Design of Image Processing System on Pressure Varied Using Interferometer Mach-Zehnder

Mujib Abdullah^{*}, Frida Agung Rakhmadi

Physics Department, Faculty of Science and Technology, UIN Sunan Kalijaga Jl. Marsda Adisucipto No. 1 Yogyakarta 55281, Indonesia. Tel. +62-274-540971, Fax. +62-274-519739 Email: abdullahmujib.am@gmail.com

Abstract. Quantitative analysis and visualization of light becomes very important when we understand the nature of light, namely interference. This also applies to light-darkness conditions (such as the nature of light when an interference phenomenon occurs) and the application of light-propagating light (such as the wavelength traveled by light in the airspace or pressurized space). Because in the nature of light requires experimental observations and program algorithms that utilize the process of analyzing the nature of the light that occurs (interferometer). This study aims to design an image processing system design to obtain qualitative from the nature of light interference. Large quantitative interference ring measurement trials were carried out using the width measurement results on the observation board which varied at pressures of 0, -100, -200, -300, -400, and -500 which were given light sources from the red laser. From the measurement results obtained the difference between rings on the board in the form of area. The area can be compared manually to get the uncertainty of the sidewall fabrication that gives an error in the measurement.

Keywords: Image processing, Interferometer

INTRODUCTION

A method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. In here today to give you a progress report on the latest advances in our research in computer vision, one of the most frontier and potentially revolutionary technologies in computer science. (Stanisalv, 2019).

Camera can take pictures like this one bay converting lights into a two-dimensional array of numbers known as pixels but these are just lifeless numbers. They do not carry meaning in themselves just like to hear is not the same as to listen, to take pictures is not the same as to see and by seeing, we really mean understanding. (Liu Fei, 2018) prototyped cars that can drive by themselves, but without smart vision, they cannot really tell the difference between a crumpled paper bag on the road, which can be run over, and a rock that size which should be avoided. We have made fabulous megapixel cameras, but we have not delivered sight to the blind. (Liu Fei, 2018)

The paper describes the simple applications of the Fabry–Perot interferometer in both absorption and emission microwave high-resolution spectroscopy. the light has been divided into two. the first light will be passed to the vacuum which is varied by the pressure and then reflected into the deflection mirror while the second light will continue to be straight so that it is only reflected the deflection mirror. (Stanisalv Zvanovec,2019) both of these lights will be found in the beam splitter and light interference will occur. The light which is divided into two will experience a

difference in speed and wavelength. this happens because there is a light path that is varied after it is reflected and some are immediately reflected without having to experience differences in pressure variations. this event see figure 1. (Jean D'Ans, 1949).

On the determination of the refractive index of air: To measure the refraction n of air, an air-filled cell with plane-parallel boundaries is used see Figure 1.

a	b
	000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

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Figure 1. Schematic representation of the cell with normal pressure (a) and nearly absolute vacuum (b).

The refractive index n of a gas is a liner funcition of the pressure p.

$$n(p) = n(p=0) + \frac{\Delta n}{\Delta P} \cdot P$$

Where the geometric length of the evacuated cell and n (P) is the refractive index of the gas present in the chamber. (Zhen, 2017) The fact that the path is traversed only once is to be taken into consideration. As a consequence of this, the optical path length is altered by Δd each time the pressure in the cell. (Jean D'Ans, TESS expert phywe) varies by ΔP and Δn . the difference in the light trajectory will be detected using a camera that is visualized into the shape of the image and produced a spectrum of histograms.

MATERIALS AND METHODS

Instrumentation

The design of image processing system on pressure varied using interferometer mach-zehnder system comprises of three red laser 5-mW, power supply and switch for 5-mW laser, Surface mirror, 30x30 mm, adjusting support, 35x35 mm, Transverse manipulator horiz, (Jean D'Ans, 1949) Vacuum hose di = 1 mm, pump variations of air, display screen, tripod, camera EOS m10, and beam splitter, the camera is used for shooting the results of the bright spectrum on the screen where there is the light interference and then analyzed using the image j application.



Figure 2. Tool design of image processing system on pressure varied using interferometer mach-zehnder.

