

Extra Credit

Sam Bryan

$$X[n] = 1 + \sin\left(\frac{\pi n}{4}\right) + \sin\left(\frac{\pi n}{8}\right)$$

$$h[n] = 1.9(-0.9)^n u[n] \quad \longleftrightarrow \quad H(\omega) = \frac{1.9 e^{j\omega}}{e^{j\omega} + 0.9}$$

$$X_1[n] = 1$$

$$X_1(\omega) = \sum_{k=-\infty}^{\infty} 2\pi \delta(\omega - 2\pi k)$$

$$Y_1(\omega) = X_1(\omega) H(\omega)$$

$$= \sum_{k=-\infty}^{\infty} 2\pi H(\omega) \delta(\omega - 2\pi k)$$

$$= \sum_{k=-\infty}^{\infty} 2\pi H(0) \delta(\omega - 2\pi k)$$

$$= \sum_{k=-\infty}^{\infty} 2\pi \delta(\omega - 2\pi k)$$

$$y_1[n] = 1$$

$$H(-\Omega) \delta(\Omega + \omega) = H(-\omega) \delta(\Omega + \omega)$$

$$|H(-\Omega)| = |H(\Omega)|$$

$$H(-\Omega_0) = |H(\Omega_0)| e^{-j\angle H(\Omega_0)}$$

$$H(-\Omega_0) |H(\Omega_0)| e^{j\angle H(\Omega_0)}$$

$$X_2[n] = \sin\left(\frac{\pi n}{4}\right) \quad \omega_0 = \frac{\pi}{4}$$

$$X_2(\omega) = \sum_{k=-\infty}^{\infty} j\pi [\delta(\omega + \frac{\pi}{4} - 2\pi k) - \delta(\omega - \frac{\pi}{4} - 2\pi k)]$$

$$Y_2(\omega) = X_2(\omega) H(\omega)$$

$$= \sum_{k=-\infty}^{\infty} j\pi [H(\omega) \delta(\omega + \frac{\pi}{4} - 2\pi k) - H(\omega) \delta(\omega - \frac{\pi}{4} - 2\pi k)]$$

$$= \sum_{k=-\infty}^{\infty} j\pi [H(\frac{\pi}{4}) \delta(\omega + \frac{\pi}{4} - 2\pi k) - H(-\frac{\pi}{4}) \delta(\omega - \frac{\pi}{4} - 2\pi k)]$$

$$= \sum_{k=-\infty}^{\infty} j\pi [|H(\frac{\pi}{4})| e^{-j\angle H(\frac{\pi}{4})} \delta(\omega + \frac{\pi}{4} - 2\pi k)$$

$$- |H(\frac{\pi}{4})| e^{j\angle H(\frac{\pi}{4})} \delta(\omega - \frac{\pi}{4} - 2\pi k)]$$

$$y_2[n] = |H(\frac{\pi}{4})| \sin\left(\frac{\pi}{4}n + \angle H(\frac{\pi}{4})\right) = 2\sqrt{2} \sin\left(\frac{\pi}{2}n - \frac{\pi}{4}\right)$$

$$= 1.08214 \sin\left(\frac{\pi}{4}n + 0.370902\right)$$

$$X_3[n] = \sin\left(\frac{\pi n}{2}\right) \quad \omega_0 = \frac{\pi}{2}$$

$$X_3(\omega) = \sum_{k=-\infty}^{\infty} j\pi [\delta(\omega + \frac{\pi}{2} - 2\pi k) - \delta(\omega - \frac{\pi}{2} - 2\pi k)]$$

$$Y_3(\omega) = X_3(\omega) H(\omega)$$

$$= \sum_{k=-\infty}^{\infty} j\pi [H(\omega) \delta(\omega + \frac{\pi}{2} - 2\pi k) - H(\omega) \delta(\omega - \frac{\pi}{2} - 2\pi k)]$$

$$= \sum_{k=-\infty}^{\infty} j\pi [|H(\frac{\pi}{2})| e^{-j\angle H(\frac{\pi}{2})} \delta(\omega + \frac{\pi}{2} - 2\pi k) - |H(\frac{\pi}{2})| e^{j\angle H(\frac{\pi}{2})} \delta(\omega - \frac{\pi}{2} - 2\pi k)]$$

$$= \sum_{k=-\infty}^{\infty} j\pi [|H(\frac{\pi}{2})| e^{-j\angle H(\frac{\pi}{2})} \delta(\omega + \frac{\pi}{2} - 2\pi k) - |H(\frac{\pi}{2})| e^{j\angle H(\frac{\pi}{2})} \delta(\omega - \frac{\pi}{2} - 2\pi k)]$$

