DOs and DON'Ts
In Engineering
Report / Thesis / Paper Writing

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KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Dhahran, Saudi Arabia

50

خمسون عاماً من الريادة والتميّز

Fifty Years of Leadership & Excellence

PRESENTATION SCOPE

- Writing Essentials …
- Common Mistakes …
- DOs …
- DON'Ts …
- Examples …
- Remarks …

PRESENTATION SCOPE

- **Writing Essentials …**
- Common Mistakes …
- DOs …
- DON'Ts …
- Examples …
- Remarks …

WRITING ESSENTIALS

WRITING YOUR THESIS OUTLINE

NOTHING SAYS "I'M ALMOST DONE" TO YOUR ADVISOR/ SPOUSE/PARENTS LIKE PRETENDING YOU HAVE A PLAN

STEP 1 Aim for a respectable number of chapters:

THESIS OUTLINE

1.
2.
3.
4.
5.
6.
7.

← chapter #'s

5 = "That's IT??"
6-7 = "Not bad"
8+ = "Are you crazy??"

STEP 2 Fill in the "freebies":

THESIS OUTLINE

1. INTRODUCTION
2. LIT REVIEW
3. METHODOLOGY
4.
5.
6.
7. CONCLUSIONS

You're half way done!

STEP 3 Make up titles for the "meat" chapters:

6. LIT REVIEW
3. METHODOLOGY
4. (THAT STUFF YOU DID YOUR FIRST YEAR)
5. (STUFF YOU'RE SUPPOSED TO BE DOING NOW)
6. (MAKE STUFF UP)
7. CONCLUSIONS

(It'll be years before you actually have to work on that later chapter, and by then your thesis topic will have changed anyway)

STEP 4 Voilá! You just bought yourself another two years

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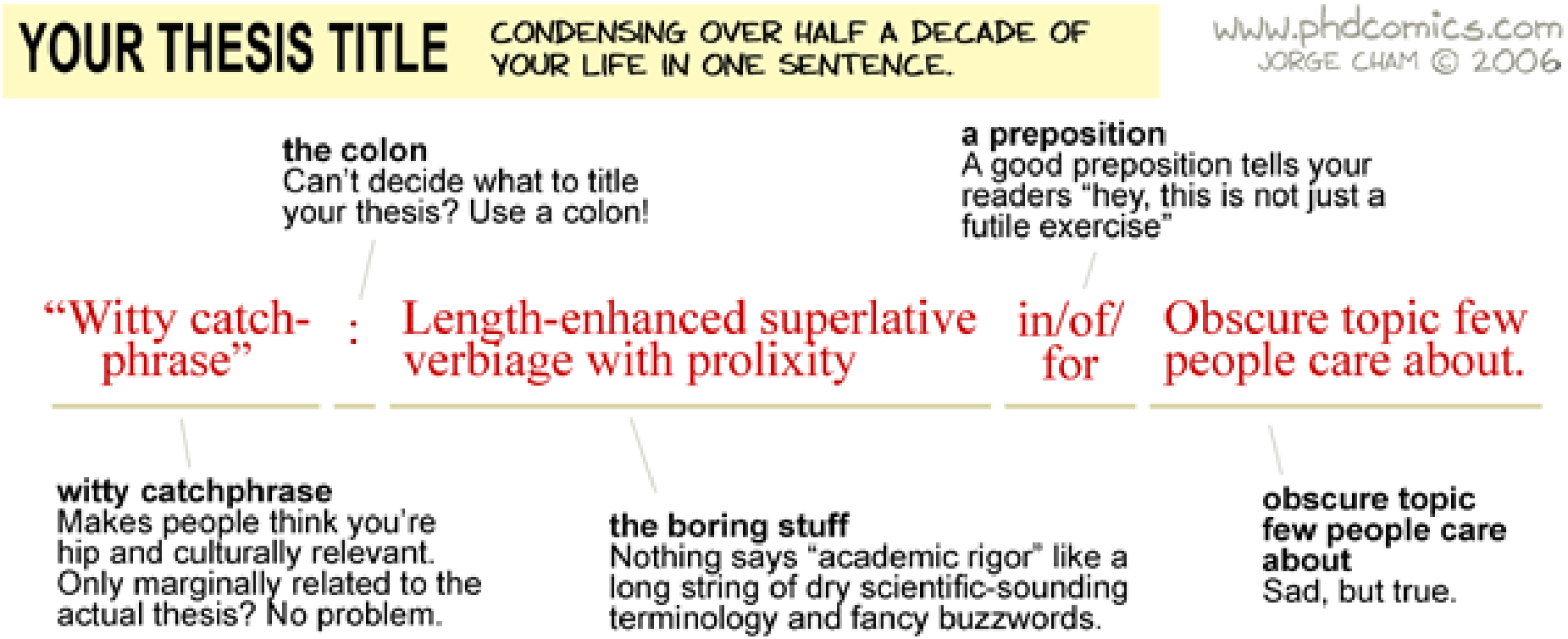

