

## 醫用超音波原理

### Computer Homework #3: Doppler Processing

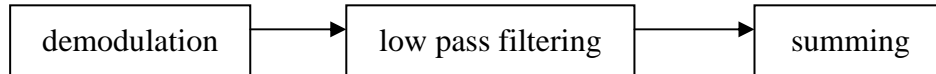
Due 12:00pm 6/12/2007 by emailing to

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0. Load hw3\_dat.mat. In this data file, *DopplerData* represents a PW Doppler data set. The size of the data is 128 X 400, representing gated received data with 128 firings and 400 data samples for each firing. In the same data file, the following parameters are also included:

- *PRI*: pulse repetition interval in *usec*.
- *fs*: sampling frequency in *MHz*.
- *f0*: center frequency of the transmitted pulse in *MHz*.

For each firing, perform the following processing. The total number of samples will reduce from 400 to a single complex sample after the processing. Repeat the processing for all firings in order to obtain 128 complex samples.



1. Based on the 128 complex samples, calculate the velocity profile using FFT. The profile should be plotted on a logarithmic scale with a 40dB range. The horizontal axis should also be labeled with proper velocity scale. (30%)
2. Re-do Problem 1 by using only the even samples. Also re-do Problem 1 by using only the first 200 data points during summation. Explain your results. (30%)
3. Based on the original complex samples, calculate and plot the mean velocity, variance and energy as the number of samples increases from 2 to 128. Also compare with the results when only using the center 100 (151:250) points for the summing. Note that the discrete correlation function is defined as the following (40%)

$$\hat{R}(n \cdot T) = \frac{1}{N - n} \sum_{i=1}^{N-n} S((i + n) \cdot T) S^*(i \cdot T) .$$

4. (bonus) Explore any related Doppler issues based on the dataset.