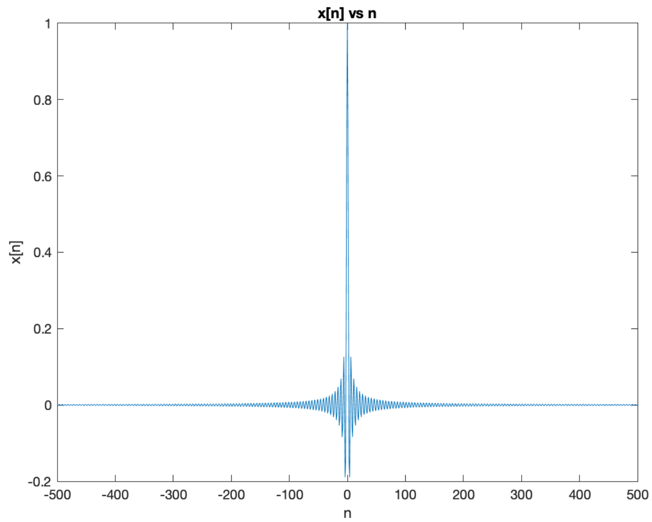
Matlab HW2

電機二 張甡源(B11901123)

4/23/2024

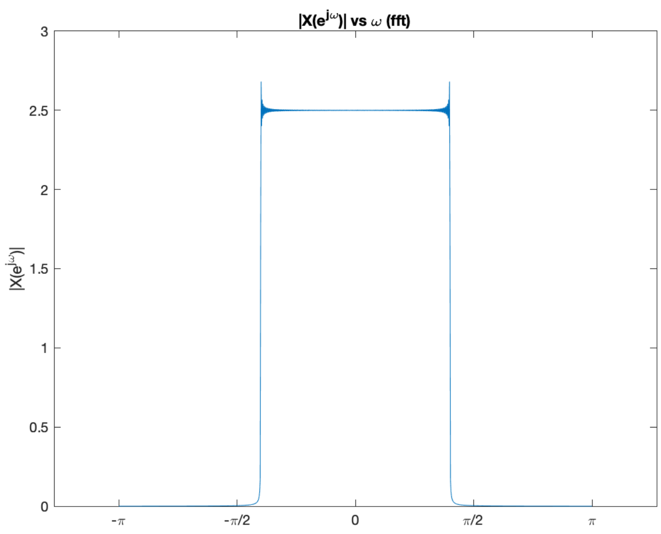
1. Result

(a)



$x[n]$ vs n

(b)

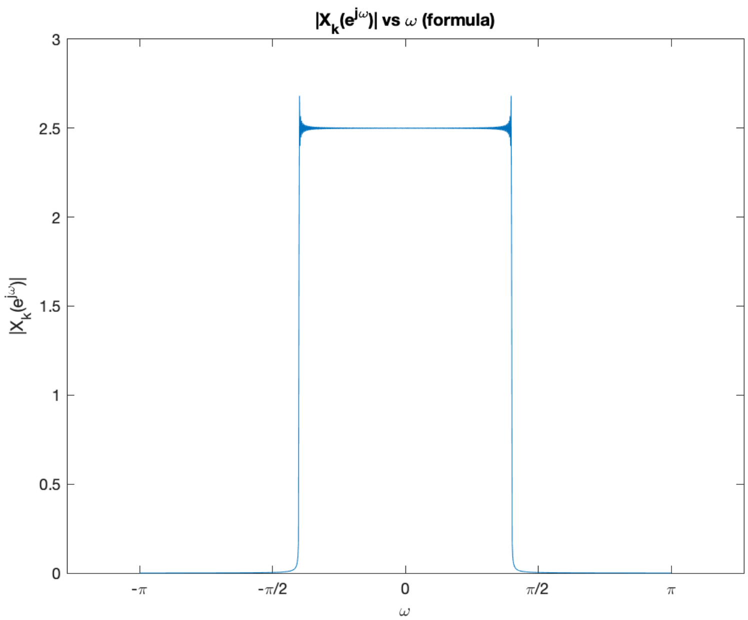


$\left|X(e^{j\omega})\right|$ vs ω

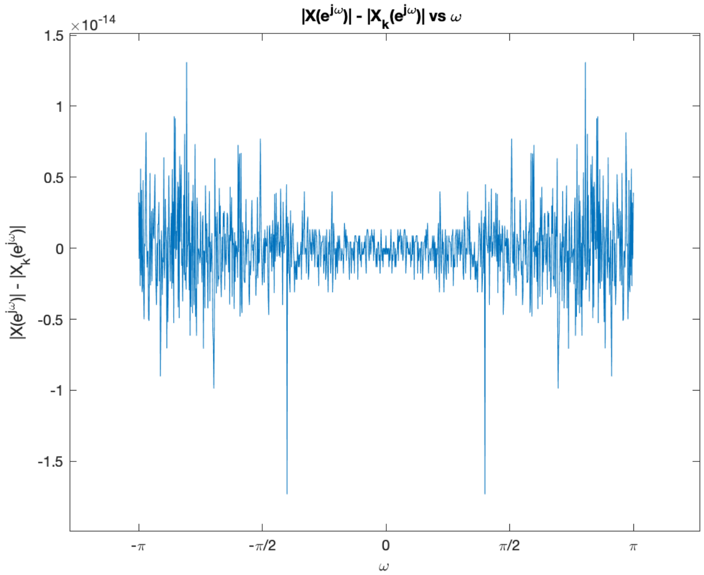
Gibb's phenomenon:

Since $x[n]$ is a finite signal, hence, we are approximating an infinite sum $\left|X(e^{j\omega})\right|$ by a partial sum. Therefore, we can see that the $\left|X(e^{j\omega})\right|$ vs ω graph has overshoot at discontinuities, which reflects the errors in approximating.

