Rigorous Simulation of Holographic Generated Volume Grating
Abstract

Holographic generated volume gratings, with a thickness much larger than the wavelength, often shows a narrow bandwidth around particular wavelength and angle. Following the two-beam interference exposure process, a volume grating inside fused silica is generated and simulated with the rigorous Fourier modal method (FMM) in VirtualLab. Both the spectral and angular dependent reflection property of the grating are analyzed.
Modeling Task

-1\textsuperscript{st} order reflection?

incident angle around 60° (to be varied)

input wavelength around 640nm (to be varied)

holographic volume grating generated by two-beam interference (640µm, 59.9° angle) exposure process, with refractive index modulation of 0.01 based on fused silica
Results

- **Wavelength scanning**

![Graph showing wavelength scanning results]

-1\textsuperscript{st} order reflection

rigorous FMM analysis of single wavelength within **18 seconds**

- shift of wavelength dependent reflection due to locally increased effective refraction index

- wavelength varying from 630 to 650 nm

incident angle fixed at 59.9°
Results

• Angle scanning

-1st order reflection

Efficiency $R(1, 0)$ [%]

Cartesian Angle $\alpha$ (Volume Grating #1... [°])

-60.5 -60 -59.5 -59

$\text{FWHM } 0.55°$

-1st order reflection?

angle varying from 58.8 to 60.8°

wavelength fixed at 644 nm

292.5 nm

507.6 nm

70 μm
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