WRITING ESSENTIALS

- **The general structure of a Thesis/Report**
  - Title Page
  - Abstract
  - Introduction and Contribution Summary
  - Background and Methodology
  - Literature Review
  - Design (multiple sections/chapters … as required)
  - Results and Discussion (multiple sections/chapters … as required)
  - Conclusions
  - References

This might differ based on your work and thesis organization!

WRITING ESSENTIALS

- **The general structure of a Paper (Conference/Journal)**
  - Abstract
  - Introduction, literature review and Contribution Summary
  - Design (multiple sub-sections … as required)
  - Results and Discussion (multiple sub-sections… as required)
  - Conclusions
  - References

WRITING ESSENTIALS

A) **Abstract:**

- Should be written after you finish your report/paper

- Should highlight the contribution of your work and its importance

- Should be concise, straight to the point, clear, and without equations, figures or diagrams.

- Should not exceed one (maximum 2) paragraph(s).

Abstract MadLibs!!

This paper presents a _____ method for _____
(synonym for *new*) (sciencey verb)
the _____. Using _____, the
(noun few people have heard of) (something you didn't invent)
_____ was measured to be _____ +/- _____
(property) (number) (number)
_____. Results show _____ agreement with
(units) (sexy adjective)
theoretical predictions and significant improvement over
previous efforts by _____, et al. The work presented
(Loser)
here has profound implications for future studies of
_____ and may one day help solve the problem of
(buzzword)
_____.
(supreme sociological concern)

Keywords: _____, _____, _____
(buzzword) (buzzword) (buzzword)

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WRITING ESSENTIALS

Example:

Abstract—A 2×2 (four-element) multiple-input multiple-output (MIMO) patch antenna system is designed and fabricated for a 2.45-GHz ISM band operation. It uses complementary split-ring resonator (CSRR) loading on its ground plane for antenna miniaturization. This reduces the single-element antenna size by 76%. The total board size of the proposed MIMO antenna system, including the GND plane is $100 \times 50 \times 0.8$ mm^3, while the single-patch antenna element has a size of 14×18 mm^2. The antenna is fabricated and tested. Measured results are in good agreement with simulations. A minimum measured isolation of 10 dB is obtained given the close interelement spacing of 0.17λ. The maximum measured gain for a single operating element is -0.8 dBi.

WRITING ESSENTIALS

B) Introduction:

- Should pave the way to the reader towards your work

- Mention the importance of the general area

- show some diagrams related to the topic and its importance if in a report (not in a paper)

- Go over some features of the technology in general

- can have multiple sub-sections

WRITING

Example:

CHAPTER 1

INTRODUCTION

The need of wireless handheld devices with additional data demanding features has grown rapidly in the last few years. Some of the enabling attributes to fulfill such demands in mobile communication devices include direction finding capability, antenna reconfigurability and adaptive beam scanning. These characteristics are required in wireless handheld devices for next generation software defined radio (SDR) and cognitive-radio (CR) platforms. In addition, the higher data rate requirements and reliability of transmitted data within wireless hand-held communication devices are met by embedding multi-input multi-output (MIMO) antenna systems in such platforms [1].

The revolutionary technique of a CR (an extension of the SDR) is a method of an efficient utilization of frequency spectrum. The front end of a CR consists of two antennas, (1) an ultra wide-band (UWB) sensing antenna and (2) a reconfigurable communication antenna. Dynamically changing the basic radiating characteristic of the antenna system is termed as antenna reconfigurability. Reconfigurable antennas are able to change their operating fundamental characteristics i.e. resonance frequency, radiation pattern, polarization and impedance bandwidth. Radar systems are also utilizing CR techniques for efficient bandwidth utilization [2].

