Application and Diversity Techniques in Coherent tomography

Noor Amizan Abd. Rahman[1,2], Ruzairi Abdul Rahim[1], Nasarudin Ahmad[1], Mohd. Shukri Abdul Manaf[1], Herman Wahid[1], Leow Pei Ling[1], Shafishuaza Shalan[1], Sophan Wahyud[1]i, Ahmad Ridwan Wahap[1], Elmy Johana Mohamad[3], Suzanna Ridzuan Aw[4], Mohd Saiful Badri Mansor[5], Jaysuman Pusppanathan[6*]

[1]*Process Tomography Research Group, School of Electrical Engineering, Faculty Engineering, Universiti Teknologi Malaysia, 81310 UTM, Malaysia.*
[2]*Electrical Technology Department, Institut Latihan Perindustrian, Ipoh*
[3]*Faculty of Electrical & Electronic Engineering, Universiti Tun Hussein Onn Malaysia.*
[4]*Faculty of Electrical & Automation Engineering Technology, TATiUC, Jalan Panchor, Telok Kalong, Kemaman, Terengganu, 24000, Malaysia*
[5]*Biomedical Engineer, Gleneagles Hospital Medini, Johor, Malaysia*
[6]*Sports Innovation & Technology Centre (SiTC), Institute of Human Centered Engineering (iHumen), Faculty of Engineering, Universiti Teknologi Malaysia 81310 Skudai Johor.*

Corresponding author email: jaysuman@utm.my

Abstract

This paper reviews the state of the art Optical Tomography (OT) and the contribution of Optical Coherent Tomography (OCT), with a view of the results of the studies that have been carried out by previous researchers. Discussion on the principles and applications of interferometric imaging technique that provides cross-sectional view of the bottom surface of the tissue micro biology and industrial used. Following a discussion of the basic theory of OCT, the time domain and domain Fourier and opinions about the issues involved in the design of the main components of the OCT either the medical field or industry. Surveys are also conducted in the diversity of techniques used to upgrade existing OCT systems. Thus in principle by introducing a newly developed imaging mode to obtain additional diagnostic information.

1.0 INTRODUCTION

Optical tomography is a form of computed tomography in which there is a digital model of the object volume by reconstructing the images made of light transmitted and scattered by an object optical tomography is used mostly as a form of research in medical imaging. In addition, this system is also used in the industrial sector to support the monitoring system. Optical tomography depends on the object that looked to be at least partially light transmitting or translucent, so that the required level if it is used in medicine to look at the soft tissue in the body, such as the current popular treatment for breast and brain tissue [1].

In addition, the optical monitoring system has become a popular choice in the industry due to low prices of optical transducers, quite simple and easy operation compared with other sensors such as capacitance sensors [2]. In addition, an optical sensor capable of measuring the high-speed particle flow because it can provide a fast response time [3].

Therefore, optical tomography can provide high frame rate that allows the electronic switching LED and laser diode and can be used in the high-pressure phase [4].

2.0 PRINCIPLES AND APPLICATIONS

While the development of this field in a variety of different techniques such as computed tomography and optical coherence tomography, established medical imaging technique that uses light to capture a micrometer-resolution, three-dimensional images from within optical scattering media (eg, biological tissue). Optical coherence tomography is based on low-coherence interferometer, typically using near-infrared light. The use of light as relatively long wavelength allows it to penetrate the scattering. Confocal microscopy, optical techniques are usually less penetrated deep into the sample, but with a higher resolution. Depending on the properties of the light source (diode super luminescent, ultra short pulsed lasers and super continuum lasers have been used), optical coherence tomography has achieved sub-micrometer resolution (with a very wide spectrum of sources emitting over ~ 100 nm wavelength range), which means the frequency domain coherence optical tomography, a gain in signal-to-noise ratio, allowing more rapid signal acquisition. Especially in ophthalmology, where can be used to obtain detailed images of the retina. Have recently also been used in interventional cardiology for the diagnosis of coronary artery disease [5].

The process undertaken by the optical beam is directed at the tissue, and a small portion of the light that reflects from the characteristics of the sub-surface collected. Note that most of the light is not reflected but instead scatters off at large angles. Use for the first time in medicine have been reported decades ago [6, 10], but all the issues discussed starting from the early work of white light interferometer, which led to the development of Optical Coherence Domain Reflectometry (OCDR), a one dimensional (1 D) between the optical techniques [11, 12]. Build originally to find faults in fiber optic cables and network components, the ability to investigate her eyes [13, 15] and other tissues [16]. In conventional imaging, the diffusely scattered light contributes to blur the background of the image.

