

Grating couplers



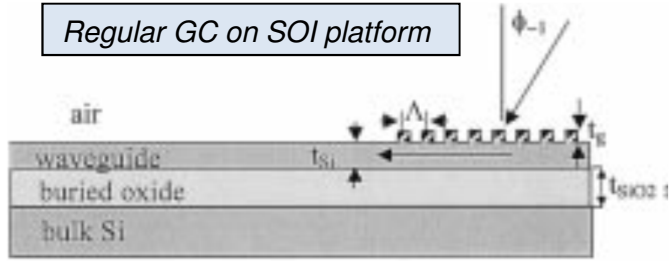
7 Capella Court
Nepean, ON, Canada
K2E 7X1

+1 (613) 224-4700
www.optiwave.com

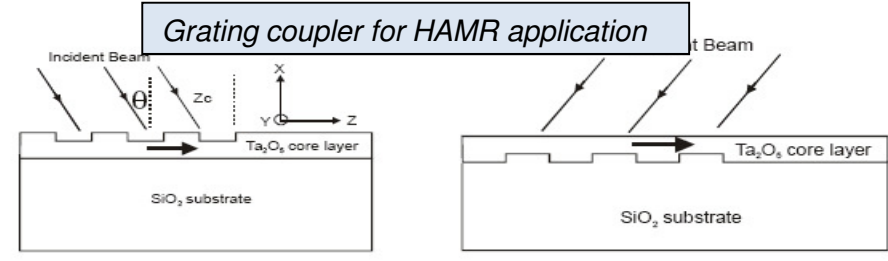
Introduction

- Grating coupler (GC) is a widely used I/O device to couple light between fibre (or free-space) and sub-micrometer waveguides.
- Two typical applications: grating coupler based on CMOS-compatible Silicon-on-Insulator (SOI) platform [1] and grating coupler for heat assisted magnetic recording (HAMR) [2].
- Designs of high coupling-efficiency : grating coupler with distributed Bragg reflectors (DBR) [3] or grating reflectors [4], binary blazed grating coupler [5], double-etched apodized grating coupler [6] et al..