MIMO antenna systems are used to increase the capacity and reliability of the data by utilizing multiple antennas in both the transmitter and receiver ends. MIMO antenna systems with reconfigurable front ends for efficient bandwidth utilization are becoming popular in recent years [3].

Radio frequency (RF) direction finding (DF) identifies the source location based on the incoming RF signals. RF based DF schemes gained popularity in commercial applications over the past few decades. DF has a wide range of applications in military, avionics, emergency services and in wireless communication devices for cognitive radio platforms [4].

The objective of this work is to design a novel reconfigurable MIMO antenna system with direction finding capabilities for cognitive radio platforms for 4G wireless standards. All antennas (reconfigurable MIMO and UWB sensing antenna) and microwave structure for direction finding should be planar in structure for easy integration with the IC's and other low profile components so that they

Need for Wireless Devices and future Expectations.

SDR and CR and their features

MIMO …

RF Direction Finding ….

WRITING ESSENTIALS

C) Literature Review:

- Very critical to cite references

- Figures you copy from references should be cited

- Create a literature review TREE showing the classifications you made and highlight the area where your work fits

WRITING ESSENTIALS

Example:

In [30] a self-oscillating C- shaped annular antenna with integrated oscillator with VCO compatibility of 48.7MHz/V is presented shown in Figure 3.3. The AIA oscillator utilizes the parasitic capacitance of the FET transistor to load the C-shaped antenna which provides slow wave loading and reduces the resonating frequency from 6.95 to 5.65 GHz and consecutively offers miniaturization ($0.041\,\lambda_0^2$). The outer and inner ring dimension of the antenna was 3.9mm and 2mm respectively and offered high DC to RF efficiency of 25.9%, low gain of -4.6dBi, phase noise -91.93dBc/100kHz, and EIRP (Effective Isotropic Radiated Power) of 7.3dBm. The efficiency of the antenna is lower although provides very good scale of miniaturization. Again, along with the DC biasing network, the effective antenna size gets the dimension $25*25mm^2$.

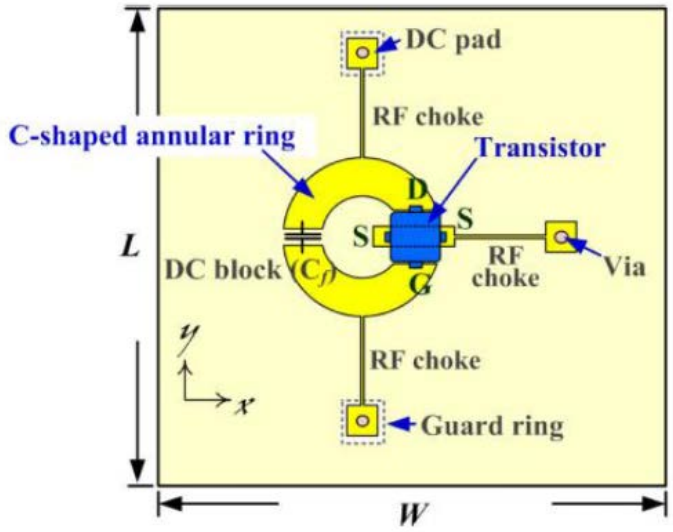


Figure 3.3 Annular Ring AIA oscillator [30]