$$y_3[n] = |H(\frac{\pi}{2})| \sin\left(\frac{\pi}{2}n + \angle H(\frac{\pi}{2})\right)$$

$$y_3[n] = 1.41421 \sin\left(\frac{\pi}{2}n + 0.732815\right)$$

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

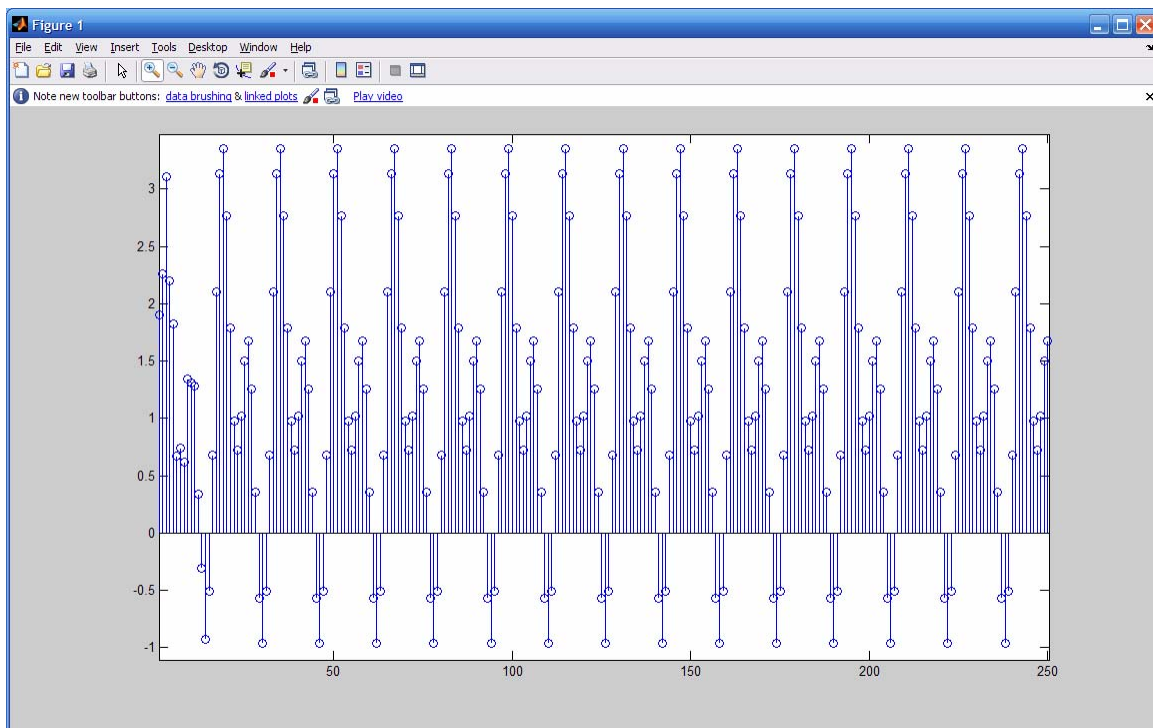
COMET

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MATLAB 7.6.0 (R2008a)
File Edit Debug Desktop Window Help
Current Directory: C:\Documents and Settings\Sam Bryan\My Documents\Sch...

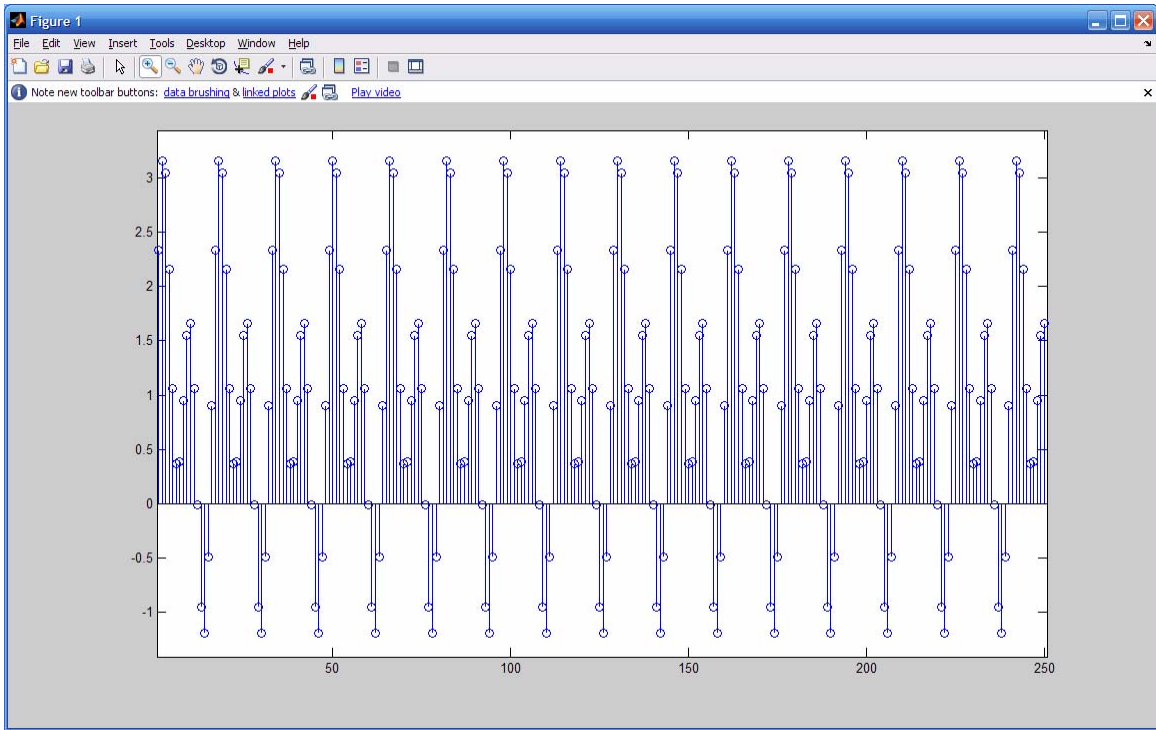
Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.

