

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

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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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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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emerging research areas providing a valuable resource for researchers and practicing engineers alike **FPGA-Based Embedded System Developer's Guide** A. Arockia Basil Raj, 2018-04-09 The book covers various aspects of VHDL programming and FPGA interfacing with examples and sample codes giving an overview of VLSI technology digital circuits design with VHDL programming components functions and procedures and arithmetic designs followed by coverage of the core of external I O programming algorithmic state machine based system design and real world interfacing examples Focus on real world applications and peripherals interfacing for different applications like data acquisition control communication display computing instrumentation digital signal processing and top module design Aims to be a quick reference guide to design digital architecture in the FPGA and develop system with RTC data transmission protocols *Proceedings of the IEEE International Conference on Industrial Technology (ICIT ...)*, 2004 **Electrical & Electronics Abstracts**, 1997 *Electronics World + Wireless World*, 1995 **Official Gazette of the United States Patent and Trademark Office**, 2006 *Electronics World*, 2003 *Japanese Technical Periodical Index*, 1987 *Science Abstracts*, 1995 *Jane's World Railways*, 1989 *Advances in Artificial Intelligence Application in Data Analysis and Control of Smart Grid* Xin Ning, Imr Fattah, Praveen Kumar Donta, Mohamed M.F. Darwish, 2023-11-23 Smart grid SG is considered a form of intelligent system that allows the electric grid to perform its functions efficiently The SG is a network that allows for the flow of electrical energy and data where the data is used to make intelligent decisions in the operation of the electric grid Artificial intelligence AI techniques such as expert system ES Machine Learning ML and deep Learning DL have brought an advancing frontier in power electronics and power engineering with their powerful data processing capabilities The SG relies on the flow of data to make its intelligent control therefore AI technology is a perfect fit for the SG The application of AI technology in the SG has the potential to improve the intelligence of the SG This research topic is focused on ways of improving the data analysis and control of SG by leveraging technologies Manuscripts with the progress made in solving a range of miscellaneous and critical problems in SG by leveraging AI methods such as ES ML and DL methods are welcome Reviews and original research that describe the latest developments in this field are considered for publication in this research topic The scope of this Research Topic will include the following themes but are not limited to 1 Data driven and artificial intelligence approaches to enhancing flexibility and resilience of SG 2 Expert system Machine Learning and Deep Learning reinforcement learning and transfer learning for applications in SG 3 AI for development in ensuring high reliability and stability of electric power system with high penetration of renewable energy 4 AI for studies in operation protection integrated planning and control of SG systems 5 AI for development in diagnostics and diagnostics for SG 6 Health monitoring of a modern wind generation system using an adaptive neuro fuzzy system 7 Space vector fault pattern identification of a smart grid subsystem by neural mapping 8 Control techniques mathematical programming methods optimization techniques and metaheuristics applied in SG 9 AI and optimization techniques for green energy and carbon

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