QUAD POLARIZATION WIDEBAND SINUOUS ANTENNA ELEMENTS AND ARRAYS

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DECLARATION

I hereby declare that the thesis is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.

Ramanan Balakrishnan

2nd February 2015

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0}$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial B}{\partial t}$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$$

and there was light

Acknowledgment

Let's thank some people here.

Contents

Abstract

A section to summarize the main contributions of this thesis.

List of Tables

List of Figures

List of Symbols

λ	wavelength
ϵ_r	relative dielectric constant
k	wave number, defined as $2\pi/\lambda$

List of Abbreviations

IEEE	Institute of Electrical and Electronics Engineers
PASS	Phased Array System Simulator
RF	Radio Frequency

Chapter 1

The basics

And so it begins ...

1.1 A simple section

A citation [1]. Here is another citation [2].

1.1.1 A sub-section

Some more text here.

Chapter 2

Figures, sub-figures and more

Chapter 3

Let's talk tables

A simple table, with my personal tastes on borders and widths is shown below.

Table 3.1
Sequential modes in four-arm sinuous antennas.

Mode number	Port 1	Port 2	Port 3	Port 4
M_{-2}	0°	−180°	0°	−180°
M_{-1}	0°	−90°	−180°	−270°
M_{+1}	0°	90°	180°	270°
M_{+2}	0°	180°	0°	180°

All the usual features of LaTeXare possible, such as merging cells, wrapping / aligning text etc ...

Table 3.2
Role of design parameters in sinuous antennas.

Parameter	Denotes	Typical values	Role
N	Number of arms	4, 6, 8	Determines the number of modes obtainable.
R_1	Outer radius	$\frac{\lambda_L}{2\pi}$ to $\frac{\lambda_L}{3\pi/4}$	Sets the lower frequency limit.
τ	Growth factor	0.6 to 0.9	Controls the ratio between adjacent cells and number of cells given a fixed size.
α	Angular span	22.5° to 90°	These two parameters together control the angular span, interleaving and input impedance of the antenna.
δ	Angular spacing	11.25° to 45°	

Finally, a large table, represented in landscape mode is shown in the next page.

Table 3.3
Review of performances of various broadband antennas.

Aspect	Dipole-based designs (biconical, discone, ...)	LPDA	Spiral	Sinuous
Frequency bandwidth	Typically max at around two octaves.	Comparable to dipole-based designs, extendable by increasing elements.	Ratios of up to 40 : 1 are possible.	Ratios comparable to spiral designs.
Multiple Polarization	Only possible if crossed elements are added.	Only possible if crossed elements are added.	Possible with cavity-backing.	Possible with reconfigurable feed network.
Planar	Planar versions possible with maximum extents of order $\lambda/2$.	3-D array of dipole ($\lambda/2$) sized elements with maximum extent determined by required bandwidth.	Planar versions possible with extent of order of λ	Planar versions possible with extent of order of λ
Radiation pattern	Cavity required for unidirectional radiation.	Cavity not required for unidirectional radiation.	Cavity required for unidirectional radiation.	Cavity required for unidirectional radiation.

Chapter 4

Equations and code

Bibliography

[1] D. R. Hofstadter, *Godel, Escher, Bach: An Eternal Golden Braid.* New York, NY, USA: Basic Books, Inc., 1979.

[2] R. Balakrishnan, K. Mouthaan, I. Hinostroza, and R. Guinvarc'h, "Dual-circular polarized planar array of connected sinuous antennas," in *Antennas and Propagation Society International Symposium (APSURSI), 2014 IEEE*, July 2014, pp. 941–942.