SELECTED TOPICS IN ADVANCED ELECTRONICS

Edited by

Khalid A. S. Al-Khateeb

IIUM Press

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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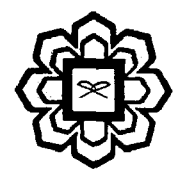

IIUM Press
International Islamic University Malaysia
2011

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Khalid A. S. Al-Khateeb: Selected Topics in Advanced Electronics

ISBN: 978-967-418-153-6

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
68100 Batu Caves
Selangor Darul Ehsan
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CONTENTS

CHAPTER 6

DESIGN OF MEMS CANTILEVER ENERGY HARVESTER

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Synopsis

This chapter introduces an analytical model of a microelectromechanical systems (MEMS) piezoelectric vibration based energy harvesting. The analytical model of a piezoelectric energy harvester is important not only to predict the amount of power produced but also to give some idea on how to improve the performance. One of the methods to model piezoelectric elements is to model both the mechanical and electrical properties of the piezoelectric system as circuit elements in an equivalent circuit model. From the equivalent circuit, circuit analysis was done using Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL). Detailed derivation was done to transform the circuit into the usable mechanical system model. Equivalent circuit simulation result using P-Spice was also presented in this chapter.

1. Introduction

Vibration based energy harvesters have become significantly popular due to the growing demand of wireless sensor networks which need miniature, portable, long lasting and easily recharged sources of power [1]. Usage of hazardous electrochemical batteries is no longer an option to power up the densely populated nodes due to their bulky sizes and high battery replacement cost [1]. The viability of piezoelectric MEMS vibration energy harvester offers a more promising solution. A piezoelectric energy harvester demonstrates the direct piezoelectric effect transforming mechanical vibration into electrical energy. Cantilever structure with proof mass at the end is the most attractive