EE581 1-D Diffraction Calculations

Write (and comment!) a program to compute the optical field behind an aperture, using the angular spectrum / transfer function approach. Do this initially for one dimensional apertures (slits) with uniform illumination. When you have your one-D code working, you can extend it to two-D to handle rectangular or circular apertures.

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 1-D code** to evaluate the diffraction pattern for three 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); % a slit of width 100 wavelengths

Aperture #2 u(*x*) = rect(*x*/100)(0.5+0.5cos(2π*x*/10)); % cosine amplitude grating, with 100λ width and 10λ period

Aperture #3 u(*x*) = rect(*x*/100)exp(j(π/2) sgn(cos(2π*x*/10))); % rectangular phase grating, with 100λ width and π radian peak-to-peak phase amplitude with 10λ period

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.