However, the OCT technique called interferometer was used to record the optical path length of photons received justify the denial of the photons are scattered several times before detection. Therefore, OCT can build a clear picture of the 3D sample thickness by subtracting the background signal while collecting light reflected directly from the surface of interest.

OCT techniques, techniques such as reflectometry and dual beam techniques based on time-domain low-coherence interferometer depth-scan Fourier-domain techniques which have been developed and led to a scheme lutherie. This scheme uses CCD cameras and CMOS detector arrays as photo detectors. Today, optical in vivo biopsy is one of the most challenging applications of OCT. High resolution, high penetration depth, and its potential for functional imaging attribute to control the quality of optical biopsy, which can be used to assess tissue and cell function and morphology in situ. There are two basic techniques for optical tomography, Diffuse Optical Tomography (DOT), and the Optical Diffraction Tomography (ODT). OCT is physically based ODT. Depth resolution is separated from the horizontal resolution. Depth resolution may be even at sites not accessible by high numerical aperture (NA) of the beam. Resolution improvement in 1μmrange and interferometric technique provides dynamic range and sensitivity (> 100 dB).

In terms of the application of this system to provide the advantages of monitoring, such as depth resolution is independent of the sample beam aperture and coherence gate can significantly increase the depth of research on the scattering medium [18]. If a comparison is made with the system is not high optical depth and transverse resolution, free connection and operation of non-invasive, and the subject contrast images. However, compared with a loss of OCT imaging methods in alternative medicine is the limited penetration depth in scattering media.

In another research [19] also says the main benefit is the OCT imaging of subsurface objects viewed at a resolution of almost microscopic, and the process is implemented with real time domain as well as no effects of ionizing radiation

Time Domain OCT

Commercializing the use of time domain OCT (TD-OCT) detection has an axial resolution of ~ 10 m and using a diode super luminescent centered 820 nm with 25 nm bandwidth. This system can detect two-dimensional optical B-scan at a speed of 400 Hz (400 A-scans / sec).

Scanning speed is limited by the speed at which the reference mirror can be moved physically: in the time-domain detection, the position of the reference mirror to control the intensity of the in-depth information collection (A-scan) and determine the spatial location of the reflection data.

The most commonly used in clinical scanning protocols peripapiller in commercial TD-OCT device to obtain three consecutive scans, retinal nerve fiber layer (RNFL) thickness was measured using an automatic segmentation analysis and the values of the average of three scans. Typical radial scan protocol consists of six B-scans centered on the fovea or optic nerve head, equally separated by 30°, six (macular scan) or four (ONH scan) millimeters in length.

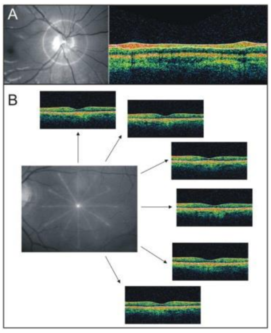

Figure 1: (A) Location of TD-OCT peripapillary scan shown on fundus photograph (left), and single cross-section OCT B-scan (right). (B) Location of TD-OCT radial macular scan shown on fundus photograph

Fourier-Domain OCT

Fourier-domain detection, which consists of two spectral-domain (SD-OCT) and the swept-source (SS-OCT) which does not require a reference mirror moves to raise the profile of the A-scan figure 2.0 [37, 38].

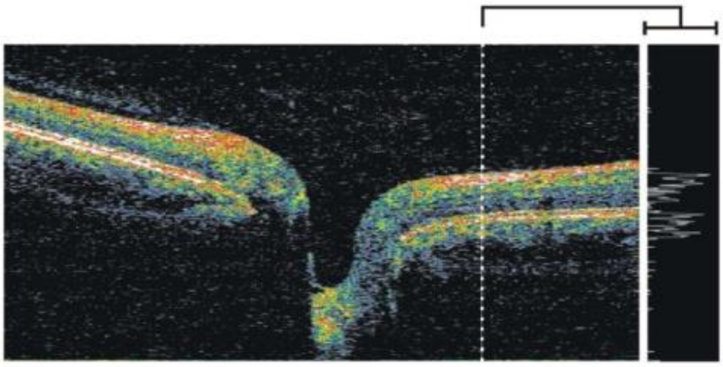

Figure 2: (left) Cross-sectional B-scan through the optic nerve head acquired using SD-OCT, with the white dashed line denoting the location of the single A-scan (right) intensity profile

OCT uses a laser to scan the retina. The resulting data is processed and analyzed by the computer and displayed as an image is correlated with the microscopic anatomy of the retina. It is a non-invasive test that provides information similar to what is seen on microscopic biopsy of the retina. It may indicate fluid under the retina, the nerve fiber loss associated with glaucoma, and many other pathological conditions.

