# Multichannel holograms with some applications in image processing


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## ABSTRACT

The present paper discusses an improvement for the method by division of cells which is used in multiplexed computer generated holograms (CGH´s). Such improvement allows increasing the final number of codified images into a single hologram. Some important properties of images are saved because they will be the key to perform the adequate operations involved in the reconstruction process. The experimental results demonstrate the effectiveness of the suggested procedure.



**Keywords:** Computer generated holograms, Image processing, Multichannel, multiplexing.


## 1. INTRODUCTION

Detour computer generated holograms (CGH)[1,2], have become a branch of modern optics that have called the attention of a number of researchers and engineers due to interesting applications in electronic and optical systems. As a complementary effort to accomplish alternative applications where a large amount of data processing is required several interesting techniques have been developed, to improve the storage capabilities in CGH with different focus[3-6]. These multiplexing methods have two common characteristics: they use four free parameters and they are designed to generate reconstructed images in orthogonal directions, avoiding overlapping between recovered images.

On the other hand, the multiplexing technique by division of cell[7] takes advantage of certain overlapping for implementing optical processing operations, at the retrieval stage. With this technique it is possible to carry out up to four codified images. Here we introduce a variation of such method in order to increase the number of stored codified objects.

In section 2, the multiplexing by division of cell technique (MDCT) is summarized, and the improvements built-in to the method are described. The experimental results are presented in section 3. Finally in section 4, we comment about the advantages and limitations of the proposed method.

## 2. CODIFICATION TECHNIQUE

The mutichannel technique by cell division works as follow. The basic cell area is divided in $Q$ vertical segments (subcells)[7]. See Fig. 1. It was found that each sub cell is suitable of working as a whole cell and hence it can be used to encode a single whole object.

The proposal of the method is depicted as follows. Fig. 1b shows a cell of size $\delta v \times \delta v$, with coordinates $(m\delta v, n\delta v)$, containing four subcells. In each subcell the width and horizontal displacements of rectangle are: $W_{q\,mn}\delta v$ and $P_{q\,mn}\delta v$, where sub indexes $mn$ reefers to the cell and sub index $q\,(q = 1, 2, ..., Q)$ identifies the codified object in relation to the number of the cell division. The objects to be encoded, are: $u_1(x, y)$ with free parameters $W_{1mn}\delta v$, $P_{1mn}\delta v$; and so, up to

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