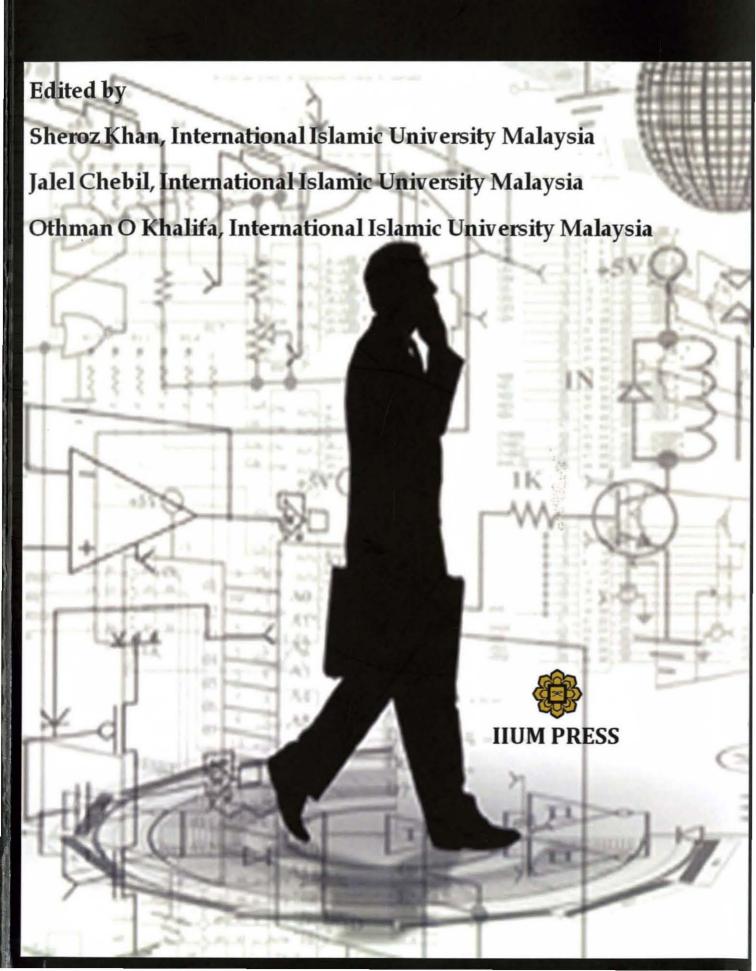
# PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS



# PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

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## Published by: IIUM Press International Islamic University Malaysia

First Edition, 2011 ©IIUM Press, IIUM

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Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Sheroz Khan, Jalal Chebil & Othman Khalifa: Principles of Transducer Devices and Components

ISBN: 978-967-418-172-7

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM (Malaysian Scholarly Publishing Council)

#### Printed By:

#### HUM PRINTING SDN.BHD.

No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan

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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.

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

Where,

C= Capacitance of the capacitor

 $\varepsilon$ = Dielectric constant or permeability

 $\in_r$ =Relative dielectric constant

 $\in_{a}$ = Free space dielectric constant

x =distance between the plates [m]

 $A = \text{area of the plates } [\text{m}^2]$