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# Modelling integrated passive structures for power converters

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# Modelling Integrated Passive Structures For Power Converters

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A dissertation submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree Master of Science in Engineering.

# Declaration

I declare that this dissertation is my own unaided work. It is being submitted for the degree of Master of Science in Engineering at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree nor examination at any other university.

Signed on _____ day of _____ 2013

_____

Adrian Floor

# Abstract

Integrated architectures for power electronic circuits have been a subject of recent interest. Integration offers several benefits such as reliability, control on parasitic elements related to discrete components, and ease of manufacture. The main objective of this particular research has been to contribute towards effective modelling of integrated passive circuits operating in power electronic circuits.

Integrating passive components in one distributed space can be difficult to understand, and hence to design. Field electromagnetics is often unwieldy for a power electronics circuit designer, so a SPICE-like circuit simulator is often an effective design environment. This dissertation closely examines both lumped and distributed SPICE-compatible models.

Four SPICE-compatible models have been investigated by comparing them with an analytical distributed solution. This analytical solution is used to thoroughly derive the causes of all resonance points, as well as impedances at low/high frequencies; which are the important factors that characterize the integrated passive. This analytical solution is only implemented in a narrow range of boundary conditions; hence the SPICE-compatible methods must be developed, since SPICE then handles the algorithmic work of handling the more complicated boundary conditions found in power electronics.

# Table of contents

1. INTRODUCTION

*1.1. Introduction to power converter circuits*

*1.2. Integrated architectures for passive components in power converters*

1.2.1. *Planar passive structure*

1.2.2. *Motivation for integrated architectures*

*1.3. Aim of this study defined in the context of modelling integrated passives*

1.3.1. *Brief introduction to current modelling methods for integrated passives*

1.3.2. *Modelling dilemma: Lumped vs. Distributed*

1.3.3. *Outcomes of this study*

2. DESCRIPTION OF MODELS FOR INTEGRATED PASSIVE STRUCTURES

*2.1. Lumped models*

2.1.1. *Reeves and Murgatroyd models*

2.1.2. *Higher-order lumped models*

2.1.3. *Cascaded lumped model*

*2.2. The Multiconductor Transmission Line (MTL) model*

2.2.1. *Mathematical model of distributed circuit*

2.2.2. *Theoretical conditions for valid use of MTL*

2.2.3. *Zhao's solution for a two-conductor L-C cell*

2.2.4. *Paul's F-domain solution for general MTL*

2.2.5. *SPICE macromodel*

2.2.6. *Other time domain solution methods*

2.2.7. *Limitations found in the MTL solution methods*

3. INTEGRATED PASSIVE STRUCTURE WITH SIMPLE BOUNDARY CONDITIONS IN THE FREQUENCY DOMAIN

*3.1. Technique for comparing models*

3.1.1. *Order of comparison: flow of thought*

3.1.2. *Validation step: Consistency between SPICE and Mathematica solutions – Lumped models*

3.1.3. *Default structure parameters used in solution of models*

## *3.2. Lumped models vs. Zhao's distributed model*

3.2.1. *At high coupling*

3.2.2. *Critique of Zhao: Propagation velocity => electrical length*

3.2.3. *At low coupling*

3.2.4. *Conclusion of comparison between lumped and Zhao models*

## *3.3. Cascaded lumped model vs. Zhao*

## *3.4. Modal macromodel vs. Zhao*

3.4.1. *Effect of self-capacitance*

3.4.2. *Comparison for different loads*

3.4.3. *At low coupling*

3.4.4. *Conclusion*

# 4. INTEGRATED PASSIVE STRUCTURE WITH SIMPLE BOUNDARY CONDITIONS IN THE TIME DOMAIN

## *4.1. Background*

4.1.1. *Simulating the step response*

4.1.2. *Understanding the input signal*

4.1.3. *Types of signal components in step responses*

## *4.2. Step response using modal macromodel*

4.2.1. *Short circuit load*

4.2.2. *Open circuit load*

4.2.3. *Capacitive load*

4.2.4. *Inductive load*

4.2.5. *10-cell cascaded model vs. modal macromodel*

## *4.3. Effect of changing structure parameters*

4.3.1. *Short circuit load*
4.3.2. *Convergence problems*
*4.4. Discussion*
5. PRACTICAL CASE: FLYBACK CONVERTER
*5.1. Introduction to the flyback converter circuit*
5.1.1. *Operation principle of a flyback*
5.1.2. *Typical parasitic effects*
*5.2. Planar passives construction and its physical constraints*
5.2.1. *Integrated passive structure for a flyback converter topology*
*5.3. Time domain simulation of the flyback*
5.3.1. *Time domain simulation setup*
5.3.2. *Results*
5.3.3. *Convergence problems in the modal decomposition macromodel*
*5.4. Physical measurements*
5.4.1. *Flyback with a wire-wound coupled inductor*
5.4.2. *Flyback with planar coupled inductor*
5.4.3. *Reconciliation of physical measurement and simulation results*
*5.5. Integrating the load DC bus capacitor*
5.5.1. *Physical constraints: technological and electromagnetic limits*
5.5.2. *Increasing L and C*
6. CONCLUSION