BIOEN 6330 Principles of Magnetic Resonance Imaging Homework #4 Due Thursday, March 11, 2010

- 1. Suppose one is equipped with a 2.0 ms-long truncated sinc RF pulse waveform (with 1.0 ms center-lobe width) and a 50 kHz digitizer. Furthermore, suppose gradient pulses can be switched instantaneously, but the amplitude is limited to be ± 2.0 G/cm.
 - (a) For a 256×256 image matrix size, what are the *smallest* slice thickness and isotropic (i.e., square) pixel size achievable?
 - (b) Sketch the minimum-TE *gradient echo* pulse sequence to realize part (a) above. Indicate the heights and widths of *all* gradient pulses. What is the minimum TE?
- 2. Repeat Problem 1b for the minimum-TE spin echo pulse sequence.
- 3. Repeat Problems 1b and 2 for the more realistic situation that gradient pulses *cannot* be switched instantaneously and that 0.5 ms ramp-up or ramp-down time is required.
- 4. Do Problem 15.4 on page 345 of textbook. Skip Part (a).
- 5. Suppose a pair of gradient pulses of duration δ , separation Δ , and height *G* are used to encode diffusion. Derive the expression for the diffusion weighting *b* factor when:
 - (a) Rectangular gradient pulses are used, and
 - (b) Half-sine gradient pulses are used.
 - (c) Compute the actual *b* factors for Parts (a) and (b) when 5.0 ms, 10.0 ms, and 10.0 G/cm are used for δ , Δ , and *G*, respectively.