Bessel Beam Generation behind a Fiber with a Holographic Optical Element
Abstract

Bessel beams, due to their extended depth of focus, are found useful in many applications. In this example, we show how to generate Bessel beam from the output of a single-mode fiber. Instead of the typical approach with a collimation lens and an axicon, we designed a holographic optical element (HOE) that incorporates both the lens and axicon functions in one. Such an optical setup is built in VirtualLab Fusion. We check the function of the HOE and examine the evolution of the field behind the HOE.
Modeling Task

input field - output from a single-mode fiber (modeled as Gaussian beam) - wavelength 1064 nm - waist radius 3.3 μm

HOE - combined function of a collimation lens and an axicon

collimation lens function (focal length 1.5 mm)

axicon function (deflection angle 7°)

How does the field look like behind the HOE with combined functions?
Function of the HOE

The HOE converts the input divergent spherical wavefront into a convergent conical one.
Field at Different Locations Behind HOE

![Diagram showing field at different locations behind HOE.](image)
Because of the axicon function, the field behind the HOE remains focused over a relatively long distance.
Peek into VirtualLab Fusion

HOE component with flexible function definition

visualization of field quantities in any section
Workflow in VirtualLab Fusion

• Define customized HOE function via programming

• Set the Fourier transforms properly
  – Fourier Transform Settings – Discussion at Examples [Use Case]

• Use Parameter Run to check field evolution
  – Usage of the Parameter Run [Use Case]
VirtualLab Fusion Technologies

- Free space
- Prisms, plates, cubes, ...
- Lenses & freeforms
- Apertures & boundaries
- Gratings
- Diffractive, Fresnel, meta lenses
- HOE, CGH, DOE
- Micro lens & freeform arrays
- SLM & adaptive components
- Diffractive beam splitters
- Scatterer
- Diffusers
- Waveguides & fibers
- Nonlinear components
- Crystals & anisotropic components
- Free space

Field Solver
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