The picture in the liter level darkroom outside. with distance of the camera 5 cm (Wang F, 2012) from the screen. the camera is placed in a fixed condition and takes the image perpendicular to the excitation source, See Figure 3.

Image Acquisition

The tool testing is carried out in the optical laboratory of the UIN Sunan Kalijaga Yogyakarta with the schematic of the tool that has been compiled according to the design that is planned in figure 3. the test is carried out by varying the pressure at 0, 100, 200, 300, 400, and 500 hPa.



Figure 3. Design of image processing system on pressure varied using interferometer mach-zehnder.

Data retrieval is done by pumping the air in the vacuum to be removed or aspirated using a pump, in the first variation the pump is in a pressurized state of 0 hPa and then take a picture on the displayed screen, in the second variation press the pump to remove the air in the container until the pressure 100 hPa take a picture on the displayed screen, experiment with variations of 200,300, and 500 hPa by treating the same to get the interference image for each pressure. light results are varied by pressure path.



Figure 4. The results of the interference in the photo, where, the images are at pressures of 0 hPa (A), 100 hPa (B), 200 hPa (C), 300 hPa (D), 400 hPa (E), and 500 hPa (F).

Image Analysis

The results of the interference in the other results of interference that are successfully saved to the image formation by the camera. Data processing can be done using application image J. The interference images from the camera were a raw file. data processing is done, data processing is carried out and analyzed to get the results of the red spectrum histogram when it occurs in the intervals of each pressure change in the container so that the results are obtained.



Figure 5. The results of the histogram where, the images are at pressures of 0 hPa (A), 100 hPa (B), 200 hPa (C), 300 hPa (D), 400 hPa (E), and 500 hPa (F).

The method of image data processing using prototype on application image J as follows :

- 1. File open: it was used to get the image to be analyzed
- 2. Open the analysis menu on the application
- 3. Select the histogram menu
- 4. Calculating dark light and bright light image histrogram in the form of the number of red distributions in this study, the optimum HPL to generate interference effect on sprague dawley oral cavity is HPL that has low intensity based on Image J application calculation.

RESULTS AND DISCUSSION

One of the properties of light is interference or the occurrence of a superposition when it is found that two or more lights are put together on a flat plane. Light interference can be done using a laser beam from one of the mach-Zehnder interferometer experiments. The results of interference in this experiment can be found on the display screen, where on the screen there is a dark and bright pattern with a round shape.

The path of light passed by photon energy packages when mach-zehnder interferometer experiments are varied with pressure. The trajectory broken down in this experiment is two paths of light, with the first light propagating directly without passing through the vacuum and the second light propagating through the vacuum with variations in pressure. This difference in trajectory is visualized by the camera and processed.



Figure 6. Image results and histogram.

Discussion

The difference in the trajectory of light that is passed by the variation of pressure makes the difference in the speed of light. This makes the distribution of energy displayed to the screen experience differences. The difference is what is processed and is produced that the hit program of each pressure variation experiences a difference. Pressurized vacuum container 0 hPa explains that the vacuum container is at normal pressure or room pressure, in this variation the laser light as a light source is reflected and then passes through the vacuum container. in the 0 hPa pressurized test, the light only passes through the obstacles in the form of a vacuum container layer.

The second experiment was carried out using a 100 hPa pressure vacuum container. At this pressure, the vacuum is basically treated to reduce air pressure by - 100hPa, so that the air in the vacuum actually decreases. This air reduction uses variations in pressure on the air pump. For the next treatment is used the same thing, by reducing so that the pressure is at 200 hPa, 300hPa, 400hPa, and 500hPa.

Reduction in pressure per variation causes the light distribution of each increase in pressure to increase. The circulation can be seen where on the histogram chart each increase in pressure undergoes a breakdown. This is due to obstacles when the light passing is reduced by reducing air pressure. This event is perpetrated using a camera which is the basis for the difference in dark distribution and light from the results of light interference.

CONCLUSIONS

Vacuum which is varied by pressure makes the trajectory of the light that is missed experience a difference in absorption energy. in this test experiments are carried out every variation of pressure, so that the results of interference and the graph magnitude of the light is obtained for each pressure of 0 hPa, 100 hPa, 200hPa, 300hPa, 400hPa and 500 hPa.

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