Circularly Serrated Aperture for Beam Apodization
Abstract

There is a high demand for beams with uniform irradiance profile (flat-top beams) in various industry sectors. It is also known that light sources with a flat-top profile are more prone to develop diffraction ripples after propagation. In this demo, we seek to tackle this challenge by introducing a serrated beam apodizer. Beam apodization plays a key role in the design of high-energy laser systems and beam delivery.
Diffraction ripples are developing due to source aperture.

Ripples dampened due to apodization.
Serrated Beam Apodizer

```javascript
if(serratedRadius >= Math.Sqrt((Math.Pow(x, 2) + Math.Pow(y, 2))))
{
    realPart = 1.0;
}
```

**Programmable Function**

**Aperture Parameters**
- **Shape:** Circular
- **Serrating amplitude:** 1 mm
- **Average radius:** 3.5 mm
- **Number of periods:** 250
Results: Beam Propagation Excluding Apodizer

Source Parameters

Shape: Elliptic
Diameter: 10x10 mm
Wavelength: 532 nm
Polarization: Linearly polarized

Optical setup in VirtualLab

Beam profile in 3 m
Results: Beam Propagation Including Apodizer

Source Parameters

- Shape: Elliptic
- Diameter: 10x10 mm
- Wavelength: 532 nm
- Polarization: Linearly polarized

Beam profile in 3 m

Optical setup in VirtualLab
Results Comparison

Without apodizer

With apodizer
Diffraction ripples are developing due to source aperture.

Truncated plane wave

Serrated aperture

Spatial filtering

Pinhole

Irradiance detector
Results: Beam Apodization with Spatial Filtering

Source Parameters
- Shape: Elliptic
- Diameter: 10x10 mm
- Wavelength: 532 nm
- Polarization: Linearly polarized
Results Comparison with Literature

Aperture Parameters
Shape: Rectangular
Serrating amplitude: 1 mm
Outer boundary: 1x1 cm
Period size: 160 µm
5X Magnification after aperture

Reference

Aperture Parameters
Shape: Circular
Serrating amplitude: 1 mm
Average radius: 4.5 mm
Number of periods: 250
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