z^{-1} + a_2z^{-2} + a_3z^{-3} + a_2z^{-4} + a_1z^{-5} + a_0z^{-6}$ . Draw a signal flow graph for for  $H(z)$  using as few multipliers as possible.
3. Find the system function  $H(z)$  from  $x(n)$  to  $y(n)$  and find the system function  $G(z)$  from  $x(n)$  to  $w(n)$ , where  $c = r \cos \theta$  and  $d = \tan \theta$ .



4. \* Let

$$H(z) = \frac{a_2 + a_1z^{-1} + z^{-2}}{1 + a_1z^{-1} + a_2z^{-2}}$$

be a causal and stable second-order allpass filter. Implement  $H(z)$  using as few multipliers as possible. Is the system still allpass after the multipliers are quantized?