>> n=0:0.5:150;
>> x=1+sin((pi*n)/4)+sin((pi*n)/2);
>> for k=1:15;
>> h(k)=1.9*(-0.9)^(k-1);
>> end;
>> z=conv(x,h);
>> stem(z)
>> y=1+(1.08214*sin(((pi*n)/4)+0.370902))+(1.41421*sin(((pi*n)/2)+0.732815));
>> stem(y)
>> stem(z)
>>
```

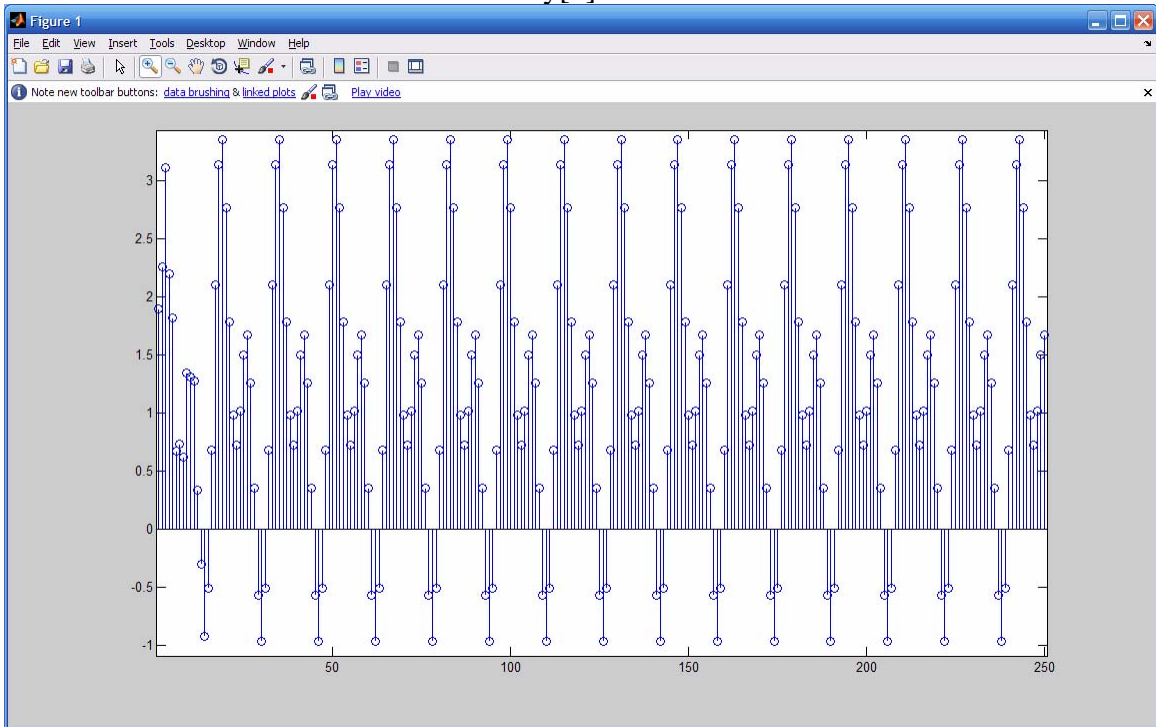
Matlab Console Commands



Plot of $x[n]$ function



Plot of $y[n]$ function



Plot of $x[n]*h[n]$ function