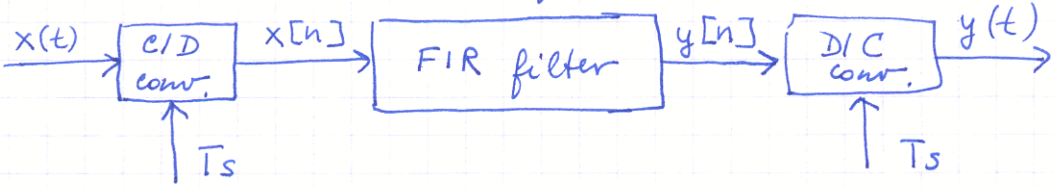
Opgave 2 : Løsningsforslag I2SIG1/maj01/DP



$$f_s = \frac{1}{T_s} = 8\,kHz$$

$$h[n] = 2\delta[n] - \delta[n-1] + 2\delta[n-2] - \delta[n-3] + 2\delta[n-4]$$

a) ved identifikation og indsættelse af koeff. fås:

$$y[n] = 2x[n] - x[n-1] + 2x[n-2] - x[n-3] + 2x[n-4]$$

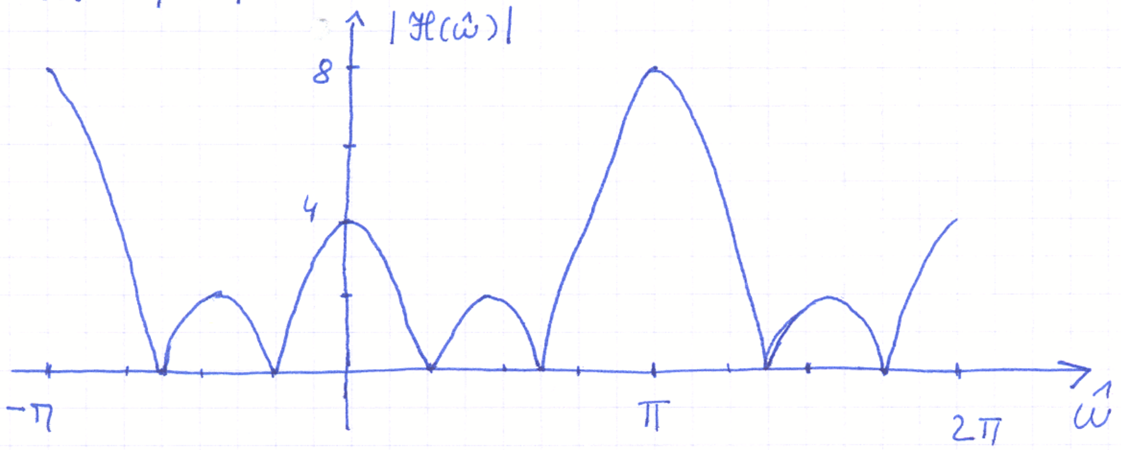
b) Tilsvarende fås:

$$\mathcal{H}(\hat{\omega}) = 2e^{-j\hat{\omega}\cdot 0} - e^{-j\hat{\omega}} + 2e^{-j\hat{\omega}2} - e^{-j\hat{\omega}3} + 2e^{-j\hat{\omega}4}$$

$$= e^{-j\hat{\omega}2}\left(2e^{j\hat{\omega}2} - e^{+j\hat{\omega}} + 2 - e^{-j\hat{\omega}} + 2e^{-j\hat{\omega}2}\right)$$

$$= \underline{e^{-j\hat{\omega}2}\left(4\cos\hat{\omega}2 - 2\cos\hat{\omega} + 2\right)}$$

c) $|\mathcal{H}(\hat{\omega})| = |4\cos\hat{\omega}2 - 2\cos\hat{\omega} + 2|$



d) $x[n] = 3 + 2\cos\frac{\pi}{4}n = 3 + 2\cos(2\pi\cdot\frac{1}{8}n)$

$$\hat{f} = \frac{f_0}{f_s} = \frac{1}{8} \Rightarrow f_0 = \frac{1}{8}\cdot 8000 = 1000\,[Hz]$$

$$\Rightarrow x_1(t) = 3 + 2\cos(2\pi.1000t)$$

alle mulige aliasfrekvenser: $f = \pm f_0 + l f_s \quad l \in \mathbb{Z}$

hvis $0 \leq f \leq 8000$ bliver der kun foldningsmulighed med $l = 1$

$$f_2 = -f_0 + f_s = -1000 + 8000 = 7000\,[Hz]$$

$$\Rightarrow x_2(t) = 3 + 2\cos(2\pi.7000t)$$

e) $\hat{\omega} = 0 \quad \mathcal{H}(0) = 4 - 2 + 2 = 4 \qquad \hat{\omega} = \frac{\pi}{4} \quad |\mathcal{H}(\frac{\pi}{4})| = |4\cos\frac{\pi}{2} - 2\cos\frac{\pi}{4} + 2|$

$|\mathcal{H}(\frac{\pi}{4})| = 2 - \sqrt{2} \simeq 0{,}586 \quad \angle\mathcal{H}(\frac{\pi}{4}) = -2\cdot\frac{\pi}{4} = -\frac{\pi}{2}$

$\underline{y[n] = 3\cdot 4 + 2\cdot 0{,}586\cos(\frac{\pi}{4}n - \frac{\pi}{2})}$ og $\underline{y(t) = 12 + 1{,}17\cos(2000\pi t - \frac{\pi}{2})}$