EE262 **Handout # 28**

Homework # 6

Due next Wednesday

1. Download the file called "hw6prob1data" from the class web directory. This file consists of 21 lines of 512 **real floating point** samples each representing echoes at 21 geophones from a single shot. Again, you will have to be careful with the "endianess" of the data. The system and Earth parameters for this experiment are:

v = 5000 m/s
t0 = 2.0 s (time delay to first sample)
Δt = 0.001 s (sample rate)
s = 80 m (geophone spacing, total array length 1600m)

a. What is the depth corresponding to the first sample, assuming zero offset to the geophone ? The last sample for the same geophone ?

b. Add the 21 lines together and plot the result. Can you identify the number and location of layers in this measurement ?

c. Stack the layers using your knowledge of the Earth and system parameters above. Now plot the result and compare with the previous result.

2. Now download the file "hw6prob2data". This file consists of 512 successive positions of the same 21 geophone array used in the previous problem, thus its size is 21*512 lines of 512 samples each. Each 21 lines represents one shot recorded at 21 geophones. **However, to save space, the data are recorded as byte values rather than floating point values.** The byte values represent signal values plus 128 in order to be able to record positive and negative signals. That is, you can decode the signal a(t) using

$$a(t_i) = b_i - 128$$

where $a(t_i)$ is the ith time sample of a() and b_i is the ith byte in the line.

Process these data using stacking techniques and create an image of the layer depths as a function of position. The Earth and system parameters are identical to those in problem 1 above. Identify likely spots to drill for oil.

3. We saw that we could avoid using dynamite blasts in some situations by vibrating the ground with a vibroseis instrument and then using signal processing to synthesize a narrow pulsed waveform. Create a sample narrow pulse by summing cosinusoidal signals with the following properties:

$$s_i(t) = \cos (2 \pi f_i t) \qquad \text{for } -5 \text{ sec} < t < 5 \text{ sec}$$

Evaluate this for vibroseis frequencies ranging from 1 Hz to 10 Hz in 0.1 Hz increments. Submit a plot of the synthesized pulse waveform. Make sure you sample your signals finely enough in time that you do not encounter aliasing.