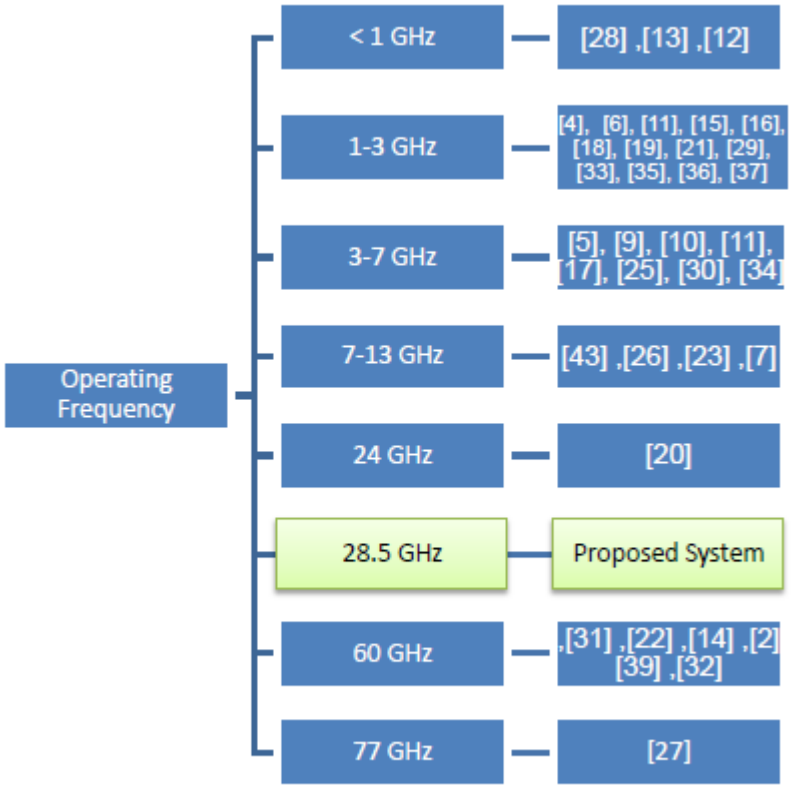


Figure 38 Classification based on operating frequency

WRITING ESSENTIALS

D) Results and Discussion:

- Figure Captions are at the BOTTOM

- Table Captions are at the TOP

- All figures, and Tables should be described in the TEXT before they are first mentioned.

- Always describe what the figure is showing, its meaning and explanation.

WRITING ESSENTIALS

Example:

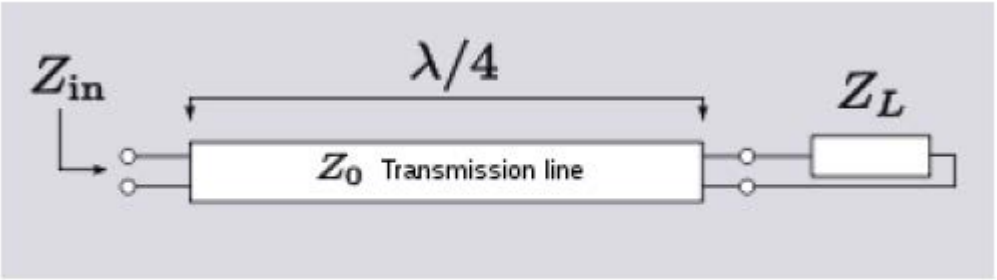


Figure 39 Quarter Wavelength Transformer

Table 1 Phase difference between output ports for 4x4 Butler

Output\Input	Beam Port-1	Beam Port-2	Beam Port-3	Beam Port-4
Array Port-5	135	45	90	0
Array Port-6	90	180	-45	45
Array Port-7	45	-45	180	90
Array Port-8	0	90	45	135
Phase Diff.	-45	135	-135	45

WRITING ESSENTIALS

E) Conclusions:

- Summaries the contributions and findings of your work.

- Not exactly the same as Abstract, but contains similar major information

- Should be several paragraphs long in a Thesis, and one paragraph in a Paper.

WRITING ESSENTIALS

Example:

VI. Conclusion

The design and analysis of an eight-element V-shaped printed circular antenna array is presented. The proposed design operates at 2.5 GHz and has been specifically catered for direction finding applications. The array is operated in switched mode (one antenna active at a time) to save cost and hardware complexity. Simulation and measurement results show a large degree of similarity. The effect of placing the antenna array on the roof of commercial vehicles has been characterized via measurements in an outdoor antenna range. The effect of the closeness of the antenna array to the roof of the car on the HPBW and maximum gain has been characterized via these measurements.

WRITING ESSENTIALS

F) References:

- Always follow IEEE Style is ALL your work, papers, reports …etc.

Example:

[12] *R. Hussain, M. U. Khan and M. S. Sharawi, "Test Paper," IEEE Transactions on Education, Vol. 1, No. 2, pp. 34-39, 2010.*

PRESENTATION SCOPE

- Writing Essentials …
- **Common Mistakes …**
- DOs …
- DON'Ts …
- Examples …
- Remarks …

COMMON MISTAKES

- **The way you layout the report/paper**
- **The way you present captions to figures and tables**
- **The way you describe figures and tables**
- **The way you write Abstracts and conclusions**

→ Pretty much …. Most of what you write has issues at the beginning! ☺

PRESENTATION SCOPE

- Writing Essentials …
- Common Mistakes …
- **DOs …**
- DON'Ts …
- Examples …
- Remarks …

