

Acknowledgment

I like to express my deep gratitude and thanks to Prof. Dr. Nafie A .AL Muslet for his supervision on this research. Thanks to Prof. Dr. Khalil Ibrahim Hajim (Institute of laser-University of Baghdad) and Prof. Dr. Yahia Badr (National Institute of Laser Enhanced Sciences (NILES) Cairo University, for their encouragement and support.

Deep thanks to Dr. Yasir AL Sharkawy (Egyptian Armed Forces) and to Dr. Mona Soliman (NILES)

Thanks to all the staff of National Institute of Laser Enhanced Sciences for their help.

A lot of thanks to the staff of Laser Institute, Sudan University of Science and Technology and Sudanese Laser and Optoelectronics Group (SLOG) and Iraq Laser and Optoelectronics Group (ILOG) for their continuous support.

Finally, and above of all, thanks to Allah for enabling me to reach the end of this work.

DEDICATION

TO

My Father Soul

TO

My Family

ABSTRACT

The objective of this research is to design and construct an optical coherence tomography (OCT) system, beside the comparison of the efficiency of this system with other tomography systems, like Photoacoustic system and Raman spectrometer, to evaluate its operation.

Michelson interferometer was designed; which represent the heart of the system, which consist of two mirrors, beam splitter to transmitt 50% of the incident light and reflect the other half. Three types of laser sources were used, helium neon with wavelength 632.8 nm and 4mW, diode lasers with two wavelengths (700 nm and 1550 nm), power $\leq 4.25\text{mW}$.

Performance of the constructed system was completed by receiving the interference fringes by the detector, which was connected to the display unit.

Digital oscilloscope, with high mathematical functions, was used to display signal information in frequency domain. From the experiments results we noticed that Fourier transformation (FT) was the best mathematical function, which can be used with the constructed (OCT) system.

Also CCD camera was used with the system to give two & three dimensional images for the studied samples.

The constructed system can be used for many purposes, for examples: measurement of the thickness and determination of optical properties for different samples.

The samples studied by the constructed OCT system were: glass slides, polymer\ pyrex\ carbon coating, layers of onion and cancer skin.

The results were represented in tables, figures and images.

To prove the good performance of the constructed OCT system the results were compared with another results gained by a Photoacoustic system for the same samples. Beside that FT Raman spectroscopy was used also to differentiate between normal and abnormal tissue.

The comparisons showed that the three tomographic systems can be used as diagnostic systems with high resolution. Also all tomographic systems have no ionizing effect compared with another tomography imaging (nuclear rays).

The comparison proved that the constructed OCT system is operated efficiently and correctly.

المستخلص

إن الهدف من هذه الدراسة هو تصميم و بناء منظومة التشخيص البصري المترابط و م قارنتها مع عدد من الطرق التشخيصيه كمنظومة الاطياف البصريه الصوتيه ومطياف رامان لغرض تقييم كفاءة عملها.

يمثل م قياس تداخل مايكلسون قلب النظام المصمم حيث يتكون من مرآتين إحداهما ثابتة والأخرى متحركة، مرآه مفضضة تقوم بتقسيم الضوء الساقط عليها الى نصفين متساويين حيث ينفذ النصف وينعكس النصف الآخر ليرتدا مره أخرى و يكونا أهداف تداخل. أستخدمت ثلاث انواع من الليزررات كمصادر ضوئيه لهذا النظام وهي ليزر الهليوم نيون بطول موجي 632.8 نانو متر و قدره م قدرها 4 ملي واط ليزري الداويد بالاطوال الموجية (700 و 1550) نانو متر و قدره م قدرها بحدود 4.25 ملي واط. اهداف التداخل الناتجه، و التي تحمل كل معلومات النماذج المدروسه، تم إستقبالها بواسطة كاشف لي قوم بتحويلها من إشارة ضوئيه الى إشارة كهربيه يمكن عرضها بعد ذلك بعدة وسائل عرض.

حيث أستخدم لذلك راسم ذبذبات رقمي يحتوي على دوال رياضيه على درجة عاليه من التطور و الدقه ومن أهم تلك الدوال الرياضيه تحويل فورير والذي يقوم بتحويل الإشارة المستقبلة إلى الفضاء الترددي لتسهيل عرض كل المعلومات التي تحويها الإشارة.

كما تم أيضاً إستخدام كاميرا لها القدرة على تمثيل إشارات التداخل الناتجه في شكل صور ثنائية وثلاثية الأبعاد.

إن النظام المصمم يمكن إستخدامه لعدة أغراض منها تحديد السماكات و الخصائص الضوئيه للنماذج المدروسه و التي شملت أنواع من الزجاج و البلاستيك و طبقات طلاء من الكربون و طبقات من البصل بالإضافة إلى عينات جلد سرطانیه و قد مثلت نتائج العمل في شكل جداول و أشكال و صور.

و أخيراً وللتأكد من جودة أداء النظام المصمم فقد تم إعادة دراسة العينات السابقة بواسطة نظام تشخيصي آخر و هو النظام الضوئي البصري. كما تم أيضاً تشخيص أنسجة سليمة وأخرى سرطانية بواسطة مطياف رامان.

ومن خلال نتائج المقارنة فقد تم التوصل إلى أن كل الأنظمة المستخدمة يمكن أن تمثل أنظمة تشخيصية ذات أداء جيد بالإضافة إلى أنها ليس بها مضار كمضار بعض أنواع التشخيص الأخرى.

لقد أثبتت نتائج المقارنة إمكانية عمل المنظومة التي بنيت كمنظومه تشخيصية بكفاءة ودقه جيدة.

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