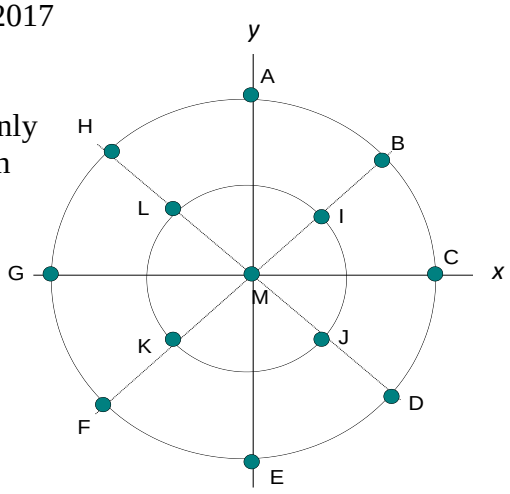
Homework 5 Due 5:00 pm on Tuesday, Feb 28, 2017



1) (20 pts) Consider an optical system for which the only aberration is third-order coma. Rays are traced through the system to intersect the pupil at points A-M.

a) Develop the ray fan equations for 3rd-order coma

b) Draw to scale and label the intersections of the points in the paraxial image plane (referenced to the chief-ray intersection).

2) (20 pts) Develop ray-fan equations for spherical, astigmatism, field curvature, and distortion, each combined with defocus (you already derived the coma ray fan in problem 1). Use your equations to draw the ray fan plots for the following cases:

a) spherical aberration where the ρ=0.7 zone is in focus

b) astigmatism at medial focus

c) coma at paraxial focus

d) distortion at field heights of 0.7 and 1.0 (at paraxial focus)

3) (10 pts) The longitudinal spherical aberration for two rays traced through a system in the tangential plane is -1.0 μm and -0.5 μm. The ray slopes (tanU') for these same two rays are -0.05 and -0.035, respectively.

a) What are the transverse ray aberrations in the paraxial plane?

b) what are the transverse ray aberrations in a plane 0.2 μm before the paraxial plane?

4) (10 points) – for EELE 582 students
Write a summary paragraph or two about expressing an optical wave front in terms of Zernike polynomials. Identify key similarities and differences with the wave front polynomial approach that was presented in class.