DO …

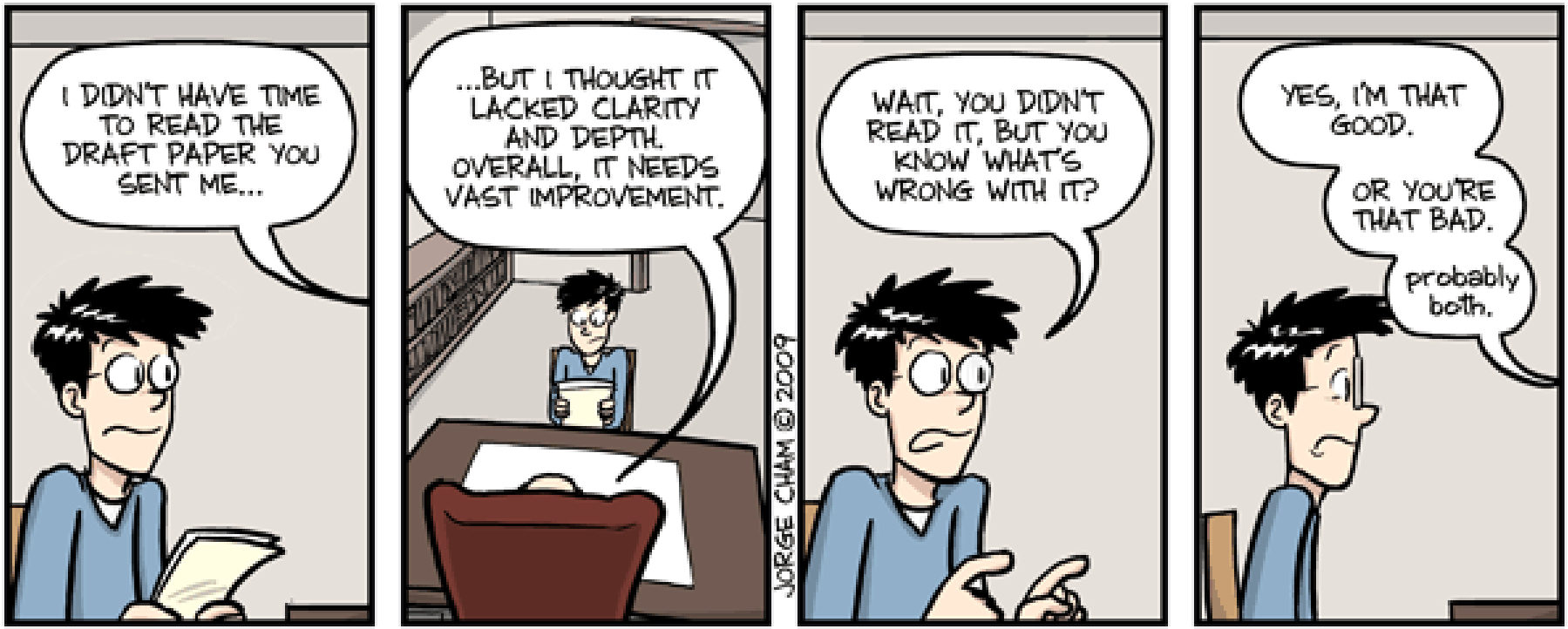
- Always Check your Figure/Table number order and match it with written text
- Always describe EACH Figure/Table you have in Text in details
- Always cite any image you use from OTHERS
- NEVER copy/paste from other works!! We can catch you … this is PLAGIARISM!! → Harsh Punishment!!

DO …

- When we provide one comment on a section to change, FOLLOW THE SAME WITH ALL OTHER SECTIONS
- In your presentation, place references related to the current slide at the end of the same slide with smaller READABLE font
- References in sequence should be grouped, i.e. [1], [2], [3], [4], should be [1] - [4].
- Equations are in ( ) (i.e. Eq. (2.3)), while references are in [ ].

