

SIMULSOFT

Simulations

SpotOptics

The software people for optics

Spot-optics s.r.l., Padova, Italy Features of SimulSoft 5.0
www.spotoptics.com

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SIMULSOFT: Simulations

1. GENERATION OF ZERNIKE WAVEFRONTS

Selection of following:

Selection of Seidel or Classical annular Zernikes polynomials
Selection of term or terms to add (coefficient and angle)
Selection of kind of noise to add: Gaussian or Random
Average of several frames
Number of spots (up to 70)
Optical parameters of optical element and Shack-Hartmann grid

Plots

Combined frame
Encircled Energy profile
Residuals
Spot diagram
Wavefront contour plot
Wavefront 3D plot

2. TELESCOPE DESIGN BASED ON ANALYTIC THEORY

SELECTION OF CONFIGURATION

Cassegrain or Gregorian (Ritchey-Chretien, Classical or Dall-Kirkham)

Plots: Field aberrations

Coma
Astigmatism
Sag
Defocus
Distortion

Plots: despace aberrations

Coma due to misalignment
Spherical aberration due to wrong focal plane

3. DIFFRACTION COMPUTATIONS BASED ON ANALYTIC THEORY:

MTF, PSF AND EE PROFILE FOR THE FOLLOWING CASES

Aberrations: defocus and spherical aberration
Pixel size of detector
Ripple on optical surface
Micro ripple on optical surface
Pointing accuracy of telescope
Atmospheric seeing

Plots

MTF as a function of normalized frequency or lines/mm
PSF and EE as a function of angular or dimensionless radius
Computation of MTF, PSF and EE from the spot diagram generated for the aberration

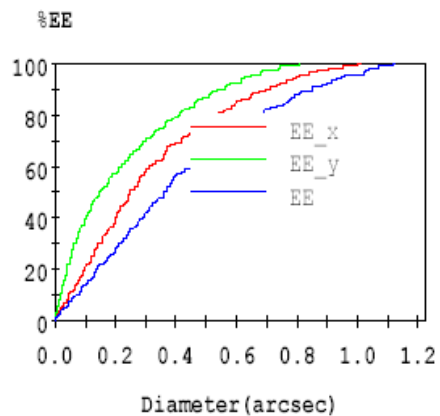
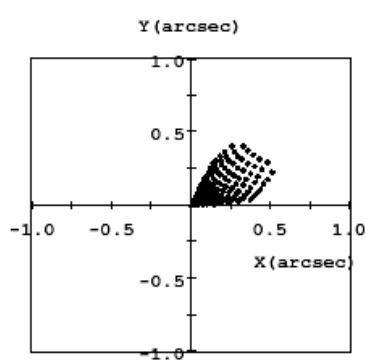
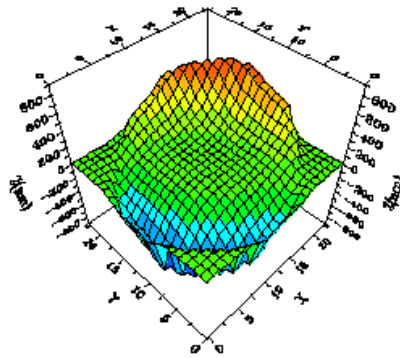
MTF, PSF and EE from spot diagrams

MTF, PSF and EE computed from the SH analysis

Plots

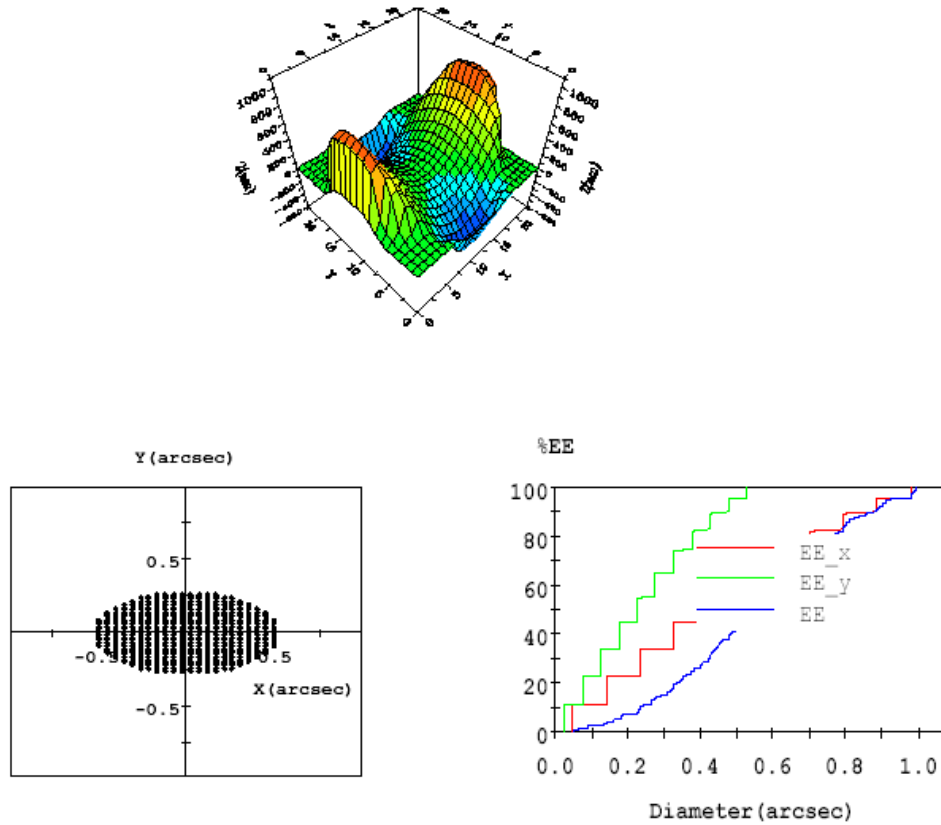
MTF as a function of normalized frequency or lines/mm
PSF and EE as a function of angular or dimensionless radius

Simulations of Zernike polynomials Coma



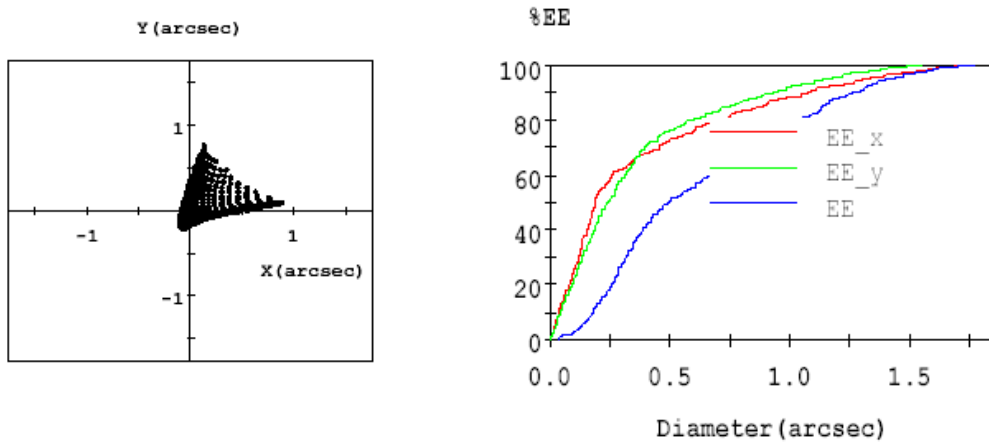
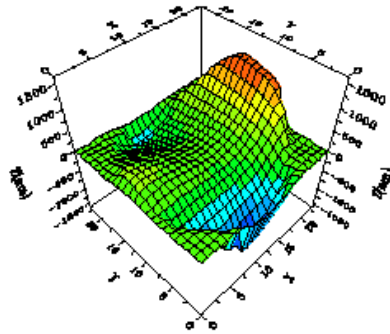
The 3D and the contour plot (above) of the wavefront, and the spot diagram and the encircled energy profile for coma (1000nm, angle=35°). The sampling is 24x24 spots.

Simulations of Zernike polynomials Astigmatism



The 3D and the contour plot (above) of the wavefront, and the spot diagram and the encircled energy profile for a combination of astigmatism (1000nm, angle=0°), and defocus (300nm). The sampling is 24x24 spots.

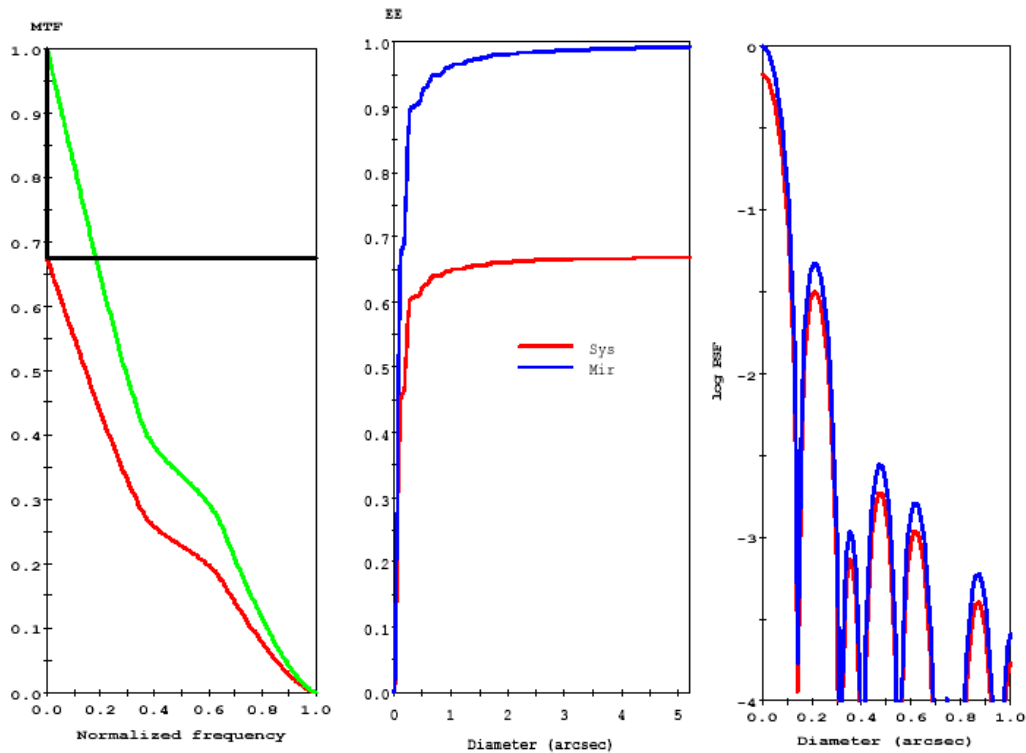
Simulations of Zernike polynomials Coma and astigmatism



