

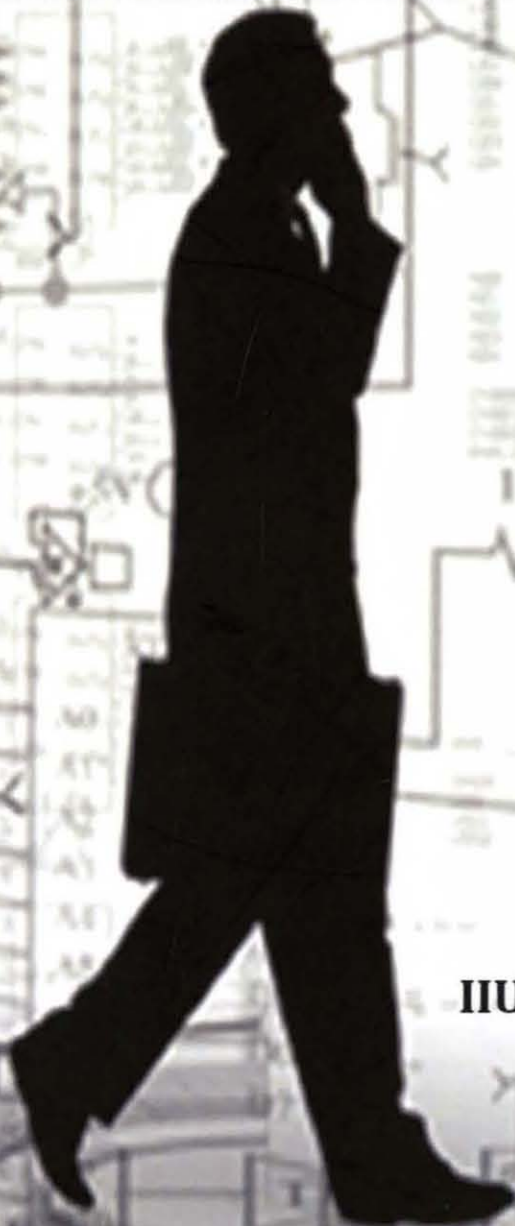
# PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

Edited by

**Sheroz Khan, International Islamic University Malaysia**

**Jalel Chebil, International Islamic University Malaysia**

**Othman O Khalifa, International Islamic University Malaysia**



**IIUM PRESS**

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## CONTENTS

Chapter		Page No.
1	RC CIRCUIT RESPONSE <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, AHM Zahirul Alam</i>	1
2	RL CIRCUIT RESPONSE <i>Rumana Tasnim, Atika Arshad, Sheroz Khan, Musse Mohamod</i>	7
3	RLC CIRCUIT RESPONSE <i>Rumana Tasnim, Atika Arshad, Sheroz Khan, Musse Mohamod</i>	13
4	CAPACITIVE SENSING FOR NON-CONTACT MEANS OF MEASUREMENT <i>Rumana Tasnim, Atika Arshad, Sheroz Khan, Musse Mohamod, Nazmus Saquib</i>	19
5	SENSORS IN ELECTRONIC APPLICATIONS <i>Rumana Tasnim, Atika Arshad, Sheroz Khan, Musse Mohamod</i>	27
6	CONTACT TYPE AND NONCONTACT TYPE GAS FLOW MEASURING SENSORS <i>Rumana Tasnim, Atika Arshad, Nazmus Saquib, Sheroz Khan, Musse Mohamod</i>	33
7	OUTPUT CONTROL DEVICES: ACTUATORS <i>Rumana Tasnim, Atika Arshad, Sheroz Khan, Musse Mohamod</i>	39
8	INDUCTIVE POWER SYSTEM FOR ENERGY HARVESTING <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, AHM Zahirul Alam</i>	45
9	ON THE ELECTRODE ARRANGEMENTS OF CAPACITIVE SENSOR FOR TWO PHASE GAS FLOW MEASUREMENT <i>Rumana Tasnim, Atika Arshad, Sheroz Khan, Musse Mohamod</i>	53
10	BASIC CONCEPT OF INDUCTANCE FOR INDUCTIVE TRANSDUCERS <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, AHM Zahirul Alam</i>	59
11	MAGNETIC PROPERTIES FOR MAGNETIC TRANSDUCER <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, AHM Zahirul Alam</i>	65
12	MAGNETIC, HYSTERESIS THEORY: APPLICATION PERSPECTIVE <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, AHM Zahirul Alam</i>	71

