COMPUTER GENERATED HOLOGRAMS
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PART II: CHAPTER THREE
POINT-ORIENTED VERSUS CELL-ORIENTED CGH'S

Introduction

In this chapter, we will compare and contrast CGH's that fall into two broad classes. These classes are cell-oriented and point-oriented. Holograms in these two classes differ in the way they utilize resources. These resources are computational and plotting. The most significant computational resource is the size of the discrete Fourier transform used in the wave propagation calculation. The second resource is the plotting device: the printer or plotter together with the final medium in which the CGH information is encoded.

In point-oriented CGH's, each pixel is uniform. There is no sub-structure. Even though a hologram pixel may consist of many output device points, all of these points are set to the same value. Point-orientation derives its name from translating each point in the calculated hologram transmittance to a pixel value in the actual hologram. Cell-oriented holograms, on the other hand, manipulate the internal structure of each hologram pixel so that each pixel in some way controls amplitude and phase. The two types of holograms have different advantages, different limitations. In order to explore theses differences, we first take two specific examples, one from each class. These examples will be of binary, amplitude and phase encoded, Fourier CGH's. The resources available to the two holograms will be identical. We assume an output device capable of 600 dpi nominal resolution and 300 dpi practically obtainable resolution. We will assume 6.8 x 6.8 inches of plotting area which will give 2048 x 2048 addressable points. The computational resources will be limited by a 128 x 128 point DFT. We will assume that the hologram will be used for display purposes so that the object will be overlaid with a random diffuser. The point-oriented hologram will be generalized-harmonic encoded in crossed square wave carriers. The cell-oriented hologram will be a Lohmann-type 3 detour phase encoded hologram. The following table summarizes the operations in constructing the two types of holograms.

Point-Oriented	Cell-Oriented
Symmetrize the object	
Discrete Fourier transform	Discrete Fourier transform
Binarize	Plot Cells
Reconstruct	Reconstruct
Error analysis	Error analysis

- Point-oriented example

- Simulating or Fabricating a point-oriented CGH
- Cell-oriented example
- Simulating or Fabricating a cell-oriented CGH