Signal Processing with FFTs

9-22-2006

Opening Discussion

- What did we talk about last class?
- Do you have any questions about the readings?

Complex Exponents of e

- It actually simplified things many times if we don't split the sin and cosine apart and instead us a nice property of complex exponentiation.
- $e^{ix} = \cos(x) + i\sin(x)$
- Matlab uses this form and it is a nice thing to know in general. For Fourier analysis, it turns places where we would have to do two integrals into places where we only do one.

Fourier Transforms

- Matlab doesn't actually solve a Fourier series, instead it solves a Fourier transform. That is a continuous form that uses integrals.

$$F(k)=\sum_{n=1}^{N} f(n)e^{-i2\pi(n-1)(k-1)/N}$$

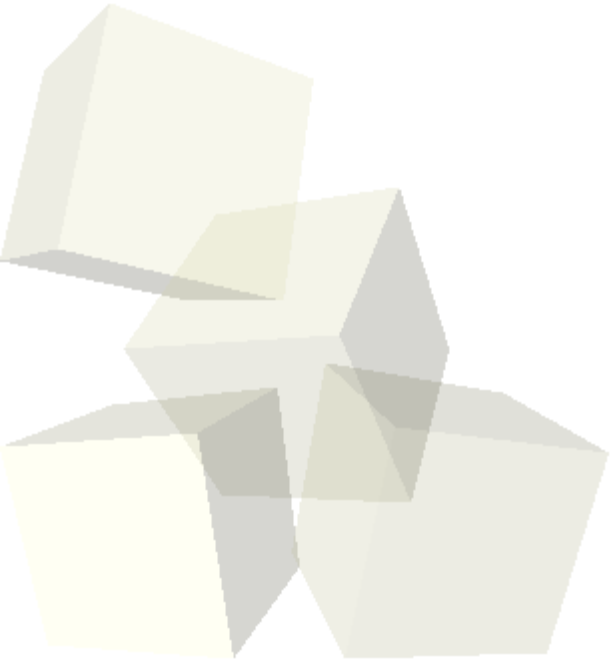
$$f(n)=\frac{1}{N}\sum_{k=1}^{N} F(k)e^{i2\pi(n-1)(k-1)/N}$$

Fast Fourier Transform

- Technically what Matlab uses is a function called a fast Fourier transform. To keep it fast, the number of elements passed into it needs to be a power of 2.
- The fft function will go from a signal series and return a series of the frequencies.
- The ifft function does the opposite.
- Notice that we don't pass in the time values so the indexes are assumed to be the times. We have to scale that back to whatever range we actually want.

Examples

- Let's spend the rest of the class working with the fft function and doing some examples.



Closing Comments

- Assignment #4 is due on Monday.
- Have a good weekend.