

# Physics 8.03

# Vibrations and Waves

Lecture 2

# Problem Set #1

- What's on it?
  - Three problems on complex notation and superposition
  - Two on simple harmonic oscillators
  - One on damped harmonic oscillator  
(Need to make a matlab plot)

# More organizational things

## ■ Text books

- *Vibrations and Waves*, by French (required)
  - Nearly every page used in 8.03
- *EM vibrations, waves and radiation*, by Bekefi and Barrett (required)
  - Lots of jumping around, pay attention to reading assignments
- *Optics*, by Hecht (recommended)
  - Useful for Polarization, Interference, Diffraction

# More organizational things

- Grades on the web
  - Part of a pilot system of web-based grade database
  - Ready in mid-February
- Anonymous (or otherwise) feedback
  - I will respond → be constructive
  - I will post your comments (anonymously) along with my response → avoid profanity

# Last time: Simple harmonic motion

- Equation of Motion

$$\frac{d^2 x}{dt^2} + \omega_0^2 x = 0$$

- Solutions in three forms

$$\begin{aligned} &= A \cos(\omega_0 t + \phi) \\ x(t) &= A \cos(\omega_0 t) + B \sin(\omega_0 t) \\ &= \text{Re}[A.e^{j(\omega_0 t + \phi)}] \end{aligned}$$

- Quadratic potential  
→ SHM

$$\begin{aligned} -\frac{dU(x)}{dx} &= F(x) = -kx \\ \Rightarrow U(x) &= \frac{1}{2} kx^2 \end{aligned}$$

# DAMPED HARMONIC MOTION

- Finish up simple harmonic motion
  - Conservative forces, quadratic potentials and SHM
  - Approximate SHO: the pendulum
- Add damping term to equation of motion
- Solutions depend on size of the damping
  - Lightly damped (under-damping)
  - Heavily damped (over-damping)
  - Critically damped