Regular GC on SOI platform



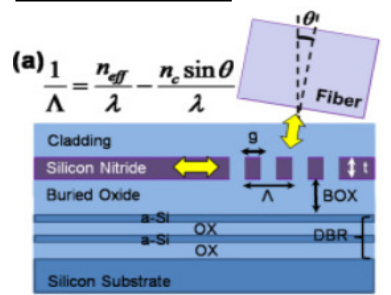
Grating coupler for HAMR application



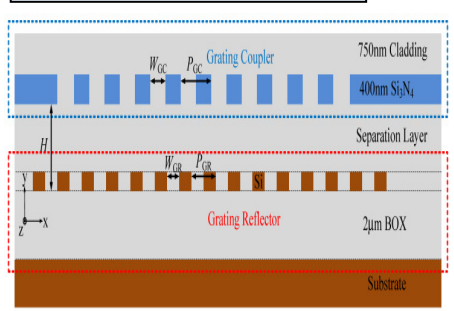
(a) Surface-corrugation

(b) Substrate-corrugation

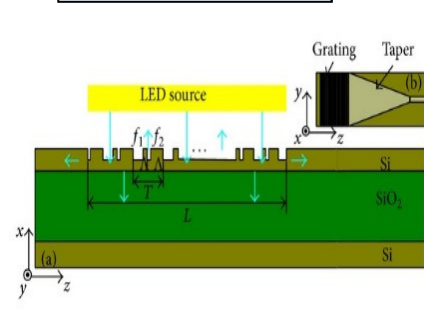
GC with DBR



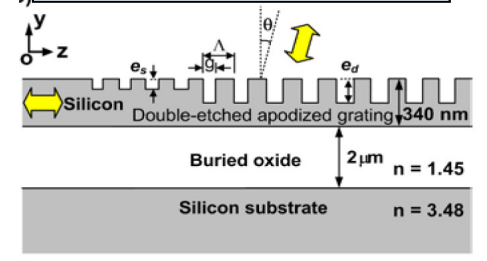
GC with grating reflector



Binary blazed GC



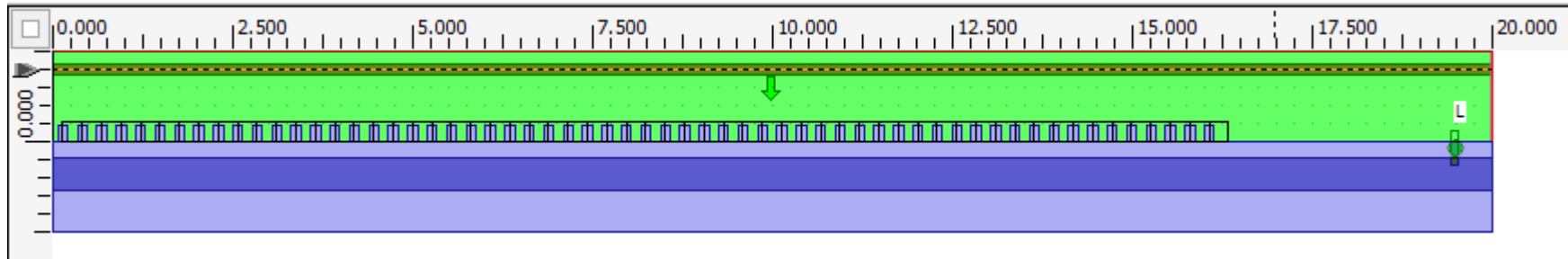
Double-etched apodized GC



[1] S. M. Csutak, et al., "CMOS-Compatible Planar Silicon Waveguide-Grating-Coupler Photodetectors Fabricated on Silicon-on-Insulator (SOI) Substrates," *IEEE JQE*. VOL. 38, NO. 5, 477-480 (2002)
 [2] Chubing Peng, et al., "Input-grating couplers for narrow Gaussian beam: influence of groove depth," *Opt. Express* 12, 6481-6490 (2004);
 [3] Huijuan Zhang, et al., "Efficient silicon nitride grating coupler with distributed Bragg reflectors," *Opt. Express* 22, 21800-21805 (2014)
 [4] Jinghui Zou, et al., "Ultra efficient silicon nitride grating coupler with bottom grating reflector," *Opt. Express* 23, 26305-26312 (2015)
 [5] Li, H., et al. "Large-area binary blazed grating coupler between nanophotonic waveguide and LED," *The Scientific World Journal*, 1-6 (2014).
 [6] Chao Li, et al. "CMOS-compatible high efficiency double-etched apodized waveguide grating coupler," *Opt. Express* 21, 7868-7874 (2013);

2D FDTD simulation

Design of grating coupler



SMGP with Gaussian transverse and a tilting angle

Input Field Properties

Continuous Wave Sine-Modulated Gaussian Pulse

Wavelength (um)

General 2D Transverse Sine-Modulated Gaussian Pulse

Input Field Transverse

Modal Gaussian Rectangular User Defined

Plane Geometry and Wave configuration

X Position (um)

Positive direction Negative direction

Initial Phase [deg]

Label: Enable Input Field

OK Cancel Help

General 2D Transverse Sine-Modulated Gaussian Pulse

Gaussian Transverse

Center Position (um) Auto

Full Width at 1/e² (um) Auto

Tilting Angle (deg) Auto

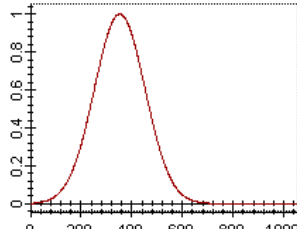
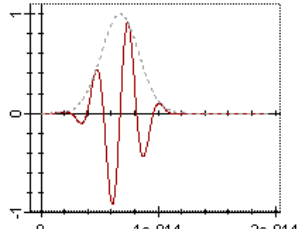
General 2D Transverse Sine-Modulated Gaussian Pulse

