Correction of Chromatic Aberration by Using a Diffractive Lens
Modern optical systems often consist of components with different working principles. For example, a diffractive lens can be used to correct the chromatic aberrations from traditional refractive lenses. Diffractive lenses are usually designed to work at a certain diffraction order; however, undesired orders do exist in practice. In this example, the PSF of a hybrid imaging system consisting of both refractive and diffractive lenses is investigated, especially, with the undesired diffraction orders taken into account.
Modeling Task

- input plane wave
  - wavelengths 486.1 nm, 587.6 nm, 656.3 nm
  - field of view angles 0°, 10°, 20°
  - diameter 5 mm

- focusing objective

- diffractive lens
  - polynomial phase function (radial symmetrical)
  - diffraction efficiencies
    - 1st order: 80%
    - 0th order: 20%

How to evaluate the PSF of a hybrid imaging system with both refractive and diffractive lenses?
Results

Different diffraction orders are clearly visualized in the ray tracing dot diagrams.
Results

Physical-optics calculation of the PSF including both diffraction orders and all colors takes 50 seconds.
Results

off-axis 10°

PSF

0th order

1st order

dot diagram

x [mm]
y [mm]
Results

off-axis 20°
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