

**Quiz 2, Monday, September 11, 2006**  
ECE 598 AL  
THE SPEECH CHAIN

**Problem 1 (4 points)**

Signal to noise ratio, in decibels, is defined to be

$$SNR = 20 \log_{10} \left( \frac{S_{RMS}}{N_{RMS}} \right)$$

where  $S_{RMS}$  is the RMS pressure, in Pascals, of the desired acoustic signal (usually speech), and  $N_{RMS}$  is the RMS pressure, in Pascals, of the noise. Suppose that two adults are conversing loudly at an RMS acoustic pressure of  $S_{RMS} = 0.1$  Pascals.

- (a) In a noisy office, the SNR might be 20dB. What is  $N_{RMS}$ ?
  
  
- (b) In a moving car, the SNR might be 0dB. What is  $N_{RMS}$ ?

**Problem 2 (6 points)**

The equation of motion for a particular spring-mass system is

$$\frac{d^2x}{dt^2} = -4x(t) \tag{1}$$

- (a) Demonstrate that  $x(t) = \cos \omega t$  is a solution to Eq. 1, for certain values of  $\omega$ .
  
  
  
  
  
  
  
  
  
  
- (b) Suppose that  $x(t) = \cos \omega t$ , where  $\omega$  is specified by Eq. 1. Plot one full period of the velocity  $dx/dt$ . Be sure to show the period (in seconds) and the peak velocity (in m/s).