Math 155, Vese

Homework # 7, due on Friday, March 2nd

(only if more time is needed, you can exceptionally turn it in on Monday, March 5)

[1] Correlation in the Frequency Domain

Download Figs. 4.41(a) and (b) and duplicate Example 4.11 to obtain Fig. 4.41(e). Give the (x,y) coordinates of the location of the maximum value in the 2D correlation function. There is no need to plot the profile in Fig. 4.41(f).

[2] Show that the Fourier transform of the 2-D continuous sine function $f(x, y) = A \sin(u_0 x + v_0 y)$ is the pair of conjugate impulses

$$F(u, v) = -i\frac{A}{2}\Big[\delta\Big(u - \frac{u_0}{2\pi}, v - \frac{v_0}{2\pi}\Big) - \delta\Big(u + \frac{u_0}{2\pi}, v + \frac{v_0}{2\pi}\Big)\Big].$$

Hint: use the continuous version of the FT, and express the sine in terms of exponentials.

(you can find in section 4.2.4 the definition of the impulse function; this topic will be discussed more in class next week).

[3] Periodic Noise Reduction Using a Notch Filter

(a) Write a program that implements sinusoidal noise of the form given in Problem [2] above. The inputs to the program must be the amplitude, A, and the two frequency components u0 and v0 shown in the problem equation.

(b) Download image 5.26(a) and add sinusoidal noise to it, with u0 = M/2 (the image is square) and v0 = 0. The value of A must be high enough for the noise to be quite visible in the image.

(c) Compute and display the spectrum of the image.

(d) Notch-filter the image using a notch filter of the form shown in Fig. 5.19(c).