(c)



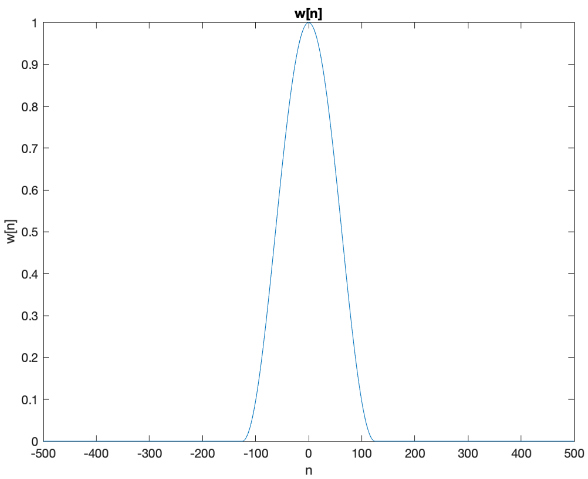
$\left|X_k(e^{j\omega})\right|$ vs ω



Subtracting the graph of problem (b) and (c), we can observe that the output is mostly equivalent, only a little error at discontinuities due to different method used ($scale\ of\ 10^{-14}$) is observed, hence we may conclude that the differences are negligible.

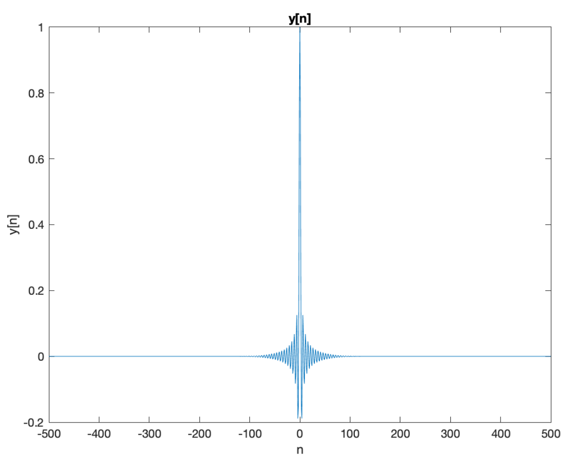
Code:
```
plot(f, abs(X)-abs(Xk))
xticks([-pi, -pi/2, 0, pi/2, pi]);
xticklabels({'-\pi', '-\pi/2', '0', '\pi/2', '\pi'});
title('|X(e^j^\omega)| - |X_k(e^j^\omega)| vs \omega ');
xlabel('\omega');
ylabel('|X(e^j^\omega)| - |X_k(e^j^\omega)|');
```

(d)



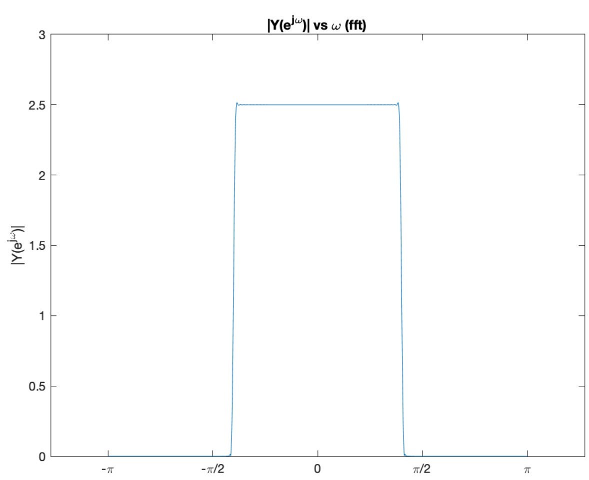
$w[n]$ vs n

(e)



$y[n]$ vs n

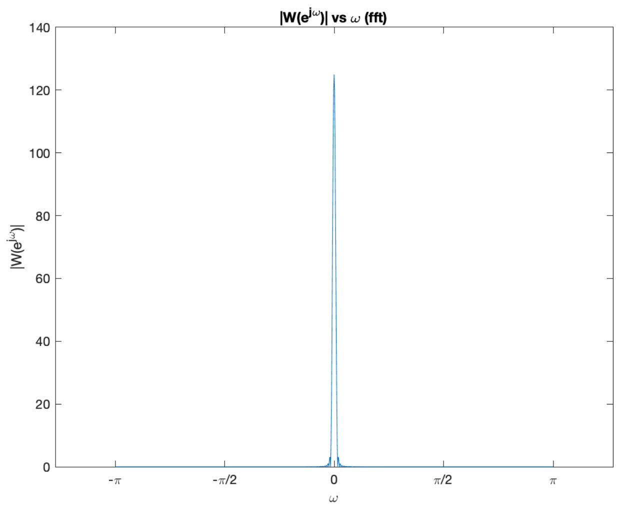
(f)



$\left|Y(e^{j\omega})\right|$ vs ω

Gibb's phenomenon:

The Fourier Transform of the signal $y[n]$ is significantly smoother after $x[n]$ multiply by $w[n]$. This indicates that Gibb's phenomenon is less evident in this case than it is in problem (b). This is because the Fourier Transform of $w[n]$ and the convolution of $\left|X(e^{j\omega})\right|$ smooth out the overshoots we can see in (b) without destroying the entire signal. That is, multiplication in the time domain is equivalent to convolution in the frequency domain.



Code:

```
W = fftshift(fft(wn));

figure(8);
plot(f, abs(W));
xticks([-pi, -pi/2, 0, pi/2, pi]);
xticklabels({'-\pi', '-\pi/2', '0', '\pi/2', '\pi'});
title('|W(e^j^\omega)| vs \omega (fft)');
xlabel('\omega');
ylabel('|W(e^j^\omega)|');
```