

# SELECTED TOPICS IN ADVANCED ELECTRONICS

Edited by  
Khalid A. S. Al-Khateeb



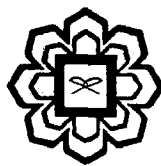
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## CHAPTER 5

### MEMS CAPACITIVE ULTRASONIC TRANSDUCERS

By

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#### **Synopsis**

Capacitive Micro-machined Ultrasonic Transducers (CMMUT) is a new type of transducers that can be used to transmit and receive ultrasonic signals in medical scanners and a variety of other applications. The behavior of (CMMUT) can be investigated based on a model of an equivalent circuit by which the characteristics are predicted. The simulation can be carried out using microwave office simulator. The various elements of the equivalent circuit and the signals produced by the (CMMUT) are discussed along these lines with results as shown in the sections below.

#### **1. Basic Principle of (CMMUT)**

The CMMUTs can be operated in a transmit or a receive mode. As a transmitter the CMMUT is capable of generating ultrasonic waves and as a receiver it can detect their echo. Figure 1 shows a CMMUT. It is actually a parallel-plate capacitor with top and bottom electrodes. A static voltage causes the membrane to be attracted towards the substrate by Coulomb forces. An AC voltage superimposed on the DC, causes the membrane to vibrate in response to the signal. Ultrasonic waves can also be generated by making the capacitor part of a tuned resonant circuit.