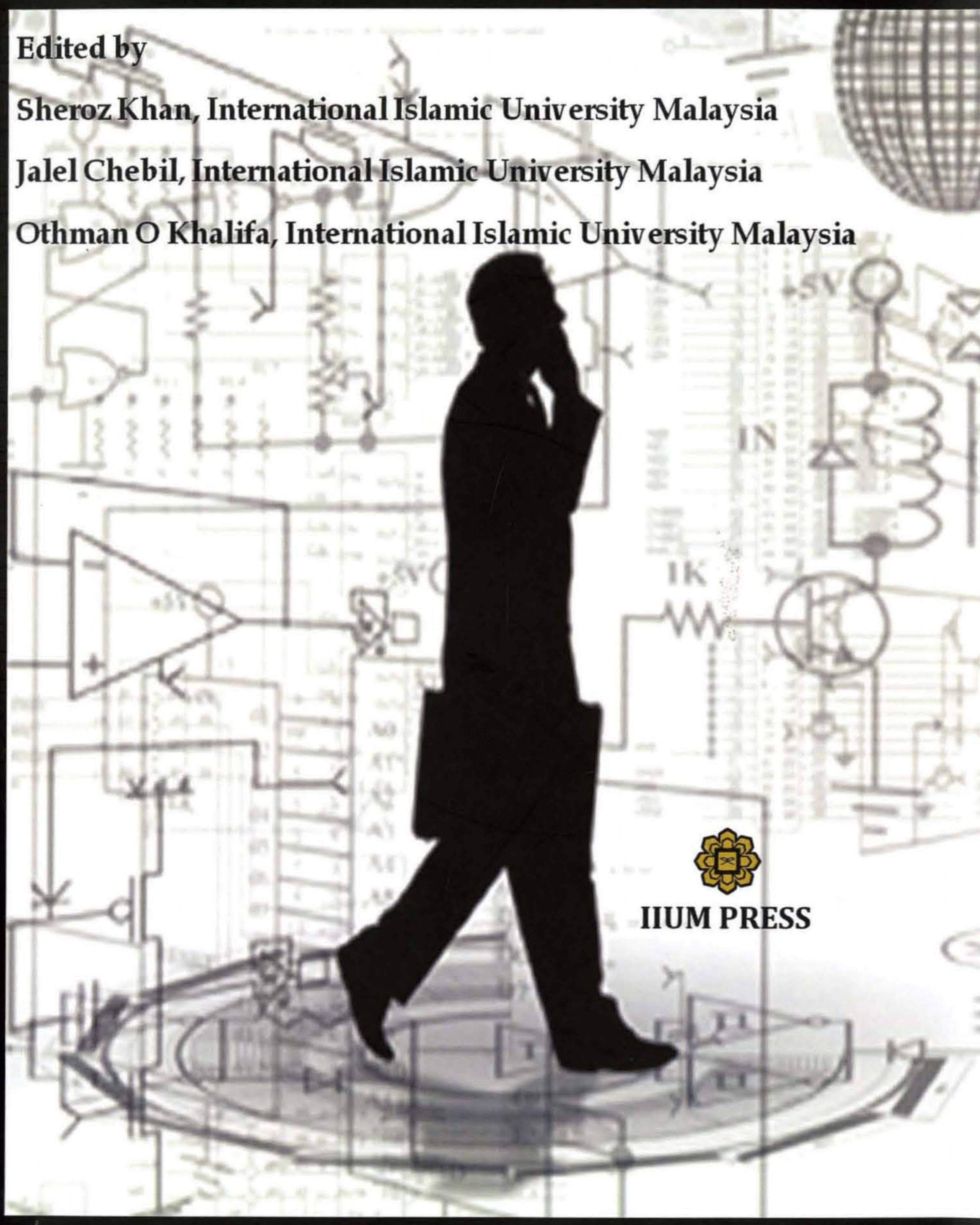
PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

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 4

CAPACITIVE SENSING FOR NON-CONTACT MEANS OF MEASUREMENT

RUMANA TASNIM, ATIKA ARSHAD, SHEROZ KHAN, MUSSE MOHAMOD, NAZMUS SAQUIB

4.0 INTRODUCTION

Capacitive sensors exhibit an electrical property called "capacitance" on the way to carry out the measurements. Capacitance is particularly defined for two conducting objects, across which the potential difference is connected. The plates are separated by an electrical insulating material named as dielectric that helps the parallel plates to uphold the stored electrical charges. Capacitive sensors are indeed capable of sensing a wide range of things—motion, chemical composition, presence of gaseous components, electric field straightforwardly. On the other hand, in an indirect manner, these sensors can also sense some variables which can be converted into motion or dielectric constant, such as pressure, acceleration, fluid level, and fluid composition.

4.1 CALCULATION OF CAPACITANE

Capacitance is determined by three parameters: (a) capacitance changes with changes in area; (b) capacitance changes with changes in distance; and (c) capacitance changes with changes in dielectric, where the capacitance is directly proportional to the surface area of the objects and the dielectric constant of the material between them, and inversely proportional to the distance between them.

$$C(x) = \frac{\varepsilon A}{x} = \frac{A}{x}(\varepsilon_r.\varepsilon_o) \qquad (4.1)$$

Where,

C= Capacitance of the capacitor

ε= Dielectric constant or permeability

$\in_r$=Relative dielectric constant

$\in_o$= Free space dielectric constant

x = distance between the plates [m]

A = area of the plates [m^2]