Visant OCT is a specialized tool that can be used to image the anterior segment of the eye. Useful, including providing detailed scan ahead to accurately measure the depth of corneal opacities, documenting the position of LASIK flap and corneal transplantation, and to discover the anatomy of the eye structures involved in maintaining the pressure. It can also help in the examination of LASIK and other conditions in figure 3.0.

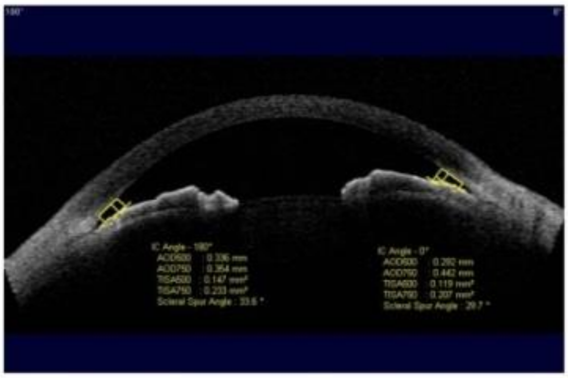

Figure 3: Visante OCT

Corneal mapping developed to assist in understanding the shape of each individual cornea. Various pathologies of the cornea, such as keratoconus, were diagnosed with topography. In addition, understanding the shape of the cornea is important in all LASIK and premium lens candidates. Corneal topographer, we not only give us information about the surface of the eye, but when combined with data Visant OCT can be used to accurately map the posterior surface also like painting the figure 4.0.

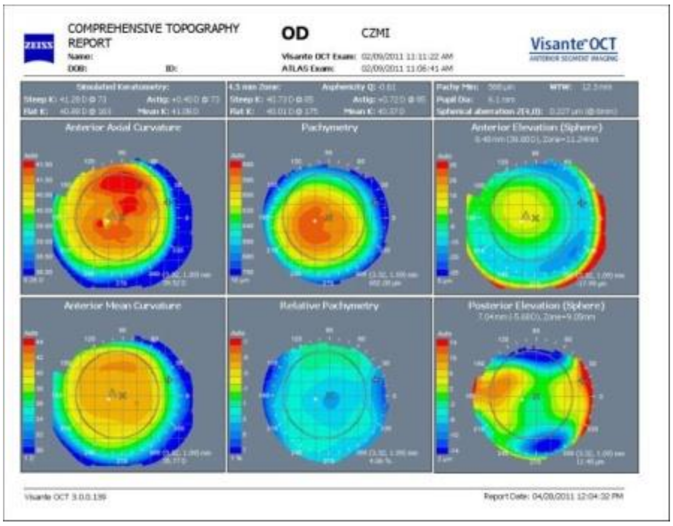

Figure 4: Advanced Corneal Mapping

On the other hand, the frequency information of all depths at a certain point on the retina obtained at the same time with a CCD camera and spectrometer (SD-OCT), or by sweeping through a range of frequencies (SS-OCT); frequency data is then translated into intensity information using the Fourier transform. Speed of up to 312.5 kHz was achieved with SD-OCT [39] and 249 kHz with SS-OCT [40]. At the time of this writing, all frequencies are commercially available systems using SD-OCT domain detection and super luminescent diode light source in accordance with a resolution of ~ 5-6 m and axial scanning speed of at most 55 kHz, with the majority of scanning at speeds around 27 kHz. In additions, the ability to take a very fast, 2D B-scan consisting of 1000 A-scans or more easily available. Most commercial SD-OCT systems to choose how much faster scanning speed for high density cross-sections to visualize both the structure of the retina. It's not easy to do with the TD-OCT because of limitations such as eye movements during scanning slower

Non-medical OCT

LCI or ‘white light interference’ [24] has been used for years in industrial metrology, such as the position of the sensor [25], to measure the thickness of thin films [26]. Recently, the LCI has been proposed as a key technology for high density data storage on optical disc multilayer [27]. There is also analysis of the application of OCT for nondestructive evaluation of highly scattering polymer-matrix composites to estimate the residual porosity, fiber architecture and structural integrity [28].

OCT has also developed into clinical care standards for the assessment of ocular structures since the use of OCT based on the principles of interferometric detection, where the echoes of backscattered light from the retina interferes with light that has traveled to the reference mirror at a known time delay. Echoes point on the retina represents the axial scan (A-scan), and the optical cross-section (B-scan) is obtained by scanning the OCT beam in the horizontal direction. The wavelength of the light source used for OCT imaging to determine the depth of penetration into the retina, and the bandwidth of the light source to set the resolution axis. Traditionally, the central wavelength of ~ 820 nm and a bandwidth of ~ 25 nm were used for imaging the eye to give the details of the internal structure of the retina at the resolution of ~ 8-10 m.

