Lecture 10

Austin Baird
UNC Department of Mathematics
UNC Department of Biology

April 2, 2014

Summary

Today we will:

Try and understand series approximations and transforms (Fourier Analysis!)

Periodic Functions

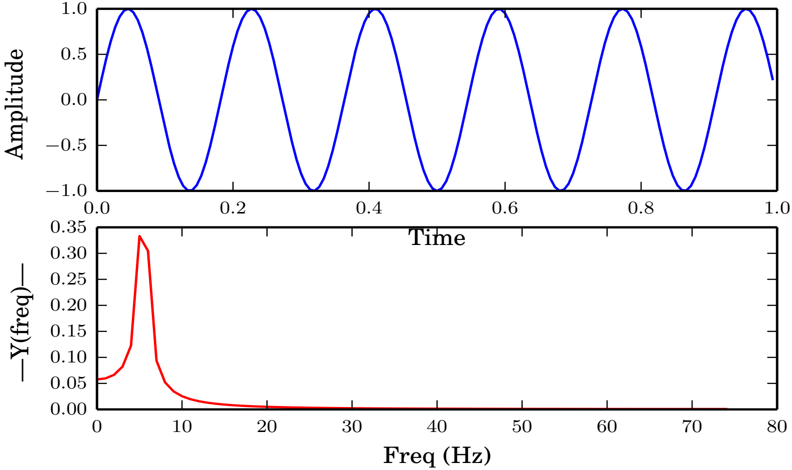
A period function satisfies the relationship:

$$f(t + nP) = f(t)$$
$$n \in \mathcal{Z}$$

Here the period is denoted P and so this relations shows that for any chosen n the graph will repeat itself with period P. Think of reconstructing a graph to have as large of a domain as you'd like by reflecting a function over and over again about the period!

Examples

Periodic data = frequency analysis:



Series Representations

Want to represent functions as an infinite series of terms:

$$\sum_{m=0}^{\infty} a_m (x - x_0)^m$$

What does this look like? What is an example of this? Taylor Series!

Taylor Series

One way to approximate functions (or not if we can deal with infinity!) is the Taylor series, defined to be:

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \dots$$

$$f(x) = \sum_{m=0}^{\infty} \frac{f^(n)(a)}{n!}(x-a)^n$$

This is the series representation of the function at a point a.

Homework 9

We want to approximate functions using a discrete amount of series points!

- Compute the taylor series centered at 0 for the function $\sin(x)$ (maybe by hand).
- (to be turned in) Graph the partial sums of this series of an increasing number of terms on the same graph.
- (to be turned in) Qualitatively describe when these functions are no longer accurate. How far do seven terms get you?
- (to be turned in) Complete this experiment with $\frac{1}{1-x}$, e^x are there similarities?
- Turn in Matlab code and a brief document of graphs and discussion (as well as the series representation of the functions).