BENG280A, Principles of Biomedical Imaging 10/17/06
Fall Quarter 2006

HOMEWORK #4
Due at the start of Class on Thursday 10/26/06

Readings:
Section 2.8; 10.1-10.3; 11.1, 11.2;

Problems:
1. Fourier Transforms
   a) Find the 1D Fourier transform of $m(x) = \exp(-x^2)\delta(x)\cos^2(2\pi\sqrt{x})$.
   b) Find and sketch the Fourier transform of the 1D function
   $$m(x) = \left[\left[rect(2x) * \sin c(4x)\right]\cos(20\pi x)\right] * \sin c(x)$$
   c) Consider the 2D object $m(x,y) = \left[\sin c\left(\frac{x}{10}\right)\sin c\left(\frac{y}{10}\right)\right]\cos(10\pi x + 20\pi y)$. Find and sketch its Fourier transform.
2. Problem 2.24
3. Problem 2.25; For this problem, you will find it useful to use Table 2.1 in the book and also the erf function in MATLAB.
4. Problem 6.13
5. Problem 6.28 parts (a)-(c).
6. Extra Credit: Part of the lecture on 10/26 will be devoted to answering questions to help with midterm preparation. Provide 1 or more questions regarding course material that you would like to be addressed in that lecture. Please e-mail your questions to the instructor and the TA – put the keyword **BE280A06** in the subject of your e-mail.

Matlab Exercise:

Define a 257x257 object where the center 61x61 square is 1 and the object is zero everywhere else.

(a) Use the **radon** function to compute the projections for angles from 0 to 180. Try angular increments of 1 degree, 0.5 degree, and 0.25 degrees (e.g. theta = 0:0.5:179.5). Examine the sinograms. Do the sinograms agree with what you found in last week's homework?

(b) Use the **iradon** function to compute the filtered backprojection reconstruction of your image. What is the effect of the varying angular increments?

(c) Experiment with the different filtering and interpolation options in iradon. What is the effect of using a Hamming or Hann filter?