

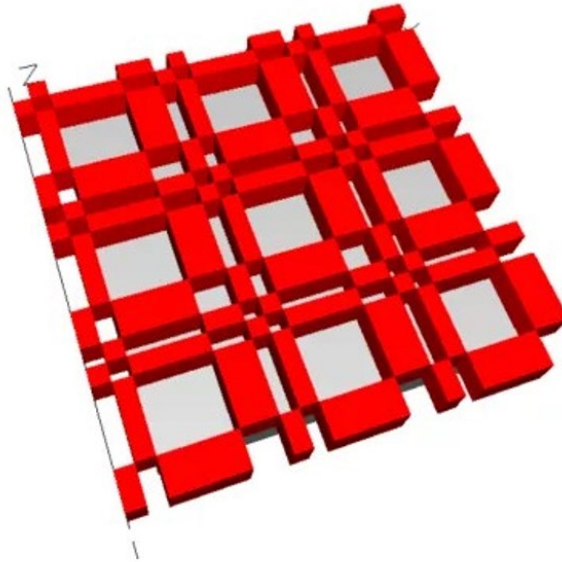
Design of Gratings for Depth Sensing

Products: RSoft CAD, DiffractMOD, MOST

Applications: Photonic Sensors and Sensing Applications

Introduction

Depth sensing has recently gained attention in emerging technologies such as facial recognition and LiDAR. Generally, depth sensing illuminates a sampling signals onto objects, and detects the reflected signals and depth information can be deduced by analyzing the reflected signal with algorithms. Several methods for this analysis are studied, including, Time of Flight (TOF), Stereoscopic Vision (SV), Structured Illumination (SI), and others.

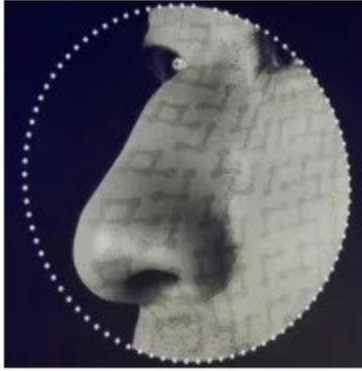


	TOF	SV	SI
Resolution	Low	Low	High
Distance	0.3 m-8 m	< 3 m	0.3-1 m
Cost	High	Low	Low

In this demonstration, structured illumination will be introduced, with improvements to cellular phone technology as the target application.

Structured Illumination

Structured illumination is widely used in microscopy for enhancing spatial resolution by illuminating the sample with patterned light and using software to analyze the information in Moiré fringes outside the normal range of observation.



Generation of regular structured light and random structured light are common challenges when working with structured illumination

The following are possible solutions and their drawbacks:

1. Regular structured light: Periodic 3D gratings can be applied to generate a regular light pattern, but a “regular sampling pattern” stands for the pattern at any given location in the image is not locally unique.
2. Random structured light: A customized phase plate can be applied to generate almost any pattern with phase retrieval techniques, but the cost is relatively high and the tolerance might be very sensitive because of the lack of periodic properties.

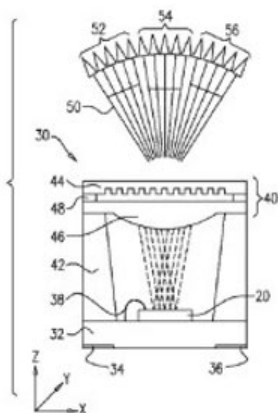
We will introduce periodic 3D gratings to show how pattern uniformity can be improved by using a source array with dynamic control of the stripe period.

Optical Gratings

In order to generate a structured pattern, the requirements and expected conditions we use are as follows:

- Input source: An array of IR laser diodes (VCSEL, DFB) is candidate to perform a light source with good coherence and polarization
- Output pattern: Widely separated patterns, uniform distribution of intensity

This set of specifications is listed based on the above requirements:



Items	Specifications
Source	VCSEL Array (850-890 nm)
Working distance	20 cm-1 m
Field of View (FOV)	> 90°
Transmittance	> 70%
Uniformity	> 70%
Number of orders	At least -4 th to + 4 th

Learn More

This application note shows an optical Dammann grating built in **RSoft CAD** with all the details, including width, height, refractive index and period. Learn how diffraction properties are rigorously calculated by **RSoft DiffractMOD** using the RCWA algorithm, instead of solving mathematical formula of grating functions.

Download the full application note and simulation files for RSoft Application Note:

Supporting Files For Application Note: "Design of Gratings for Depth Sensing"



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