Light source with a wavelength longer (1050 nm, 1310 nm) was used in addition to the 830 nm source for enhanced penetration depth (example lamina cribrosa and choroidal imaging) and good signal strength in subjects with the opacity of the lens [29, 30 31]

In addition, broadband light sources have been widely integrated into the system to improve the OCT axial resolution [32, 33, 34] and the application as a scan at rated speed [35, 36] This study focuses on the use of fast scan, high-resolution OCT system for the collection of three-dimensional scan of the retina using a system with a wavelength in the range 800-900 nm.

OCT in ophthalmology

The main causes of high transfer media eye. Another reason is the sensitivity and accuracy of the interferometric OCT appropriate and near-optical quality of many structures ophthalmology. Freedom depth resolution of the sample beam aperture allows high sensitivity recording as the use of medical structures in the fundus of the eye [20]. OCT can help to give a description and size details pathological changes in the structure of the cornea and anterior chamber angle and iris, this study related corneal ablation monitoring laser by OCT. Prototype femto second titanium-sapphire laser light source that has been shown, the axial resolution is non-transparent and transparent tissue 1-3μmin [21] has been achieved, allowing unprecedented in vivo imaging of sub-cellular structures intraregional.

Endoscopic OCT in intra-arterial imaging.

OCT was predestinated as a modality for high-resolution endoscopic intra luminal imaging system organ. Introduced by Tearney et al [21, 22], the potential for endoscopic OCT for early diagnosis of tumors and guide appropriate biopsy [23] PS-OCT in dentistry. Transmission of light in dental tissue using PS-OCT reveals birefingence strong in enamel and anisotropic propagation of light through the dentin tubules.

Industrial applications.

Optical tomography in industrial as a measuring tools for the measurement of parameters such as the concentration profile, the profiles of velocity and mass flow rate. This system can also be used to measure the velocity of the beads in the flow rig, flow measuring bubbles, imaging station to estimate the rate of combustion, and the concentration profile of the flow. Optical and gamma-ray sensors are included in the hard-sphere where the image reconstruction algorithm is relatively easy to implement compared with the soft-field sensors [41]. In optical tomography, the method of preparation or the alignment of the sensor as an important start to decide the objectives.

Industrial applications of optical sensors consist of a set of transmitter and receiver this means that the light from the source / transmitter that operates in the medium to be detected by the receiver [42]. Most pipes and vessels in the manufacturing industry and has a thin transparent image (mostly opaque). Therefore, a good design of the optics required to ensure that most of the light received by the receiver [43]. From the research that has been conducted previously [44] are summarized in the table and a description of the arrangement made.

Referring to figure 5.0, showed two orthogonal projections composed of several parallel views, to figure 6.0, two rectilinear projections consisting of several views of parallel inclined at 45° to each other, to a combination of two orthogonal projections and two straight lines through the diagram 7.0. Three fan beam projections and four fan beam projections refer to figure 8.0.

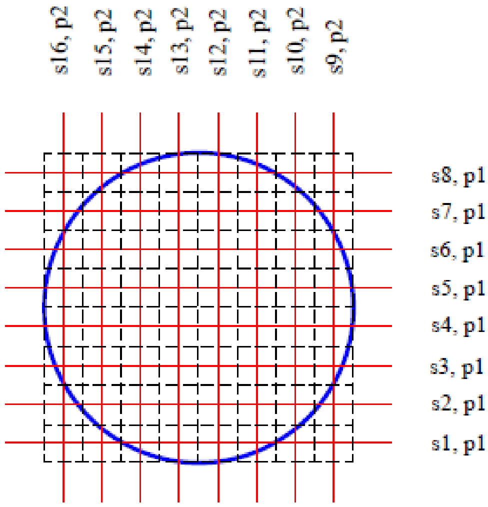

Figure 5: Two orthogonal projections consisting of several parallel views.

