UNIVERSITI TEKNOLOGI MARA

RESISTIVITY CHARACTERISTICS OF CONDUCTIVE RUBBER SHEET AND QUANTUM TUNNELLING COMPOSITE PILLS FOR ROBOTIC HAND TACTILE SENSING APPLICATION

AHSANA AQILAH BINTI AHMAD

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Mechanical Engineering

February 2014

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have complied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Ahsana Aqilah Binti Ahmad
Student I.D. No.	:	2010294788
Programme	:	Masters of Science (By research)
Faculty	:	Mechanical Engineering
Thesis Title	:	Resistivity Characteristics of Conductive Rubber Sheet and Quantum Tunnelling Composite Pills for Robotic Hand Tactile Sensing Application
Signature of Student	:	
Date	:	February 2014

ABSTRACT

The thesis presents resistivity characteristics of Conductive Rubber Sheet (CRS) and Quantum Tunnelling Composite (QTC) Pills for robotic hand tactile sensing application. These materials are suitable to be used as transducer in tactile sensing applications. Therefore, the thesis highlights the potential of these two materials as a tactile sensing transducer and later describes the best design parameters for them to be applied as a tactile sensor. In the thesis, the tactile sensing mechanism that includes the operating principle and hardware architecture of the sensor are explained. The experimental setup to determine the fundamental properties of Conductive Rubber Sheet (CRS) and Quantum Tunnelling Composite (QTC) Pills is presented. Resistivity behavior is of the major factors in choosing Conductive Rubber Sheet (CRS) and Quantum Tunnelling Composite (QTC) Pills over the other materials. These materials resistivity need to be tested to ascertain its viability as a tactile sensor. The parameters are voltage supply, the separation gap and sensor construction. The results show the Quantum Tunnelling Composite (QTC) Pills is better in term of reproducibility and stability of the resistance values as compared to the Conductive Rubber Sheet (CRS). However in terms of the sensitivity, Conductive Rubber Sheet (CRS) is better in comparison with the Quantum Tunnelling Composite (QTC) Pills whereby it can cover lower loading range when compared to QTC Pills. However, since the reproducibility of Conductive Rubber Sheet (CRS); 5.05Ω standard deviation is lower than the Quantum Tunnelling Composite (QTC) Pills; 2.11Ω standard deviation, it is more preferable to choose the Quantum Tunnelling Composite (QTC) Pills over Conductive Rubber Sheet (CRS). Furthermore with 5V supply voltage and 0.5mm separation gap, the Quantum Tunnelling Composite (QTC) Pills can perform well similar to the 25V supply voltage. Hence, with the superiority attributes shown, Quantum Tunnelling Composite (QTC) Pills are preferred materials for tactile sensor.

ACKNOWLEDGEMENTS

Bissmillahirrahmanirrahim,

Alhamdulillah. Thanks to Allah SWT, whom with His willing giving me the opportunity to complete this thesis.

I would like to thank everyone for making this work possible. First and foremost I offer my sincerest gratitude to my supervisor, Prof. Ir. Dr. Hj. Ahmed Jaffar and my co-supervisor, Dr.-Ing. Low Cheng Yee for giving me the opportunity to work on this interesting project and for his encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the research.

Thanks to all academic and administrative staff members at the Center of Excellence for Humanoid Robots and Bio Sensing, Faculty of Mechanical Engineering, UiTM for their cooperation, kindness and assistance during the tenure of my studies.

Also a special thanks to my postgraduate colleagues for assisting me in giving advises idea and technical supports to this research work.

Furthermore, thank you to Universiti Teknologi MARA for providing me the financial support under the Young Lecturer Scheme. Besides that, part of this project is supported by the Ministry of Higher Education Malaysia (MOHE) under the Fundamental Research Grant Scheme (FRGS) (600-RMI/ST/FRGS 5/3Fst (86/2010)).

Last but not least, I would like to thank my father, Hj Ahmad b. Noh and mother, Hjh. Mariyana binti Pilus for their endless support. Also, a special thanks to my husband, Aqil bin Ahmad Yusoff and my son Amru Irsyad for boundless love, patience and endless encouragement to motivate and support me in pursuing my study.

TABLE OF CONTENTS