Examining the Various Methods of Creating Holograms

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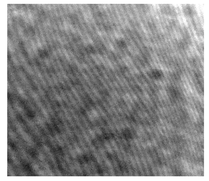
Introduction

Holography, the study of holograms, has been known for a relatively long time. In 1971, Dennis Gabor won the Nobel Prize in Physics for his research in Holography. In this project, various methods of creating holograms were examined.

Theory

- Hologram is a two-dimensional image with depth, which is created by recording the interference patterns between a coherent and stable light beam and a beam that is reflected off the object.

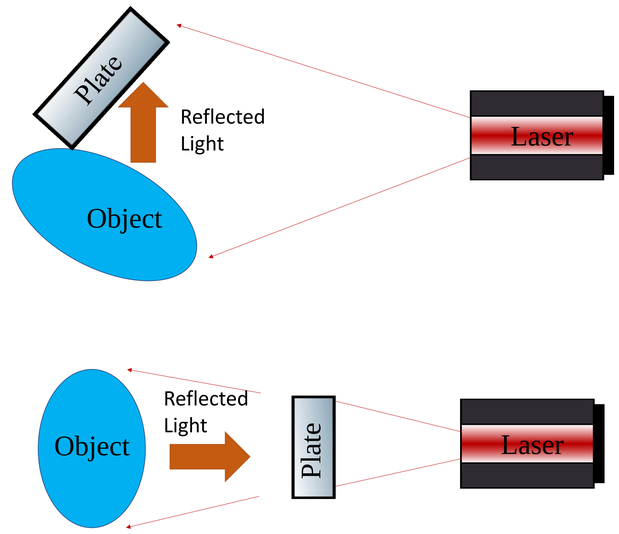


- To observe the created hologram, a light source of the same frequency used to create the hologram must be used to decode the interference pattern.

Discussion

- With the success of creating multiple holograms, various opportunities can be explore in further work.
- The creation of dual-channel holograms are in the works. To do this, the exposure time are cut in half. The 2nd channel are encoded on a different orientation of the emulsion side.
- Furthermore, a diffraction grating can be created using holographic technology. Since hologram is an recorded interference pattern, it is possible to create a diffraction plate by interference two plates with each other.
- In the future, a hologram of another hologram created with the same wavelength can be explore..

Apparatus



Transmission

- A diode produces around 3.0 mW stable and divergent beam. It is mounted on a long post, with a clamp holding the diode in place.
- The diode is shined at a angle downwards such that the beam illuminates both the plate and the object.
- The plate and the object are placed 45 degree relative to each other, with the emulsion side facing towards the object.
- Before exposure, a cardboard box, which acts like a shutter, is placed in front of the beam so the beam doesn't hit the plate.

Reflection

- The same laser diode is held parallel to the table instead of being at an angle.
- The plate is placed directly in front of the object, with the emulsion side facing towards the object.

Results

- Several holograms of each type, reflection and transmission, were created successfully.
- Various objects, ranging from coins to small action figures, were "encoded" onto the holographic plates.
- Aside from the plates, holographic films were also used to create holograms. It should be noted that the apparatus is slightly different than the it is for plates, with the films requiring two transparent plate and butterfly clips to clamp the film in place.

References and Acknowledgement

[1] Saxby, Graham. *Practical Holography*. 3rd ed. Philidephia: IoP, 2004.
[2] Tung H. Jeong. *Fundamental of Photonics*. SPIE, 2008, pp. 381–413.

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Integraf

The plates, films, and developer agents were obtained from a small company, known as Integraf. The plates and films used in this experiment were the PFG-01 and the PFG-03. The chemicals used to develop them were the JD2 and the JD4 respectively. It is possible to buy a complete kit to make holograms, as shown below. There are online manuals on their website to describe how to utilize them in further details.