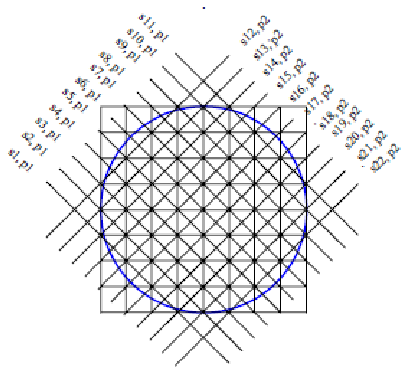

Figure 6: Two rectilinear projections consisting of several parallel views inclined at 45° to one another

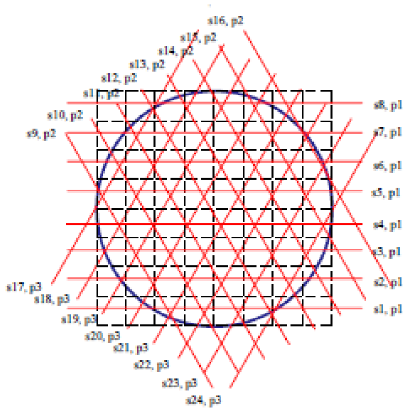

Figure 7: Three fan-beam projections

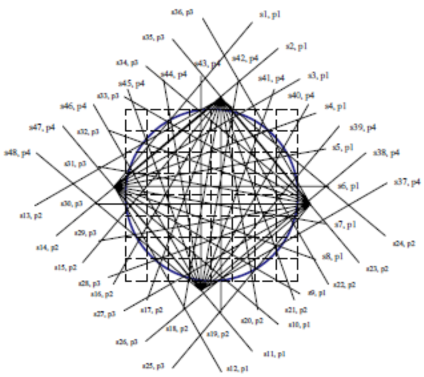

Figure 8: Four fan-beam projections

Transmission angle can be determined by looking at the data sheet of the transmitter which is usually the point of asking. A light emitting unacceptable by one or more receivers depending on the angle of delivery as shown in figure 9.0.

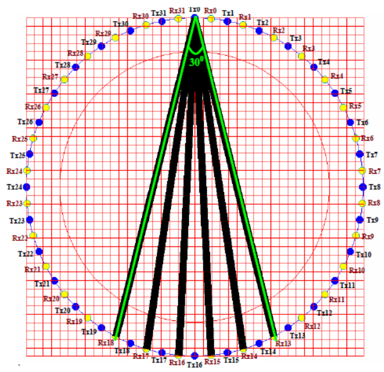

Figure 9: Type of projection and number of sensors in previous researchers

The number of transmitter and receiver is similar to parallel beam projections while the fan beam projection may be unequal [45]. There are also advantages in the use of the fiber optic tomography process in which one of them all the transducers used to survive with the environment, especially in the industry and this does not affect the ability of the components and systems that are used more factors as temperature, vibration, pressure and viscosity of the fluid can be overcome. With the alternative design which separates the electronic circuit from contamination when the system is used as a measure to improve the effectiveness of the control circuit for the monitoring and uninterrupted environment and parameters measured were not disturbed. Optical fiber is not attacking the process because it is installed on the outside of the pipe.

Two types of light visible light and invisible light in this system because the wavelength of light is the same as the light of lights around the 380-750nm. Wavelength is close to making a light emitting 700-1000nm and faster to deploy to the receiver [45] and usually a diode as a light-receiving device can be seen, however, sometimes it is also used as a source. Photodiode designs on the market designed in a variety of wavelengths of visible light. Since this diode as detection devices used many applications tomography project.

3.0 DIVERSITY TECHNIQUE OCT

Diffuse optical tomography (DOT) is emerging modalities to reconstruct the optical parameters of the medium are very scattered. However, the ill-posedness and nonlinear light scattering makes the problem very difficult DOT. Diffuse optical imaging (DOI) is a method of imaging using near infrared spectroscopy (NIRS) [46] or fluorescence-based methods [47]. When used to create a 3D model of the imaged volume of materials DOI referred to as diffuse optical tomography, and 2D imaging methods are classified as diffuse optical topography.

This technique has many applications in neuroscience, sports medicine, wound monitoring, and detection of cancer. Usually DOI techniques to monitor changes in the concentration of oxygenated and deoxygenated hemoglobin and may be measuring the redox state of cytochrome. This technique can also be referred to as diffuse optical tomography (DOT), near infrared optical tomography (Pirot) or fluorescence diffuse optical tomography (FDOT), depending on use.

In neuroscience, functional measurements were made using a wavelength NIR technique can classify the DOI as Functional Near Infrared Spectroscopy (FNIRS). This progress in search and recommendation algorithms reconstruction of non-recurring and appropriate for the problem of diffuse optical tomography is more than a conventional press sensing. Based on the measurement of the optical flux is scattered and attenuated. The first problem is the inverse problem of DOT is not linear because of the nonlinear coupling between the optical parameters of the unknown and the photon flux.

The second problem is ill-posed because of severe diffuse nature of light propagation. Linearization methods have been proposed to tackle this problem, which is computationally expensive, or prone to error due to linear. The new algorithm is a hybrid approach using conventional *CS* algorithm to find the support of a *Cr* target, and use the MUSIC criteria common to find r still there, where k is the number of target and r is the number of independent lighting design.

