Opg 6.5

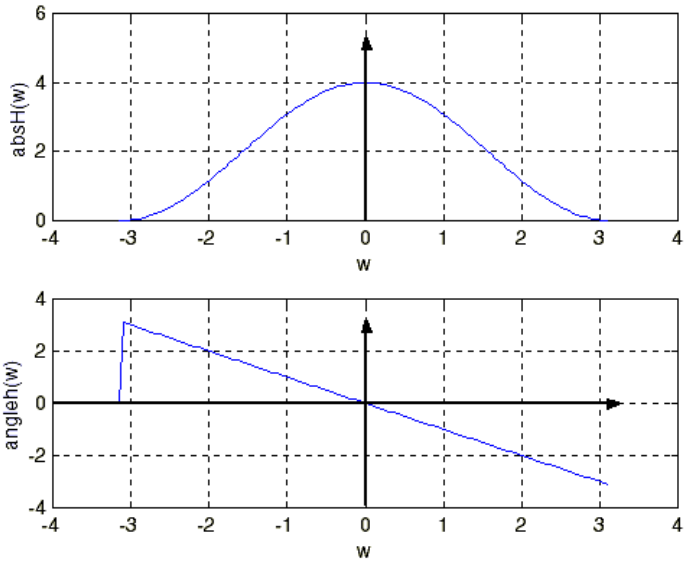
LTI: $y[n] = x[n] + 2x[n-1] + x[n-2]$

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

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

$= e^{-j\hat{\omega}}(e^{j\hat{\omega}} + 2 + e^{-j\hat{\omega}}) = e^{-j\hat{\omega}}(2 + 2\cos\hat{\omega}) = \underline{2(1+\cos\hat{\omega})e^{-j\hat{\omega}}}$

b) $|H(\hat{\omega})| = 2(1+\cos\hat{\omega})$ $\arg H(\hat{\omega}) = -\hat{\omega}$



Mathlab-kode, der genererer figurerne:

```
» w=-pi:0.05:pi;
» B=[1 2 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: $x[n]=10+4\cos(0.5\pi n+\frac{\pi}{4})$. Bestem output $y[n]$.

$\hat{\omega}=0$: $|H(0)|=2(1+\cos 0)=4$ $\arg H(0)=-0=0$

$\hat{\omega}=0.5\pi$: $|H(0.5\pi)|=2(1+\cos\frac{\pi}{2})=2$ $\arg H(\frac{\pi}{2})=-\frac{\pi}{2}$

$$y[n]=4\cdot 10+2\cdot 4\cos(0.5\pi n+\frac{\pi}{4}+(-\frac{\pi}{2}))=\underline{40+8\cos(\frac{\pi}{2}n-\frac{\pi}{4})}$$

d) Input: $x[n]=\delta[n]$. Bestem output $y[n]$.

$$\underline{h[n]=\delta[n]+2\delta[n-1]+\delta[n-2]}$$

e)

$$y[n]=\sum_{k=0}^{M}h[k]x[n-k]=x[n]+2x[n-1]+x[n-2] \quad \text{og} \quad x[n]=u[n].$$

n	n<0	0	1	2	3	4	n>4
x[n]	0	1	1	1	1	1	1
h[n]	0	1	2	1	0	0	0
h[0]x[n-0]	0	1	1	1	1	1	1
h[1]x[n-1]	0	0	2	2	2	2	2
h[2]x[n-2]	0	0	0	1	1	1	1
y[n]=h[n]*x[n]	0	1	3	4	4	4	4