# PHYS 325: Lecture 18

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## Lecture Span

- Greens functions
- Delta functions
- Fourier Stuff

## Fourier Series

Applied for periodic functions.

$$F(t) = \frac{a_0}{2} + \sum_{p=1}^{\infty} a_p \cos(p\Omega t) + \sum_{p=1}^{\infty} \sin(p\Omega t) \tag{1}$$

Note that

$$a_0 = \frac{2}{T} \int_T F(t) dt \tag{2}$$

$$a_p = \frac{2}{T} \int_T F(t) \cos(p\Omega t) dt \tag{3}$$

and

$$b_p = \frac{2}{T} \int_T F(t) \sin(p\Omega t) dt \tag{4}$$

Note: $\cos(mx)$ and $\cos(nx)$ are "orthogonal" for $m \neq n$, that is

$$< \cos(mx), \cos(nx) >_T = 0 \tag{5}$$

Same argument for $\sin([m, n]x)$.

## Gibbs Phenomenon

Overshooting followed by undershooting. This is prevalent in Fourier series fitting.

## Summary

EOM:

$$m\ddot{x} + c\dot{x} + kx = F(t) \tag{6}$$

Then for $\Omega = \frac{2\pi}{T}$, then

$$F(t) = \frac{a_0}{2} + \sum a_p \cos(p\Omega t) + \sum b_p \sin(p\Omega t) \tag{7}$$

The steady state solution $x(t)$ is the solution for $t >> 0$.