MUSIC was originally developed to estimate the parameters of continuous, hands, reducing the time discretization has two damaging effects. First, it increases the level of sparsity k for spatially distributed targets a specific size without increasing R, thus increasing the number of error prone

Numerical results

Remote target reconstructed to measure the benefits of the original algorithm is more general MUSIC S-OMP. Second, the target length is used for the recovery to demonstrate the possibility of imaging spatially varying spectral MUSIC function with the public. DOT problem can be converted to the problem of multiple measurement vectors. In addition, we show that the new algorithm can be used to extend the target image using a common spectral MUSIC [48].

Intravascular ultrasound (IVUS), a catheter-based technique, has been increasingly used for the clinical dedetection and diagnosis of atherosclerosis to overcome the drawbacks of these imaging modalities [49]. IVUS has several advantages, such as its low cost and lack of radiation and contrast agent.

However there are two limitations of OCT when used for intravascular imaging applications. First, OCT is restricted to imaging 1 to 2 mm below the surface in turbid biological tissue, which makes it difficult to give entire cross-sectional information regarding artery anatomy and provide quantitative arterial thickness measurements. Second, OCT requires displacing arterial blood to minimize scattering by infusing a saline solution. To alleviate the effects of the saline solution on

blood circulation, only a minimum amount of saline flushing will be used for OCT once the area of interest has been found by IVUS.

A commercial transducer modeling software Piezo-CAD (Sonic Concepts, Woodinville, WA) was used to simulate the performance of the ultrasound transducer and a pulse-echo test was performed using the Panametrics 5900PR pulser/receiver. In figure 10(a), the designed center frequency was 35 M Hz, and the −6-dB fractional bandwidth was 65%. The measured center frequency of the fabricated transducer was 34 M Hz, and −6-dB fractional bandwidth was 53% folowing figure 10(b).

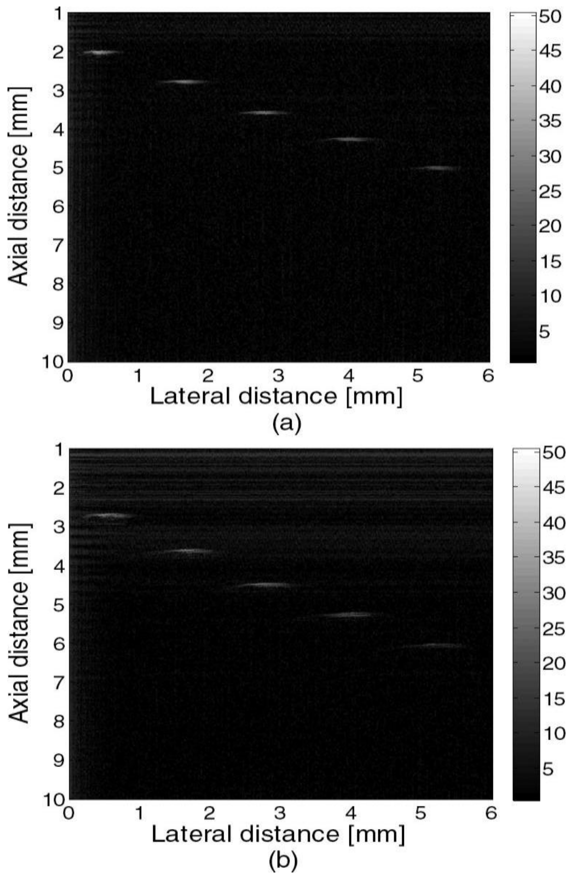

Figure 10: Simulate the performance of the ultrasound transducer and a pulse-echo test was performed using the Panametrics 5900PR pulser/receiver