Default Value

FWHM (Sec) Center Frequency [THz] = 352.697

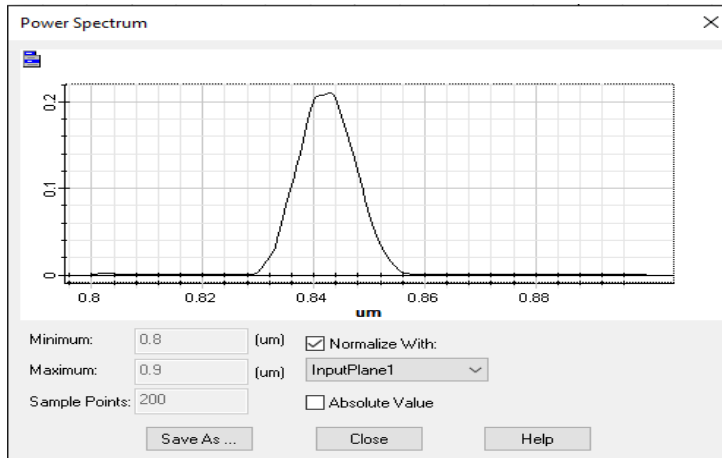
Time Delay (Sec) FWHM [THz] = 235.131

Time Series **Spectrum**

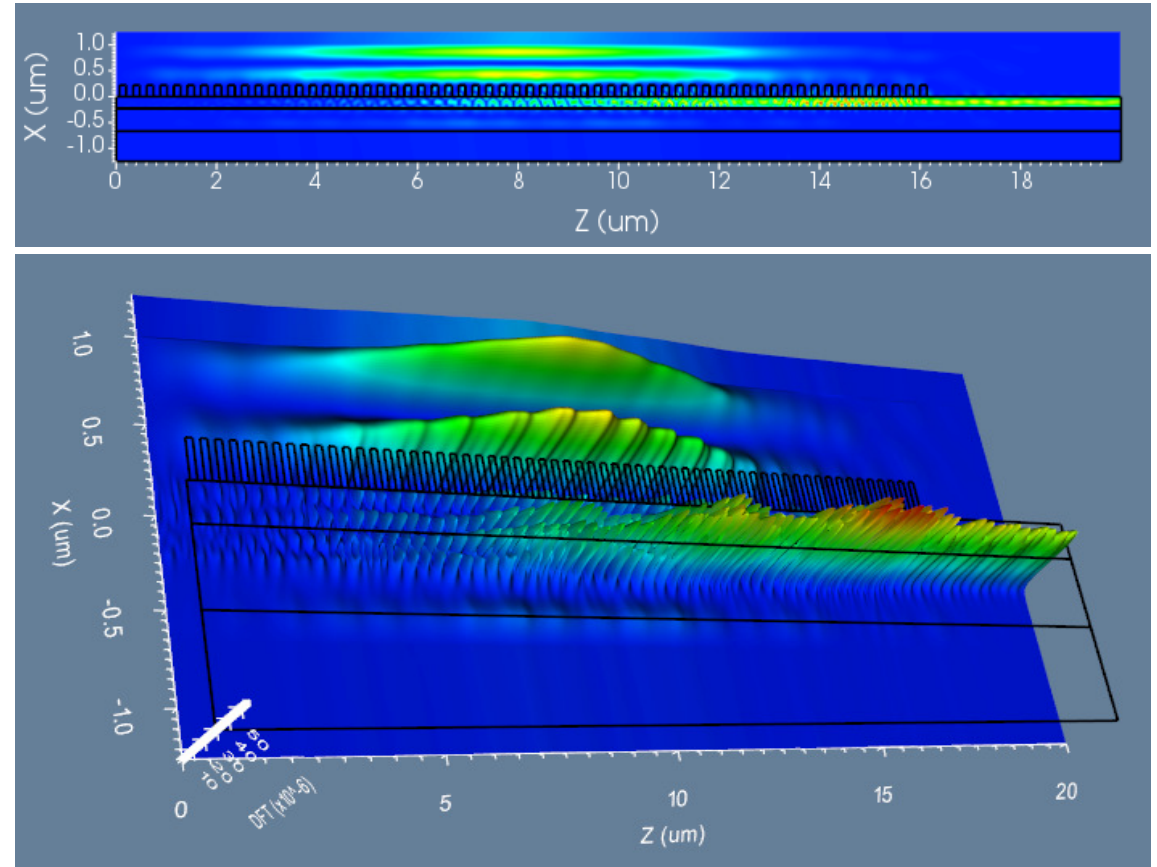


Simulation results

The power spectrum from the line detector.



The intensity image (2D & 3D) of E_y for wavelength 0.843um from the area detector.



The E_y field in time domain from the point detector.

