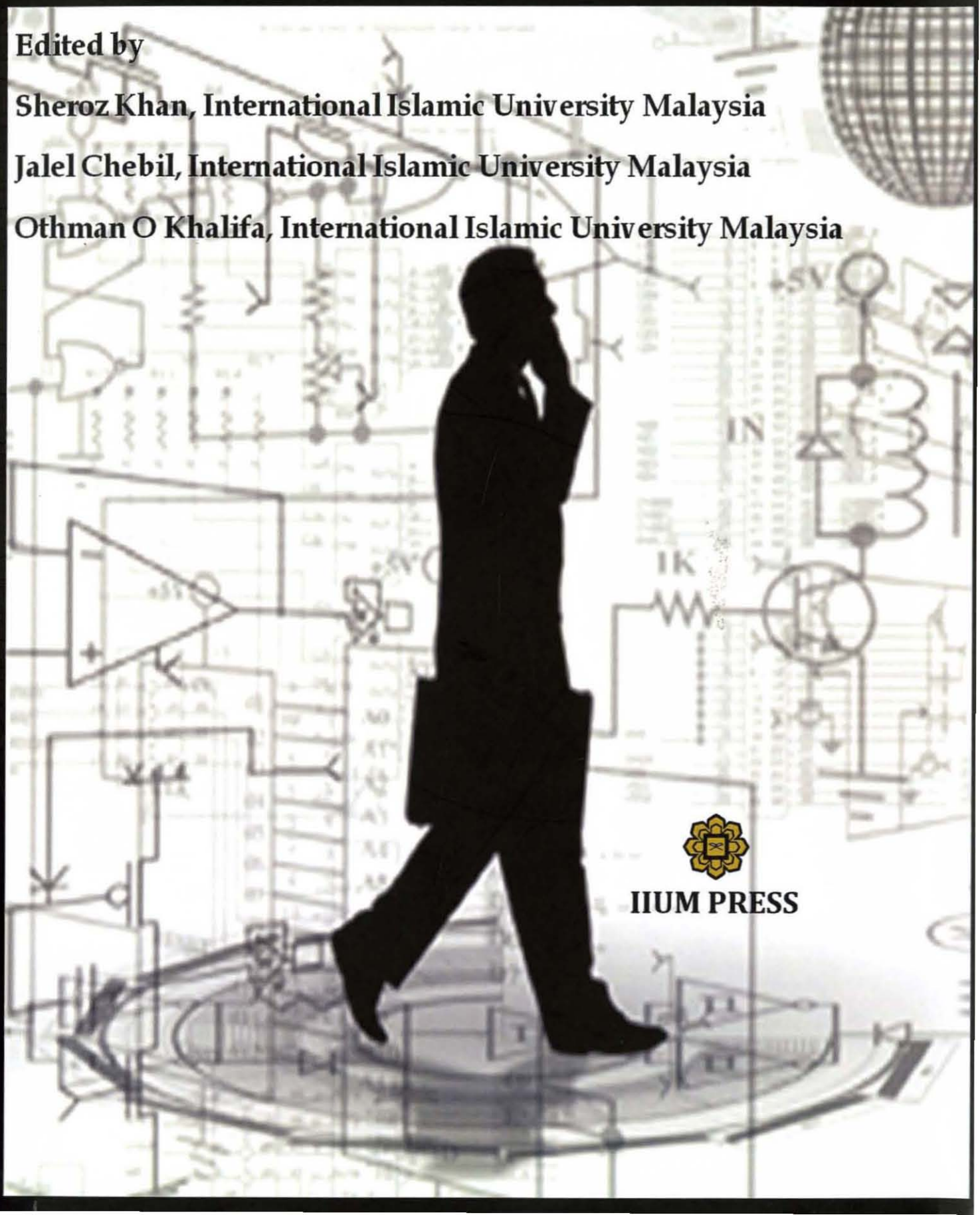
PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

Edited by

Sheroz Khan, International Islamic University Malaysia

Jalel Chebil, International Islamic University Malaysia

Othman O Khalifa, International Islamic University Malaysia



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Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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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 word 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