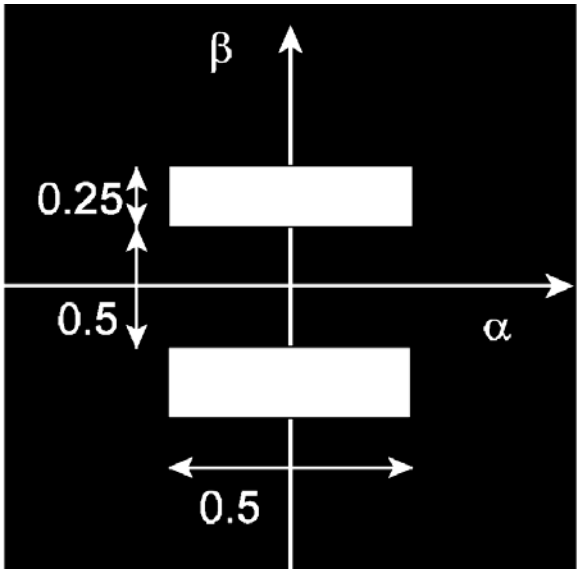
TF-1) An incoherent light source of approximately 500 nm wavelength is used with a 10 mm diameter, 200 mm focal length lens. The lens images a sinusoidal test target that is located hundreds of meters from the lens.

a) What is the modulation transfer function cutoff frequency in units of lines/radian in object space?
b) What is the modulation transfer function cutoff frequency in units of lines/mm in image space?
c) Repeat part a and b for a 5 mm diameter, 100 mm focal length lens.
d) What do we know about the wavefront aberration if the phase of the OTF is directly proportional to spatial frequency and the modulus of the OTF is equal to the unaberrated value.

TF-2) Sketch OTF(ξ,0) and OTF(0,η) for the pupil distribution below, assuming a luminous object. The white areas are open parts of the aperture.



TF-3) A 20 mm diameter lens having a 200 mm focal length operating at a wavelength of 500 nm is used to image a target. Assuming no aberration, what is the cutoff frequency of the modulation transfer function in image space if

a) The target is at infinity?
b) The target is 400 mm from the lens?
c) Repeat a and b for the case where the lens has 2 waves of third-order spherical aberration.

TF-4) An optical system with the square aperture shown below is used to image an incoherently illuminated object. The pupil function has a 180^o phase step as shown in the figure.

a) If l = 0.5 meter, d = 0.1 meter, and the wavelength is 500nm, what is the cutoff frequency in units of lines/radian in the x and y directions?

b) Give equations for the MTF as a function of spatial frequency in the x and y directions.

c) Sketch the MTF in the x and y directions.