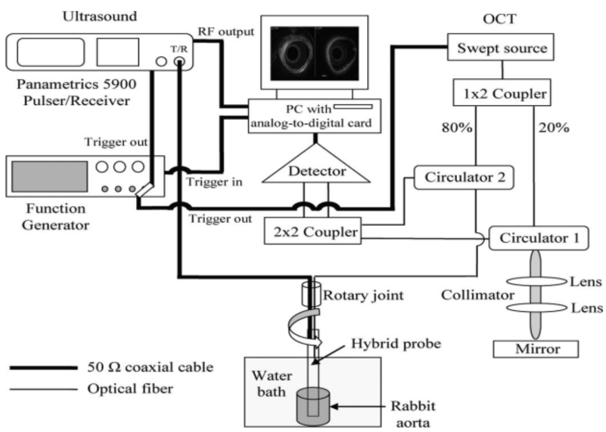

Figure 11: Schematic diagram of the *in vitro* rabbit aorta imaging system

A dual-modality biomedical imaging probe using IVUS and OCT technologies has been developed and *in vitro* images of a rabbit aorta were acquired. These images have successfully demonstrated the feasibility and potential of this dual-modality probe. We believe that the ultrasound-guided OC T is a promising approach for detecting plaques. However, there are some drawbacks to this probe configuration. First, the small difference in the positioning of the IVUS and the OCT probes creates slightly different imaging areas. This issue can be solved using a ring ultrasound transducer and placing the OCT optic fiber inside it. Another problem is that a significant portion of the ultrasound signal is lost because of absorption or imperfect reflection when using a mirror. To minimize this loss, a polished reflector made of high acoustic impedance materials, such as stainless steel or tungsten could be used. Finally, the size of the probe can be an issue. Although a 2.82-mm diameter probe is suitable for an *in vitro* experiment, a smaller probe is required to do an *in vivo* intravascular imaging experiment in the future [50].

Study data acquisition process that is used as the signal sample and hold circuit refers to the application and construction of the signal sample and hold (S / H) circuit to simplify the process of data acquisition using a Keithley DAS 1802HC Metrabyte. Besides having a "Memory DC" feature which can easily be converted to a digital format, sample and hold circuit also has the capability of sampling segments of the wave and held until the time is right for change.

Other examples and Hold (S/H) circuit.

S/H amplifier is used to store analog data which is then digitized by a slow A / D converter. In this way, high-speed or multiplexed analog data can be digitized without needing ultra high-speed, complex, and expensive A / D converter. This capacitor voltage continues to decrease over time, known as "content heavy" (Leonard, 1993). The best option is probably the polypropylene, and polystyrene or Mylar afterwards (National Semiconductor Corporation, 1995). Everything needed for the S / H unless the capacitor can hold is placed on the chip, so the circuit monolithic sample-and-hold, such as the LF398 is available and very easy to use [51].

Embedded system based optical tomography: The concentration profile was undertaken to determine to reduce or even eliminate the need for a personal computer and the DAQ. Collecting the data used to reconstruct cross-sectional images of an object or material that flows in pipes. The accuracy of image reconstruction is upgrade of 12.5 percent using hybrid image reconstruction algorithm. Results prove that the data acquisition and image reconstruction algorithm is able to obtain accurate data to reconstruct the image of the cross section with only a small error compared to the expected measurement.

Originality / value - The system has been customized DSP controller for data acquisition of 16 £ 16 optical sensors (arranged in orthogonal projection) and 23 £ 23 optical sensors (arranged in a straight line projection). While the process of reading the sensor algorithms to detect the location of the cross-sectional images. Optical tomography involves the use of non-invasive optical sensors to obtain information necessary to produce images of internal features of the system dynamics. The working principle involves projecting a beam of light through the medium of a boundary point and detecting the level of light received at another boundary point [52].

Sensing system as one unit with sensors and optical sensors arranged in parallel beam projection was implemented. There are two layers of sensors are used, the upstream and downstream to support the analysis of algorithms based on the measurement of the velocity profile. Each layer, there are four sensor arrays arranged in parallel beam projection Two sensors are arranged, example orthogonal sensors are arranged in such a way that they are orthogonal light beam projection (908) of each other while the two sensor arrays, namely, rectilinear sensors are arranged so that their projected light beam 458 to the orthogonal projection of each layer, there are four sensor arrays arranged in parallel beam projection. Two arrays of sensors, sensor of orthogonal arranged in such a way that they are orthogonal light beam projection (908) of each other while the two sensor arrays, namely, rectilinear sensors are arranged so that their projected light beam 458 to the orthogonal projection.

Sensor unit includes a LED driver circuit and amplifier circuit to convert the received light into an electrical signal. Each sensor of the sensor output current is inversely proportional to the light intensity measurement. Thus, higher currents generated when the amount of light a bit and lower currents produced when there is lighter.

Signal conditioning circuit design as the data acquisition rate, overall, there are 156 sensors obtained at each scan, causing a size that takes a very long time, especially using a single digitizer with a low conversion rate is to accelerate time measurements using dedicated low conversion rate of the digitizer each sensor or group of sensors each. LCDs can be triggered to convert the signal at the same time that requires a sample and hold circuit can be eliminated and the use of a high conversion rate of the ADC is multiplexed analog signal multiplexers each for conversion.

One method that is faster than the ADC for sampling sensor rectilinear projection desired by sampling sensor for projection line has been implemented using voltage comparator hardware. Each voltage comparator is implemented using TLC in 2354 referred to a voltage divider using a variable resistor

Hybrid reconstruction algorithm derived from the linear sensor readings back to normal projection algorithm using sensitivity distributions as a weighting factor to get a picture, to a parallel beam projection, each sensor in accordance with one of the distribution of sensitivity, where the pixels have a sensitivity of 1 if the sensor is considered through the pixel and 0 if not. Based on this algorithm, the voltage multiplied by the sensitivity of the sensor (1 or 0) to obtain the concentration of pixels.

Image reconstruction of a charge coupled device based optical tomographic instrumentation system for particle sizing once the research to investigates the use of charge coupled device (abbreviated as CCD) linear image sensors in an optical tomographic instrumentation system used for sizing particles. The measurement system, consisting of four CCD linear image sensors are configured around an octagonal shaped flow pipe for a four projections system is explained. Image reconstruction for a four-projection optical tomography. Model is used to relate attenuation due to variations in optical density, $[R]$, expressed in matrix form this represents the forward problem in tomography $[S]$ $[R]$ = $[M]$. In practice, measurements $[M]$ are used to estimate the optical density distribution by solving the inverse problem $[R]$ = $[S]-1[M]$.

Direct inversion of the sensitivity matrix, $[S]$, is not possible and two approximations are considered and compared—the transpose and the pseudo inverse sensitivity matrices.

Electrical tomography has relatively poor spatial resolution, diameter of cross section [52]. The X-ray computed tomography method is well known, but specific safety procedures need to be followed by the operator. PET needs operator intervention and radioactive particles. Ultrasonic tomography is complex to use due to spurious reflections and diffraction effects and may therefore require a high degree of engineering design [53].

The majority of these techniques are off-line, with direct optical providing the only truly on-line measurement [54]. An optical tomography system that uses optical fibre bundles has problems in ensuring every fibre has similar optical characteristics. Thus, a system based on CCD devices is proposed which may provide very high resolution (better than 1%), mathematical modelling is an important tool in simulating a system. It can predict the output of a system with known conditions. Three types of mathematical model are developed in this project for investigating the effects due to particles, the effects due to light sources and the effects due to diffraction on the optical tomography system.

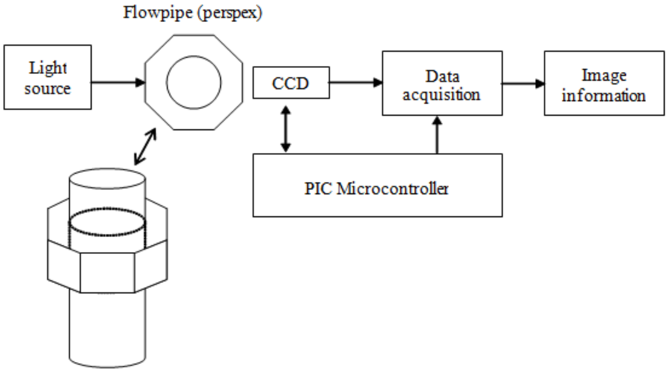

Figure 12: A block diagram of the optical tomography system

In an optical imaging system, the object density along the optical path (according to Beer-Lambert Law) exponentially attenuates the light intensity, the optical tomography system consists of four projection systems where each projection is generated by a ray-box which has a laser diode, objective lens, and an spherical lens in it and a CCD linear image sensor at the other side of the pipe. The CCD linear image sensor used in the system has 2,048 effective pixels with a pixel size of 14 micron by 14 micron.

Image Reconstruction Process

Several techniques have been used in optical tomography to produce images from measured data, such as layergram back-projection (LYGBP) by Ibrahim [55], linear back-projection (LBP) by Abdul Rahim, Algebraic reconstruction technique (ART) by Reinecke and Mewes [55], iteration techniques, Fourier inversion techniques and others [56].

Xie [52] highlighted techniques used in transmission tomography such as optical and X-ray methods, which are based on straight-line propagation. The forward problem has to be performed first in order to obtain the expected output from the sensors (for known attenuation coefficients of water and the particle). The calculated output from the forward problem is then used in the back-projection process—the inverse problem.

4.0 CONCLUSION

Needs and demands innovation in the field of photonics, the development of optical tomography (OCT) has grown rapidly in less than 10 years. Development eventually led to the widespread use of OCT in the medical sector as a diagnostic technique or industry that can assist in the monitoring process efficient, thus innovation depends on the ability of researchers to solve some problems to upgrade to a more efficient system which currently limit the performance of OCT systems. Stronger and wider band light source, interferometer configuration novel, faster scanning, and high-contrast imaging mode is a continuous development that could lead to the solution of these problems. More effort is needed to put the theory of optical coherence tomography of biological tissue at a much stronger foundation. As other historians describe medical imaging modality, the combination of a solid theoretical analysis and new technology offers the best hope for the future.

Acknowledgement

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