EE581 2-D Diffraction Calculations

Write (and comment!) a program to compute the optical field behind a 2 dimensional aperture, using the angular spectrum / transfer function approach. This should be an extension of your code for 1D diffraction calculations from the last homework.

Using the DFT (fft), you need to consider proper mapping from the space domain to the frequency domain, and the use of zero padding and sample density. In general, more points are better, but of course when you get to 2D-fft calculations, there will be time and memory constraints. You'll want to explore these tradeoffs.

To help you do that, please **use your 2-D code** to evaluate the diffraction pattern for four different apertures, at two different distances behind the aperture screen.

Assume $\lambda = 1$ for all calculations

Evaluate each aperture for $z = 100$ and $z = 10000$ wavelengths

Aperture #1 u(*x*) = rect(*x*/100) rect(*y*/100); % a square of width 100λ

Aperture #2 u(*x*) = circ(*r*/50); % a circle of diameter 100λ

Aperture #3 u(*x*) = circ(*r*/50)(0.5+0.5cos(2π*x*/10)); % cosine amplitude grating, with 10λ period, inside a circular aperture of diameter 100λ

Aperture #4 u(*x*) = circ(*r*/50)exp(j(π/2) sgn(cos(2π*x*/10))); % rectangular phase grating, with 10λ period and π radian peak-to-peak phase amplitude, inside a circular aperture of diameter 100λ

What to hand in:

Please include a copy of your code, and plots of the diffraction patterns for each aperture at both *z* locations. Provide a short description, including justification for your choices for sample spacing and record lengths.