AIR UNIVERSITY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

BACHELOR OF ELECTRICAL ENGINEERING

TITLE OF THE FINAL YEAR PROJECT IN AU

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Supervisor:
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Acknowledge

UNDERTAKING this final year project has been a truly life-changing experience for me and it would not have been possible to do without the support and guidance that I received from many people. First and foremost, I would like to thank my supervisor xxx, who has constantly encouraged me to strive for excellence in my career. He has been a continual source of inspiration for me, and has exceeded the call of a supervisor in every possible respect. He is an exceptional scientist, mentor, and friend. Without his guidance and constant feedback this FYP would not have been achievable.

My special thanks to my group mate Sarah for the stimulating discussions, for the sleepless nights we were working together before deadlines, and for all the fun we have had in the last three years. I also wish to thank my colleagues Ali, Ahmed and all others. I shared with them the joys and the sorrows of the Politecnico di Milano; and thanks to them and to their support, moral and technical, which I am here today to write these thanks.

Abstract

THE final year project is focused on terahertz imaging using novel source antenna designs in order to study material characterization of objects in both frequency and time domain. Initially, a novel shaped horn antenna is designed to improve the spot focusing characteristics at terahertz frequencies. A waveguide-horn-waveguide structure scheme is used to model a horn antenna in order to avoid lens correction over horn apertures, usually needed to enhance the spot focusing. The horn antenna is designed and simulated with an accurate proprietary Body-of-revolution Finite-Element code and fed by circular waveguide operating at TE11 mode. The performance of designed antenna is compared with similar lens corrected horn antenna applied to near field frequency domain material characterization. Comparison study highlighted that, the shaped horn provided better spot focusing as compared to lens corrected horn antenna for similar terahertz frequencies. Time domain analysis of the designed is in progress and initially good agreement is found between calculated and simulated material properties in single layered medium.

The future work of this research is to evaluate the theoretical work in terms of measurement within a system at a terahertz lab facility. The time domain analysis in multiple layered medium is also planned to be experimented depending on the available resources. The possible applications of this research are biomedical imaging for detection and diagnoses of cancer, non-destructive testing of structural defects in objects, security scanning at airports and communication systems with ultra-high data rates.

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CHAPTER 1

Introduction

1.1 Introduction

Remember that wherever you want you can cite with `\cite{a1}` [**?**], [**?**] and/or [**?**] someone. Or use `\footnote{That's a footnote}` like this[1]

1.2 Imaging Systems

You can insert a definition

Definition 1.2.1. *AU: Air University*

1.3 Movivation and Aim of the Project

1.3.1 And a subsection

In this sub section I will include many images just to make the list of figures meaningful.

[1] That's a footnote

Figure 1.1: *Caption of this image.*

1.4 Road Map

1.4.1 And also many sub

Or again more nested

- item 1
- item 2
- item 3

CHAPTER 2

Background

2.1 Introduction

Remember that wherever you want you can cite with `\cite{a1}` [**?**], [**?**] and/or [**?**] someone. Or use `\footnote{That's a footnote}` like this[1]

2.2 New section

You can insert a definition

Definition 2.2.1. *AU: Air University*

2.3 Another section

2.3.1 And a subsection

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[1] That's a footnote

Figure 2.1: *Caption of this image.*

2.4 New section

2.4.1 And also many sub

Or again more nested

- item 1
- item 2
- item 3

2.5 New section

This is an example of table. You can see it in Table 5.1.

Table 2.1: *Table caption*

Col 1 Dim C.1	Col 2 Dim C.3	Col2 Dim C.3
Data 1.1	Data 1.2	Data 1.3
Data 2.1	Data 2.2	Data 2.3
Data 3.1	Data 3.2	Data 3.3

2.6 You can do as many section as you want

The following equation has been created using $$: $y_1 = a * x + b$.
This is a more complex equation:

$$y_2 = a * x + b$$

, created using `\[ \]`

This is, (5.1), an enumerated equation:

$$y_3 = a * x + b \tag{2.1}$$

, created using:

```
\begin{equation}\label{eq:eeq1}
    y_3 = a*x + b
\end{equation}
```

CHAPTER 3

Simulations

3.1 Introduction

Remember that wherever you want you can cite with `\cite{a1}` [**?**], [**?**] and/or [**?**] someone. Or use `\footnote{That's a footnote}` like this[1]

3.2 New section

You can insert a definition

Definition 3.2.1. *AU: Air University*

3.3 Another section

3.3.1 And a subsection

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[1] That's a footnote

Figure 3.1: *Caption of this image.*

3.4 New section

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- item 1
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, created using:

```
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    y_3 = a*x + b
\end{equation}
```

CHAPTER 4

Measurements

4.1 Introduction

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4.2 New section

You can insert a definition

Definition 4.2.1. *AU: Air University*

4.3 Another section

4.3.1 And a subsection

In this sub section I will include many images just to make the list of figures meaningful.

[1] That's a footnote

Figure 4.1: *Caption of this image.*

4.4 New section

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- item 1
- item 2
- item 3

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, created using:

```
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    y_3 = a*x + b
\end{equation}
```

CHAPTER 5

Conclusions

5.1 Introduction

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You can insert a definition

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