The 3D and the contour plot (above) of the wavefront, and the spot diagram and the encircled energy profile for a combination of astigmatism (1000nm, angle=0°), and coma (1000nm, angle=35°). The sampling is 24x24 spots.

Diffraction analysis effect of microripple on MTF,

Other physical effects that can be studied: defocus, spherical aberration, pixel size and seeing.

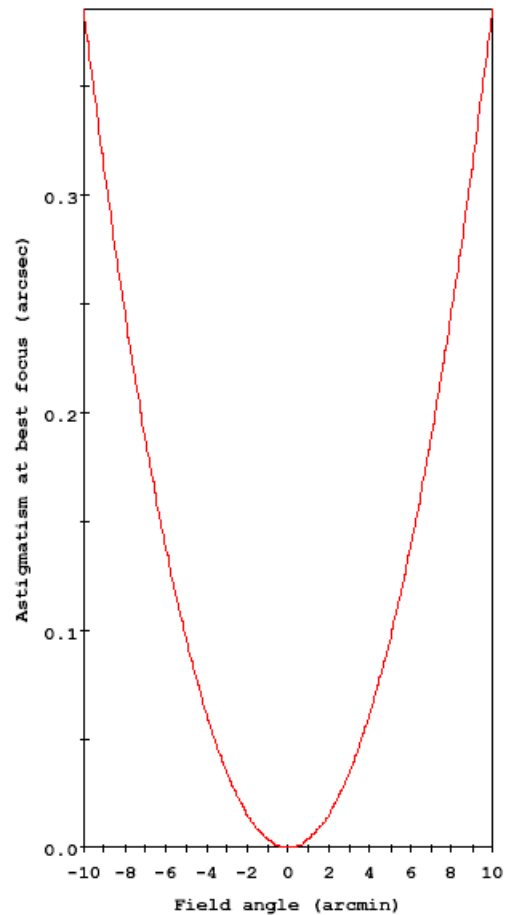
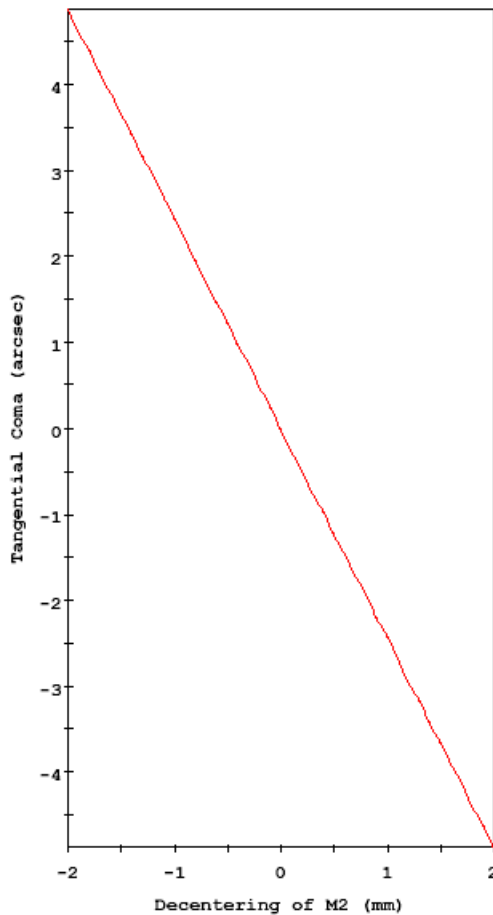


The effect of microripple on the MTF is shown in the figure at left (black line). The green line shows the MTF of a perfect mirror and the red line the MTF of the mirror due to the microripple. An rms value of 0.1_ was assumed for the ripple.

The effect of ripple on the EE profile is shown in the middle panel and on the PSF on the right panel. Evidently, even a small amount of microripple can dramatically change the quality of the image obtained from the optical system.

Telescope design based on analytic theory

Ritchey-Chretien Cassegrain telescope. Ritchey-Chretien Cassegrain telescope.



Field astigmatism

include: coma due to tilt, spherical aberration due to wrong plane, distortion, sag of focal surface.

These plots can be obtained for a Ritchey-Chretien, classical cassegrain and Gregorian telescopes.



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