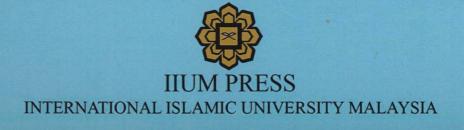
## INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION



Edited by

Sheroz Khan, International Islamic University Malaysia AHM Zahirul Alam, International Islamic University Malaysia Anis Nurashikin Nordin, International Islamic University Malaysia



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Anis Nurashikin Nordin, International Islamic University Malaysia



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#### Chapter 17

### MATHEMATICAL MODEL FOR CONTACTLESS MEASUREMENT

NURUL ARFAH BINTI CHE MUSTAPHA, AHM ZAHIRUL ALAM, SHEROZ KHAN

#### 17.1. INTRODUCTION

A contactless transmission is analysed in order to explain how it could become a candidate to replace the traditional cable connections across narrow gaps or cavities. Due to its better performance, the resonant sensor is chosen to develop the measurement system. Changes in the impedance of the test coil are made to reflect the changes in the capacitance of the sensor circuit and magnetically coupled to the test coil. Also the distance changes between the readout circuit and the sensing circuit related to the leakage flux lines is analyzed. The proposed model has two parameters; parasitic capacitance and the changes of couple and leakage fluxes. In (Daniele, Emilio, Mauro & Andrea, 2008), the frequency range of the system is up to 40 MHz. As a solution to these problems, this chapter discusses an analysis of a telemetry system that is based on the coupling of two planar coils. A capacitive transducer is connected to the first one, whereas an impedance analyzer is connected to the second one; the distance between the two coils can change. On the readout coil, an equation for the impedance is derived using simple circuit analysis concepts to show the frequency component at which the resonance is taking place. With these equations in hand, the relation of these frequencies with the system parameters is mind to be studied. This is done by obtaining simulation results that could be confirmed by experimental results.

#### 17.2. CIRCUIT DESCRIPTION

An analysis of an effect of a coupled and leakage fluxes between two normal inductor coils of a normal telemetric system is studied. The circuit of Fig. 17.1 is the commonly used model to analyze the telemetric systems due to limitation from the presents of parasitic capacitance and the distance between readout circuit and sensing circuit can change due to practical use.

#### 17.3. THEORY AND DERIVATIONS

The derivation of the circuit is as below: