

Microcontroller Based Automatic Switching Types Multi-frequency Electrical Impedance Spectroscopy(EIS) System For Early Detection of Breast Cancer

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ISSN: 2186-0114
<http://www.IJEI.org>

ARTICLE HISTORY

Received: 14 June, 2013
 Revised: 12 October, 2013
 Accepted: 7 October, 2013

Published online:

8 December, 2013

Vol. 2 , No. 2, 2013

Abstract

Breast Cancer is among the top five causes of cancer death and topmost cause among women worldwide. The early diagnosis through simple, non-invasive and inexpensive screening can provide great deal of aid especially for the poor people of Bangladesh. Making diagnostics measurement available to the widely geographically spread population in developing countries is a challenge which is unlikely to be met by the technology used in the west. Multi-frequency Electrical Impedance Spectroscopy is quite attractive in this context as the instrumentation is relatively simple and there is no known health hazard. Electrical Impedance Spectroscopy has been the subject of quite intensive research in breast cancer screening for about 10 years. EIS is a medical imaging technique in which image of the conductivity or permittivity of part of the object is inferred from the surface of the electrical measurement through a set of electrodes. Tissue impedance spectroscopy involves injection of constant current into tissues at different frequencies and measurement of voltage gradients. Automatic switching system is needed for the reliability of the EIS system and automatic switching between electrodes are implemented using digitally controlled analogue switch (MC14551B) and the sequence of switching is controlled by locally available microcontroller ATmega8. This paper focuses on the instrumentation of microcontroller based automatic switching type EIS system for early detection of breast cancer. In this research work EIS system has been designed using function generator, Howland V/I converter, automatic switching system using digitally controlled analogue switch (MC14551B) and the sequence of switching is controlled by microcontroller ATmega8, instrumentation amplifier and Butterworth bandpass filter. In our previous research work the automatic switching between electrodes has not been done but in this research work automatic switching has been implemented using Arduino board microcontroller and Arduino board has been designed. The performance of designed EIS system each section is found to be satisfactory and measurement on resistive components gave an error of 2.2% which indicates that proposed system can be used for breast cancer screening trials.

Keywords: Electrical Impedance Spectroscopy, Multi-frequency, Microcontroller, Instrumentation

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1. INTRODUCTION

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BREAST CANCER is one of the most common cancers and leading cause of cancer death among women worldwide [1][2]. Breast cancer incidence is increasing over the year with more than 1 million reported each year [3]. In addition to that an average 37,300 women died globally in conjunction to the disease [2][4]. As there is no cancer registry system in Bangladesh so we do not have accurate data on this. Like other developed countries the number of patients is increasing day by day in Bangladesh too. The most common form of screening system available to

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RJ Shavelson



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Inverse Synthetic Aperture Radar Imaging With MATLAB Algorithms Caner Ozdemir, 2021-05-04 Build your knowledge of SAR ISAR imaging with this comprehensive and insightful resource The newly revised Second Edition of Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms covers in greater detail the fundamental and advanced topics necessary for a complete understanding of inverse synthetic aperture radar ISAR imaging and its concepts Distinguished author and academician Caner Ozdemir describes the practical aspects of ISAR imaging and presents illustrative examples of the radar signal processing algorithms used for ISAR imaging The topics in each chapter are supplemented with MATLAB codes to assist readers in better understanding each of the principles discussed within the book This new edition includes discussions of the most up to date topics to arise in the field of ISAR imaging and ISAR hardware design The book provides a comprehensive analysis of advanced techniques like Fourier based radar imaging algorithms and motion compensation techniques along with radar fundamentals for readers new to the subject The author covers a wide variety of topics including Radar fundamentals including concepts like radar cross section maximum detectable range frequency modulated continuous wave and doppler frequency and pulsed radar The theoretical and practical aspects of signal processing algorithms used in ISAR imaging The numeric implementation of all necessary algorithms in MATLAB ISAR hardware emerging topics on SAR ISAR focusing algorithms such as bistatic ISAR imaging polarimetric ISAR imaging and near field ISAR imaging Applications of SAR ISAR imaging techniques to other radar imaging problems such as thru the wall radar imaging and ground penetrating radar imaging Perfect for graduate students in the fields of electrical and electronics engineering electromagnetism imaging radar and physics Inverse Synthetic Aperture Radar Imaging With MATLAB Algorithms also belongs on the bookshelves of practicing researchers in the related areas looking for a useful resource to assist them in their day to day professional work

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Seismic Instruments, 2003

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