Opg 6.6

LTI: $y[n] = x[n] - x[n-2]$

$\{b_k\} = \{1, 0, -1\}$ $L = 3$, $M = 2$

a) $H(\hat{\omega}) = \sum_{k=0}^{2} b_k e^{-j\hat{\omega}k} = \underline{1 - e^{-j\hat{\omega}2}}$

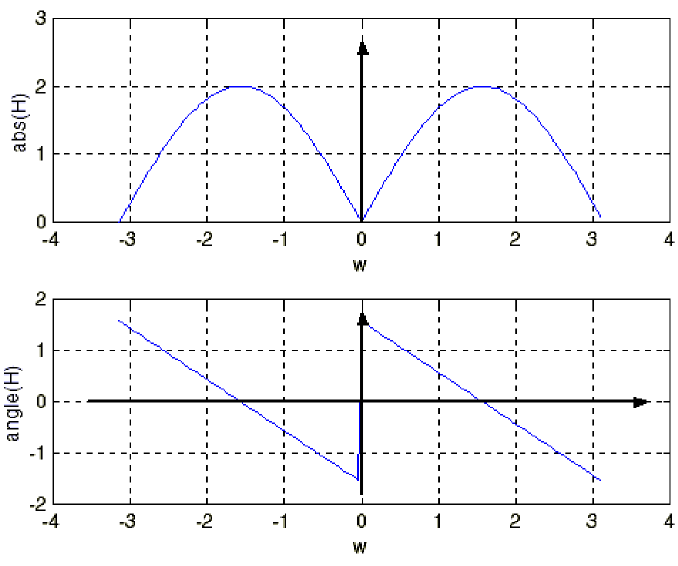
$= e^{-j\hat{\omega}}(e^{j\hat{\omega}} - e^{-j\hat{\omega}}) = 2je^{-j\hat{\omega}} \sin\hat{\omega} = \underline{2\sin\hat{\omega} \cdot e^{-j(\hat{\omega}-\frac{\pi}{2})}}$

b) $\sin\hat{\omega} < 0$ for $-\pi < \hat{\omega} < 0$, altså:

$$H(\hat{\omega}) = \begin{cases} 2|\sin\hat{\omega}| \cdot e^{-j(\hat{\omega}+\frac{\pi}{2})} & -\pi < \hat{\omega} < 0 \\ 2|\sin\hat{\omega}| \cdot e^{-j(\hat{\omega}-\frac{\pi}{2})} & 0 < \hat{\omega} < \pi \end{cases}$$

$|H(\hat{\omega})| = 2|\sin\hat{\omega}|$

$$\arg H(\hat{\omega}) = \begin{cases} -(\hat{\omega} + \frac{\pi}{2}) & -\pi < \hat{\omega} < 0 \\ -(\hat{\omega} - \frac{\pi}{2}) & 0 < \hat{\omega} < \pi \end{cases}$$



Mathlab-kode, der genererer figurerne:

```
» w=-pi:0.05:pi;
» B=[1 0 -1];
» A=[1];
» H=freqz(B,A,w);
» subplot(2,1,1), plot(w,abs(H))
» subplot(2,1,2), plot(w,angle(H))
»
```

c) Input: $x[n] = 4 + \cos(0.25\pi n - \frac{\pi}{4})$. Bestem output $y[n]$.

$\hat{\omega} = 0$: $|H(0)| = 2|\sin 0| = 0$ $\arg H(0) = \pm\frac{\pi}{2}$

$\hat{\omega} = \frac{\pi}{4}$: $\left|H(\frac{\pi}{4})\right| = 2\left|\sin\frac{\pi}{4}\right| = \sqrt{2}$ $\arg H(\frac{\pi}{4}) = \frac{\pi}{4}$

$$y[n] = 0\cdot 4 + \sqrt{2}\cdot\cos(\frac{\pi}{4}n - \frac{\pi}{4} + \frac{\pi}{4}) = \underline{\sqrt{2}\cos(\frac{\pi}{4}n)}$$

d) Input: $x_1[n] = \left(4 + \cos(0.25\pi n - \frac{\pi}{4})\right)u[n]$.

Den transiente del er forbi for: $\underline{n \geq M = 2}$.