13	THE PRINCIPLE OF RESISTIVE SENSING <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, AHM Zahirul Alam</i>	75
14	SPIKES BLOCKING AND SURGE PROTECTION <i>Ahmad Lutfi Torla, Sheroz Khan, Asan Gani</i>	83
15	VOLTAGE SUPPLY AND VOLTAGE REGULATION <i>Ahmad Lutfi Torla, Sheroz Khan, Asan Gani</i>	89
16	FULL-WAVE RECTIFICATION OF A LOW-VOLTAGE SOURCE <i>Ahmad Lutfi Torla, Sheroz Khan, Asan Gani</i>	99
17	DESIGN OF DIFFERENTIAL RESISTIVE MEASURING SYSTEM AND ITS APPLICATIONS <i>Deji Abdulwahab, Sheroz Khan, Jalel Chebil</i>	107
18	LINEARIZING TECHNIQUES FOR SENSOR OUTPUT <i>Mohammad Tahir Siddiqi, Sheroz Khan, Ummer Siddiqi</i>	115
19	SENSOR AND SENSOR RESPONSE-ISSUES AND INTERFACING <i>Syed Masrur Ahmmad, Sheroz Khan, Anis Nurashinkin, Md Rasiuddin Khan</i>	119
20	UWB PULSE GENERATION SHAPING AND ANALYSIS <i>Zeeshan Shahid, Sheroz Khan, AHM Zahirul Alam</i>	133
21	POWER SUPPLY POWER-SUPPLY INTERFERENCE IN SMART SENSORS-TO-MICRONROLLER INTERFACE FOR BIOMEDICAL SIGNALS <i>Mohammad Ashraful, Sheroz Khan, Muhammad Ibrahimy</i>	139
22	RESPONSE AND INACCURACY ISSUES OF SENSORS <i>Mohammad Ashraful, Sheroz Khan, Muhammad Ibrahimy</i>	165
23	PERFORMANCE IMPROVEMENT OF SENSORS RESPONSE USING PIECE-WISE NON-LINEAR (PWL) A/D AND PULSE-WIDTH MODULATION (PWM) A/D TECHNIQUES <i>Ismaila Tijani, Sheroz Khan</i>	175
24	POWER SUPPLY INTERFERENCE IN SMART SENSOR MICROCONTROLLER INTERFACE <i>Ismaila Tijani, Sheroz Khan</i>	185

25	2.45 GHz PASSIVE RFID TAG ANTENNA MOUNTING ON VARIOUS PLATFORMS <i>Abubeker A. Yussuf, Md Rafiqul Islam, Sheroz Khan, Othman O. Khalifa, AHM Zahirul Alam</i>	201
26	ANALYSIS OF HYBRID STEPPER MOTOR PERFORMANCE UNDER THE INFLUENCE OF VOLTAGE SUPPLY INTERFERENCE <i>Abdulazeez F. Salami, Wahab A. Lawal, Sheroz Khan, Teddy Surya Gunawan, Sigit Puspito Wigati Jarot</i>	217
27	PC SOUND CARD BASED INSTRUMENTATION AND CONTROL <i>Teddy Surya Gunawan</i>	229
28	PIECE-WISE LINEAR ANALOG TO DIGITAL (PLADC) CONVERTER PROCESS <i>Abdulazeez F. Salami, Wahab A. Lawal, Sheroz Khan, AHM Zahirul Alam</i>	239
29	DESIGN AND IMPLEMENTATION OF AN OPTIMAL FUZZY LOGIC CONTROLLER USING EGENTIC ALGORITHM <i>Salami Femi Abdulazeez, Lawal Wahab Adetunji, Sheroz Khan, AHM Zahirul Alam, Momoh Jimoh E. Salami, Shihab Ahmed Hameed, Aisha Hasan Abdalla and Mohd Rafiqul Islam</i>	249
30	DESIGN AND HARDWARE IMPLEMENTATION OF CONDITIONING CIRCUIT FOR ACCURATE READING FROM TRANSDUCERS WITH NONLINEAR RESPONSES <i>Khairul Hasan, Aliza Aini Md Ralib, Ma Li Ya, Atika Arshad, Sheroz Khan</i>	265
31	TRANSDUCERS-TO-MICROCONTROLLER INTERFACES-SOFTWARE SOLUTION APPROACH <i>Lawal Wahab Adetunji, Salami Femi Abdulaziz, Sheroz Khan, AHM Zahirul Alam, Mohammad Rafiqul Islam, Shihab A. Hameed and Aisha Hasan Abdalla</i>	277
32	WAVELET ANALYSIS OF THE ECG SIGNALS FOR THREE COMMON HEART DISEASES IN JORDAN <i>Jalel Chebil, Jamal Al Nabulsi</i>	291
33	FUNCTIONAL ELECTRICAL STIMULATION SYSTEM AND PROFILE FOR WALKING <i>Noreha Abdul Malik</i>	303

