

INTERFACING ELECTRONIC FOR MEASUREMENT,
SIGNAL PROCESSING AND WIRELESS
COMMUNICATION



Edited by

Sheroz Khan, International Islamic University Malaysia

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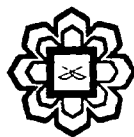
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CONTENTS

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 27

MVL DESIGN AND CURRENT MODE CIRCUIT ELEMENTS

SOHELI FARHANA, AHM ZAHIRUL ALAM, SHEROZ KHAN

27.1. INTRODUCTION

Multiple-valued logic or multi-valued logic (MVL) can be considered as a mixture of both binary logic and analog signal processing and as a result, it has the ability to enrich digital electronics by incorporating the advantages of both binary logic and analog signal processing. Such capabilities include retaining the inherent noise resistance feature of binary systems as well as being able to represent more information in a single signal just as in the case of the analog signal. The use of MVL can also significantly reduce the amount of interconnection lines required to communicate within a chip and with other chips and hence reduce chip size. There is also a possibility of reducing the power consumption of chips since a reduction in interconnections will translate into lesser needs of capacitance which account for the major of dynamic power dissipation in submicron VLSI systems. A brief discussion is done in this chapter based on commonly used basic current-mode construction of cells in analog and multiple-valued logic (MVL). The discussion includes cells such as current mirrors and current comparators.

27.2. CURRENT-MODE CIRCUIT ELEMENTS

27.2.1. Current Mirrors

In all analog and mixed mode VLSI circuits, a current mirror (CM) is an integral part of signal processing elements. As the name suggests, a current mirror is used to generate duplication (if necessary, it may be attenuated or amplified) of a given reference current.

Some of the desirable characteristics of current mirrors are (Sung, Park, Seong & Kim, 2002) low AC equivalent input resistance, and small DC voltage drop at the input node high output resistance, so that the output current is independent of the output voltage, whether DC or AC low output compliance voltage, such that maximum voltage swing at the output node is allow for good frequency response for high frequency applications linear current transfer ratio. In most cases the transfer ratio should be constant and ideally is set by the transistor geometry.

A simple realization of a MOS current-mirror is presented in Fig. 27.1. If one assumes that the transistors operate in the saturation region ($V_{DS} > V_{GS} - V_T$) so that the drain current equation is