

INTERFACING ELECTRONIC FOR MEASUREMENT,  
SIGNAL PROCESSING AND WIRELESS  
COMMUNICATION



Edited by

Sheroz Khan, International Islamic University Malaysia

AHM Zahirul Alam, International Islamic University Malaysia

Anis Nurashikin Nordin, International Islamic University Malaysia



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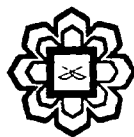
# **INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION**

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## CONTENTS

Chapter	Title	Page
1	INDUCTIVE SENSOR Atika Arshad, RumanaTasnim, Sheroz Khan, AHM Zahirul Alam	1
2	WIRELESS TRANSFER OF LOW-POWER TO IMPLANTED BIOMEDICAL DEVICES: INTRODUCTION AND 2-D COIL PARAMETERS Imran M. Khan, Sheroz Khan, Othman O. Khalifa	8
3	WIRELESS TRANSFER OF POWER TO LOW-POWER IMPLANTED BIOMEDICAL DEVICES: 3-DIMENSIONAL COIL DESIGN CONSIDERATIONS Imran M. Khan, Sheroz Khan, Othman O. Khalifa	14
4	WIRELESS TRANSFER OF LOW-POWER TO IMPLANTED BIOMEDICAL DEVICES: INDUCTIVE LINK DESIGN Imran M. Khan, Aminullah Khan, Sheroz Khan, Othman O. Khalifa	22
5	WIRELESS TRANSFER OF LOW-POWER TO IMPLANTED BIOMEDICAL DEVICES: RECTIFIER DESIGN Imran M. Khan, Sheroz Khan, Othman O. Khalifa	28
6	DATA CONVERSION BASIC CONCEPTS Ma Li Ya, Sheroz Khan, Anis Nurashikin	36
7	NYQUIST-RATE ANALOG-TO-DIGITAL CONVERTER Ma Li Ya, Sheroz Khan, Anis Nurashikin	41
8	OVERSAMPLING ANALOG-TO-DIGITAL CONVERTER Ma Li Ya, Sheroz Khan, Anis Nurashikin	47
9	SWITCHED-CAPACITOR INTEGRATOR DESIGN Ma Li Ya, Sheroz Khan, Anis Nurashikin	53
10	CMOS OPERATIONAL AMPLIFIER DESIGN Ma Li Ya, Sheroz Khan, Anis Nurashikin	60

11	DIGITAL-TO-ANALOG CONVERTER Ma Li Ya, Sheroz Khan, Anis Nurashikin	68
12	CONVERTERS RESULTS VERIFICATIONS Ma Li Ya, Sheroz Khan, Anis Nurashikin	73
13	DEVELOPMENT OF WEARABLE REFLECTANCE PULSE OXIMETRY FOR TELEHEALTH MONITORING SYSTEM Muhammad Arham, Syed Zulfauzi, Othman O. Khalifa	77
14	DESIGN OF CAPACITIVE MEASURING SYSTEM FOR HIGH FREQUENCY BAND TRANSDUCER Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	83
15	PRINCIPLE OF CAPACITANCE TO VOLTAGE CONVERTER Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	89
16	CMOS OPERATIONAL AMPLIFIER TESTING FOR CAPACITIVE TO VOLTAGE CONVERTER Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	95
17	MATHEMATICAL MODEL FOR CONTACTLESS MEASUREMENT Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	102
18	FREQUENCY RESPONSE OF A CONTACTLESS MEASUREMENT Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	107
19	A MATHEMATICAL STUDY OF A THERMISTOR ASTABLE MULTIVIBRATOR IN A LINEARIZATION TECHNIQUE Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	113

20	A STUDY OF LINEARIZATION TECHNIQUE USING A NONLINEAR THERMISTOR  Nurul Arfah binti Che Mustapha, AHM Zahirul Alam, Sheroz Khan	117
21	COGNITIVE RADIO VS INTELLIGENT ANTENNA  Siti Rabani Mat Nawawi, Nurul Farhah Toha, Khaizuran Abdullah, M. Rafiqul Islam, Sheroz Khan	123
22	UWB PULSE GENERATION AND MODULATION CIRCUITS FOR BIOMEDICAL IMPLANTS  Mokhaled M., Mohammed, Sheroz Khan, Jalel Chebil, Khaled A. S. Al-Khateeb, Imran Moez Khan	134
23	UWB COMMUNICATIONS FOR BIOMEDICAL IMPLANTS  Mokhaled M. Mohammed, Sheroz Khan, Jalel Chebil, Khalid A. S. Al-Khateeb, Imran Moez Khan	141
24	UWB PULSE GENERATION FOR BIOMEDICAL IMPLANTS  Mokhaled M., Mohammed, Sheroz Khan, Jalel Chebil, Khaled A. S. Al-Khateeb, Imran Moez Khan	145
25	ULTRA-WIDE BAND TECHNOLOGY  Mokhaled M., Mohammed, Sheroz Khan, Jalel Chebil, Khaled A. S. Al-Khateeb, Imran Moez Khan	149
26	MVL ADC DESIGN AND SIMULATION  Soheli Farhana, AHM Zahirul Alam, Sheroz Khan	153
27	MVL DESIGN AND CURRENT MODE CIRCUIT ELEMENTS  Soheli Farhana, AHM Zahirul Alam, Sheroz Khan	159
28	NOISE MODULATED CRYPTOGRAPHIC GENERATION FOR USE IN UWB WIRELESS COMMUNICATION  Siti Hazwani Yaacob, Sigit Puspito Wigati Jarot, Sheroz Khan	164
29	UWB PULSE GENERATION AND SHAPING: ANALYSIS AND SIMULATION RESULTS  Zeeshan Shahid, Sheroz Khan, AHM Zahirul Alam	173

30	SIMULATIONS OF RESISTANCE VARIATIONS TO PULSE GENERATOR CIRCUITS	177
	Zeeshan Shahid, Sheroz Khan, AHM Zahirul Alam	
31	PULSE OXIMETRY DESIGN USING ARDUINO BOARD	184
	Muhammad Arham, Syed Zulfauzi and Othman O. Khalifa	

## Chapter 3

# WIRELESS TRANSFER OF POWER TO LOW-POWER IMPLANTED BIOMEDICAL DEVICES: 3-DIMENSIONAL COIL DESIGN CONSIDERATIONS

IMRAN M. KHAN, SHEROZ KHAN, OTHMAN O. KHALIFA

The most important parameter between two coils that needs to be optimized in terms of transmit and receive coils for power is the mutual inductance between them. The mutual inductance is a measure of the transmit coil's flux field that is incident on the receive coil. This measure can only be optimized if the flux field is calculated for a given geometry of transmit coil using some kind of model. However, many assumptions made in the modelling of inductive coils are quite limiting and do not provide an accurate picture of the flux – with many secondary effects causing inconsistencies. This chapter looks into some considerations for the 3D coil geometry of a transmit coil.

### 3.1. INTRODUCTION

Continuous patient monitoring is of paramount importance in the medical field. This is especially true for chronic illnesses such as heart disease, cerebrovascular disease, malignancies and several different types of infections. The seriousness of these disorders is compounded by the fact that they are amongst the top ten fatal diseases in the world (World Health Organization, 2010). Furthermore, the managerial care required in these types of diseases often requires lifestyle changes that need to be monitored for their impact on the human body as generally these diseases effect the quality of life of patients and become a major consideration in their everyday life. Research into possible cures for these diseases also requires monitoring of slight drug and dosage modifications. However, continuous patient monitoring would place a great strain on hospitals and clinics and is impractical in developing countries with limited medical resources. Furthermore, there is a recent trend in implanted devices to attempt building System-On-Chip (SoC) devices that provide all the functions of sensing and even responding in emergency situations that would otherwise need medical attention at a hospital. Heart-assist devices in particular employ this design vision by utilizing sensors that monitor the magnitude of the nerve action potential to determine whether it would trigger a natural cardiac cycle. If low threshold action potential is detected, the device tries to amplify the trigger by discharging a capacitor to assist the muscular contraction. Such devices would need on-demand power supply that must be reliable and efficient