34	FUZZY LOGIC BASED TEMPERATURE CONTROL OF THERMOELECTRIC COOLER FOR SINGLE PHOTON AVALANCHE DIODE APPLICATION <i>Nurul Izzati Samsuddin, Salmiah Ahmad, Nurul Fadzlin Hasbullah</i>	311
35	SPECTRUM SENSING FOR COGNITIVE RADIOS <i>Izyan Munyanti Abu Hanifah, Siti Natrah Che Rus, Sigit Puspito Wigati Jarot</i>	317
36	COGNITIVE RADIO VS INTELLIGENT ANTENNA <i>Siti Rabani Mat Nawati, Nurul Farhah Toha, Khaizuran Abdullah, M. Rafiqul Islam, Sheroz Khan</i>	327
37	APPLICATION AND CASE STUDIES OF MAGNETIC INDUCTION <i>Atika Arshad, Rumana Tasnim, Sheroz Khan, A H M Zahirul Alam</i>	341

## Chapter 28

# PIECE-WISE LINEAR ANALOG TO DIGITAL (PLADC) CONVERTER PROCESS

ABDULAZEEZ F. SALAMI, WAHAB A. LAWAL, SHEROZ KHAN, AHM ZAHIRUL ALAM

### 28.0 INTRODUCTION

Transducers are devices that transform energy from one form to another. Such transformation process may be applicable in the measurement of physical quantities, transfer of information and also in performing a certain control action. Transducers used as measuring devices are generally termed as sensors. Such transducers detect the changes in characteristics of a physical quantity and convert the change into a corresponding electrical signal. This is a common phenomenon when transducers are used to detect temperature, speed, force, liquid level or viscosity. On the other hand transducers, used to carry out control actions, are termed as actuators. These transducers usually convert an electrical signal into some form of physical control action such as heating or movement and are carried by the control devices. Various types of transducers exist meant for sensing and controlling different physical quantities. For example, a light dependent resistor (LDR) or a photodiode can be used to sense light intensity of an environment while lamps and LED displays can be used to control it. Likewise, a thermistor can be used to measure the temperature of an environment while a heater/fan can be used to control it and a tachometer can be used to measure the speed of a device while a stepper motor can be used to control it [1-3]. The focus of this chapter is on the problems and issues related to the interfacing of transducers when used as measuring devices or sensors in smart applications. Smart applications are also termed as tuned control for detecting changes in the parameter of interest which used to be ignorable in the traditional measurement and control systems.

The output signal generated from transducer sensors can either be analog or digital. Analog type sensors generate a continuous output signal for every change in the physical quantity being measured. This can be in the form of an output voltage varying proportionally in relation to changes in the physical quantity. An example of such sensors is a thermistor that changes its resistive value for every change in the external temperature of the environment. Digital type sensors on the other hand produce discretized output levels that represent an on/off switch. Such sensors can be in the form of a proximity switch to detect objects, or a level switch to detect if a tank is empty or full. No matter the output is analog or digital, transducers are to be interfaced to the external world on one side and to the digital systems on the other side. This chapter addresses the errors related to the nonlinear behavior of transducers which they exhibit when deriving information of the physical parameter of the external world devices. Here, the nonlinearity issue is explained