

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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INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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EMAIL: [iiumprinting@yahoo.com](mailto:iiumprinting@yahoo.com)

## 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 Nawwi, 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 HazwaniYaacob, 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 17

# MATHEMATICAL MODEL FOR CONTACTLESS MEASUREMENT

NURUL ARFAH BINTI CHE MUSTAPHA, AHM ZAHIRUL ALAM, SHEROZ KHAN

### 17.1. INTRODUCTION

A contactless transmission is analysed in order to explain how it could become a candidate to replace the traditional cable connections across narrow gaps or cavities. Due to its better performance, the resonant sensor is chosen to develop the measurement system. Changes in the impedance of the test coil are made to reflect the changes in the capacitance of the sensor circuit and magnetically coupled to the test coil. Also the distance changes between the readout circuit and the sensing circuit related to the leakage flux lines is analyzed. The proposed model has two parameters; parasitic capacitance and the changes of couple and leakage fluxes. In (Daniele, Emilio, Mauro & Andrea, 2008), the frequency range of the system is up to 40 MHz. As a solution to these problems, this chapter discusses an analysis of a telemetry system that is based on the coupling of two planar coils. A capacitive transducer is connected to the first one, whereas an impedance analyzer is connected to the second one; the distance between the two coils can change. On the readout coil, an equation for the impedance is derived using simple circuit analysis concepts to show the frequency component at which the resonance is taking place. With these equations in hand, the relation of these frequencies with the system parameters is mind to be studied. This is done by obtaining simulation results that could be confirmed by experimental results.

### 17.2. CIRCUIT DESCRIPTION

An analysis of an effect of a coupled and leakage fluxes between two normal inductor coils of a normal telemetric system is studied. The circuit of Fig. 17.1 is the commonly used model to analyze the telemetric systems due to limitation from the presents of parasitic capacitance and the distance between readout circuit and sensing circuit can change due to practical use.

### 17.3. THEORY AND DERIVATIONS

The derivation of the circuit is as below: