Recitation 15, April 6, 2006

Fourier Series: Harmonic response

This recitation is meant to clear up questions about Fourier series. The main new thing is using Fourier series to explore the periodic response of a harmonic oscillator to a periodic signal.

1. Find the Fourier series for the function of period 2π which is given by $f(t) = t/\pi$ for $-\pi < t < \pi$.

2. Find the Fourier series for the function of circular frequency ω which is given by $g(t) = t/L$ for $-L < t < L$, where $L = \pi/\omega$.

3. Now drive the harmonic oscillator with the function $g(t)$ from **(2)**:
$\ddot{x} + \omega_n^2 x = g(t)$. Express a periodic solution as a Fourier series.

4. Imagine changing the capacitance in the AM turner; this changes ω_n. For what values of ω_n does resonance occur?—that is, for what values of ω_n does there fail to be a periodic solution? When ω_n is near one of those values, what is the periodic solution like?