AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Electronics Engineering and Electrical Communications

The Design of Interface Circuits for MEMS Sensors

A Thesis submitted in partial fulfilment of the requirements of
Master of Science in Electrical Engineering
(Electronics Engineering and Electrical Communications)

by
Alaa Mohamed Safwat Mahmoud Abu Baker
Bachelor of Science in Electrical Engineering
(Electronics Engineering and Electrical Communications)
Faculty of Engineering, Ain Shams University, 2011

Supervised By
Prof. Dr.Mohamed Amin Dessoki
Dr.Ayman Hassan Abd El-Aziz Hassan Ismail

Cairo, 2018

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Examiners' Committee

Name and affiliation	**Signature**
Prof. Dr.El-Sayed Mostafa Saad Electronics & Communications Engineering Dep Faculty of Engineering, Helwan University.	.....
Prof. Dr. Khaled Wagih Sharaf Electronics & Communications Engineering Dep Faculty of Engineering, Ain Shams University.	.....
Prof. Dr. Mohamed Amin Dessouky Electronics & Communications Engineering Dep Faculty of Engineering, Ain Shams University.	.....

Date:24/11/2018

Statement

This thesis is submitted as a partial fulfillment of Master of Science in Electrical Engineering, Faculty of Engineering, Ain shams University. The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Name: Alaa Mohamed Safwat Mahmoud Abu Baker

Signature

.....

Date: 24/11/2018

Researcher Data

Name:Alaa Mohamed Safwat Mahmoud Abu Baker
Date of Birth: 22/10/1988
Place of Birth: Cairo, Egypt
Last academic degree: Bachelor of Science in Electrical Engineering
Field of specialization:Electronics Engineering and Electrical Communications
University issued the degree :Ain Shams
Date of issued degree : June 2011

Abstract

Faculty of Engineering – Ain Shams University
Electronics and Communication Engineering Department

Thesis title: **" The Design of Interface Circuits for MEMS Sensors "**
Submitted by: **Alaa Mohamed Safwat Mahmoud Abu Baker**
Degree: **Master of Science in Electrical Engineering**

Abstract A new energy-efficient dual-slope capacitance-to-digital interface circuit is proposed. The proposed interface circuit is a general purpose interface that can be adapted for multi-sensors IOT applications. This interface utilizes a new iterative charge sharing technique, which can be easily configured for different capacitive sensor ranges. The interface employs a switched capacitor circuit followed by a low-power dynamic comparator and a digital controller with a counter to generate the digital output, corresponding to the input capacitance of the sensor. The simplicity of the proposed capacitance-to-digital converter(CDC) architecture leads to an energy efficient interface. Detailed analysis of the proposed CDC architecture with emphasis on the linearity, conversion time, and noise are presented and verified by the simulation. The proposed CDC achieves a resolution of 8.4 bit 1.56pJ FOM for a capacitor sensor range of 8pF and a supply voltage of 1.2V in 0.18μm CMOS technology node.

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Alaa Mohamed Safwat Mahmoud Abu Baker
Electronics and Communication Department
Faculty of Engineering
Ain Shams University
Cairo, Egypt
November 2018

Thesis Summary

Summary

The thesis is divided into Five chapters as listed below:

Chapter 1

Chapter 1 provides the introduction, motivation, and objective of this work

Chapter 2

Chapter 2 covers different types of MEMS capacitive sensors with state of art capacitance to digital interface circuits with emphasis on the advantages and disadvantages relative to the proposed capacitance to digital interface circuit

Chapter 3

Chapter 3 provides the introduction for the proposed CDC system, with system and circuit analysis for the proposed system.

Chapter 4

Chapter 4 gives the circuits implementation and simulation results for the proposed capacitance to digital converter using equations determined in the chapter 3, Also the achieved performance parameters for the proposed system is compared with state of art capacitance to digital converters.

Chapter 5

chapter 5 provides the conclusion of the work, and future work.

Key words: Capacitance to digital converter (CDC)

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