University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

WEN YIN

BEng (Shanghai Maritime University, 2011)

"Diffusive Acoustic Confocal Imaging System (DACI): A New Novel Method for Prostate Cancer Diagnosis"

Department of Mechanical Engineering

Wednesday, December 6, 2017
9:00 A.M.
Engineering and Computer Science Building
Room 468

Supervisory Committee:
Dr. Rodney Herring, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Barbara Sawicki, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Adam Zielinski, Department of Electrical and Computer Engineering, UVic

Chair of Oral Examination:
Dr. Francis Nano, Department of Biochemistry and Microbiology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

This research was undertaken to develop a diffusive acoustic confocal imaging system (DACI) for prostate disease detection. The focus of this project is to obtain the phase information to characterize the variation in mechanical properties through the soft biological tissues. The importance of the phase was examined closely by investigating the acoustic propagation behaviour through the tissues. In order to realize the future prototype design used for routine examination, a practical design layout was introduced and the concept called virtual source was proposed. The diffusive scattered intensity at the virtual source position is able to provide sufficient intensity to carry the phase information. This concept was demonstrated by the simulation models created in ZEMAX and COMSOL using ray-tracing algorithm.

A signal generation and data acquisition device was set up upon the universal software radio peripheral (USRP) platform to enable the high sampling frequency and the frame synchronization between the signal transmission and reception. Due to the in-phase and quadrature signal representation feature in the USRP, the phase was able to be preserved and measured directly. With the experiment conducted upon the prostate phantom with tissue mimicking material, DACI has demonstrated its ability to obtain both the magnitude and the phase information from the received signal. Future work is required to reconstruct the [D speed of sound information within the prostate gland by the phase information captured.