

Oscillations: Forced Systems & Index of Refraction (Reading: Chapter 5.5 - 5.6)

**Help:**

i Energy loss in a damped-driven oscillator. The problem set is light this week so that you have more time to prepare for and take the midterm.

Consider a damped oscillator, with natural frequency  $\omega_0$  and damping constant  $\beta$  both fixed, that is driven by a force  $F(t) = F_0 \cos(\omega t)$ .

- (a) Find the rate  $P(t)$  at which  $F(t)$  does work and show that the average rate  $\langle P \rangle$  over any number of complete cycles is  $m\beta\omega^2 A^2$ .
- (b) Verify that this is the same as the average rate at which energy is lost to the resistive force.
- (c) Show that as  $\omega$  is varied  $\langle P \rangle$  is maximum when  $\omega = \omega_0$ ; that is, the resonance of the power occurs at  $\omega = \omega_0$  (exactly).

