GENERAL INTRODUCTION

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Coherent optical data processing has captured the imagination and attention of many researches. This interst is due to the potential advantages of optical processors compared to digital or other analog systems. An optical data processor is a two - dimensional system in which all points in the input plane of a lens are operated on in parallel. This is in contrast to other processors which are inherently serial and which require extensive duplication of circuitry of components to achieve parallel processing. Coherent optical processors can also inherently perform Fourior transforms, correlations and convolutions on two dimensional data.

Many applications for these operations have been described in several survey articles [1-9]. Perhaps the major interest in optical computing lies in the high data through put possible. The above operations can be performed in parallel on two - dimensional data at processing rates that can approach the speed of light. It is limited only by the input and output transducers and the rate at which data can be placed in the system.

In most coherent optical processors, data was recorded on photographic film. Furthermore, no universal set of specifications and device characteristics was appropriate for all applications.

In the first chapter, the spectral sensitivity and resolution of the different types of holographic plates were discussed. Effect of the linearity for characteristic curve on the quality of the images was also studied. The superposed noise and distortions were results of increased recorded images on the same phatagraphic plate. To increase the efficiency of the hologram, the amplitude hologram must be converted to phase hologram by bleaching processes.

Numbers of information processing techniques were described in chapaters II, III and IV. The low frequency optical signal was modulated by amplitude crossed gratings as in chapter II. The effect of exposure time and bleaching processes on the quality of images were studied. A method of storing a number of real amplitude images on the same phtographic plate by modulating each image on a different spatial carrier was described. The contrast and signal - to - noise ratio were also studied. To record the two amplitude objects on the one array of the crossed grating and retrieve each after the other, the crossed grating must be changed by another frequency. Some letters and numbers were used as amplitude objects.

In chapter III, the effective the phenomenon of cross-talk on the retrieved images was studied. Two amplitude objects were recorded on the same photographic plate. The signals were modulated by a random diffuser. The double exposure technique was used. The photographic plate was shifted when recording the two amplitude objects. The lateral shift between the two exposures was 10μm for all processes. The capacity and the signal to noise ratio as a result of the orientation of the cross - talk were studied theoritically and experimentaly.

In chapter IV, two techniques were used to detect the optical difference between two images. Some latters and Effil tower were used as amplitude objects. The first technique used the ground glass as a modulated signal. The double exposure technique was used. There was lateral shift between the two exposures. The two amplitude objects were identical but there was small difference betwen them. The second technique was studying the effect of introducing a glass wedge between an amplitude grating and its self-images. The subtraction betwen two amplitude objects was also discussed.