INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION

Edited by

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Anis Nurashikin Nordin, International Islamic University Malaysia

IIUM PRESS

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Sheroz Khan, AHM Zahirul Alam & Anis Nurashikin Nordin: Interfacing Electronic for Measurement, Signal Processing and Wireless Communication.

ISBN: 978-967-418-171-0

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

Printed By:
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
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Chapter 1

INDUCTIVE SENSOR

ATIKA ARSHAD, RUMANATASNIM, SHEROZ KHAN, AHM ZAHIRUL ALAM

Due to the simplicity in construction, inductive sensors can be manufactured directly by a user. Among the existing inductive sensors the most typical inductive sensors are inductive proximity sensor, linear displacement sensor, position sensor, flow sensors, pressure sensors etc. Alternative names for induction coil sensors are search coils, pickup coils or magnetic loop sensors.Some special type of coil sensors includes rogowski coil, gradiometer sensors, vibrating coil sensors and tangential field sensors. Studies have analysed different properties of coil sensors and researchs have help to develop innovative techniques for processing output signal. Inductive sensor is constructed based on the concept of inductor. The change in the geometrical dimensions of an inductor or a change in the position of the core, produces changes in the inductance of an inductor, and hence a change in the voltage appearing across it. This property makes an inductor to be used as an inductive transducer.

1.1. INDUCTOR CONSTRUCTION

The inductance of an inductor varies with its physical dimension, the number of turns the inductor is made of, and its construction. The inductor is composed of a coil of copper wire wounded around a non-conductive core whose material can be either magnetic or non-magnetic. Inductance for inductors of different geometrical dimensions can be derived from electromagnetic theory and the related formulas are shown below.

(i). The Basic inductance formula can be given by

$$L = \frac{\mu_0 \mu_r N^2 A}{l} \tag{1}$$

Where:

L = Inductance in henries (H)

μ_0 = permeability of free space = $4\pi \times 10^{-7}$ H/m

μ_r = relative permeability of core material

N = number of turns

A = area of cross-section of the coil in square metres (m^2)

l = length of coil in metres (m)