DO …

- **Always define all parameters in Equations, right after the equation**
- **Always define abbreviations the first time you use them, and from that point onwards, use the abbreviated expression**



PRESENTATION SCOPE

- Writing Essentials …
- Common Mistakes …
- DOs …
- **DON'Ts …**
- Examples …
- Remarks …

DON'T …

- NEVER user different font sizes and types for the text in different sections … All should be same.
- NEVER ALTER A TEMPLATE (especially for a conference or a journal)
- NEVER IGNORE a CORRECTION given to you
- NEVER Start a section with a subsection number, always write a short paragraph describing what will be in the new section

DON'T …

- **Never place Figures/Tables next to text, always figures are placed in the middle between paragraphs**
- **Never submit your paper/thesis before reading it TWICE at least … you need to identify simple issues before submitting it to your professor! i.e. missing bookmarks, Figures, etc …**

COMMON MARKS YOU WILL SEE ON YOUR CORRECTED REPORTS/PAPERS

- // → New Paragraph
- ^ → Add text written in this position
-  → Answer this question HERE (in the box), or there is a REMARK in the box for you to take action
- (*) → Add text from this location to another location with the same mark (move text)
- [.] → Add a reference

PRESENTATION SCOPE

- Writing Essentials …
- Common Mistakes …
- DOs …
- DON'Ts …
- **Examples …**
- Remarks …

EXAMPLES

1)

The Hybrid Coupler can be built by connecting two pairs of quarter-wavelength micro strip lines of certain characteristic impedance with another pair of the same length but with impedance equal to the characteristic value divided by $\sqrt{2}$.

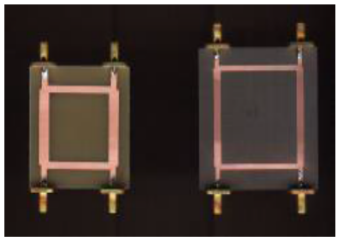


Figure 5 Fabricated Hybrid Coupler

COMMENTS on a newly submitted Proposal.

Table 6.5:Excitation phase at θ =40, φ=0..... **Error! Bookmark not defined.**

Table 6.6:Excitation phase at θ =40, φ =180..... **Error! Bookmark not defined.**03

Table 6.7 The Different States of operation For Switch Matrix..... **Error! Bookmark not defined.**

Table 6.8: The Progressive Phase For Antenna Elements in The First Case..... **Error! Bookmark not defined.**

Table 6.10: The Single Path State For Transfer Switch..... **Error! Bookmark not defined.**22

electromagnetic.

Mainly our demand to have antenna with maximum gain , smaller size with the wider bandwidth. In general, the radiation pattern that can be radiated from the antenna, gain and the operation band width can be considered as the main parameters for any antenna in any application. The organization of the chapter is as follows, Antenna parameters, Microstrip Patch Antenna, Antenna Arrays, Power Splitter/Combiner, Phase Shifters and Microcontroller (Ardino Mega 2560).

2.1 Antenna Parameters

In this section we are going to discuss the following antenna parameters ,Radiation pattern, Reflection coefficient, Return loss, Scattering Matrix, Band width and quality factor, Directivity, Gain and Efficiency.

COMMENTS on a newly submitted Proposal.

$$e_{cd} = \frac{Prad}{Pin} \quad (2.7)$$

(2.6)

So equation (6) will be

$$G = e_{cd} D \quad (2.8)$$

EX

2)

Abstract—**The design of an eight-element array of V-shaped circular printed antennas for vehicular localization is presented. The proposed antenna operates in the 2.5-GHz band with a measured bandwidth (BW) of approximately 240 MHz. The simulation results and the field measurements of a fabricated array show a high degree of correlation. For a thorough understanding of the antenna operation, parametric sweeps are conducted to investigate the effect of the various antenna parameters on its resonance frequency and operating BW. The effect of mounting the antenna array on the rooftops of vehicles is investigated, specifically its effect on the half-power beamwidth (HPBW) and maximum gain. These results are based on measurements conducted at an outdoor antenna range facility.**

Index Terms—**Circular antenna arrays, direction-finding, ISM band, microstrip antennas.**

I. Introduction

DIRECTION-FINDING (DF) systems are commonly used in military applications for target localization and determining the position of signal sources. DF systems are also used in commercial and civil applications to track and locate tagged animals for constant behavioral studies and locating people buried under rubble during earthquakes or other catastrophes [1].

An emerging application of DF systems is for vehicle localization in parking lots. Devices based on the Global Positioning System (GPS) have proved highly effective in open-air parking lots [2], but useless in multistory or covered parking garages. Radio frequency (RF)-based DF systems can be used in such parking structures. In [3], a comparative performance analysis of three RF-DF methods was conducted in parking garages. Antenna arrays of four and eight elements were used, with controlled directional radiation properties. The radiation patterns were specified within the modeling tool without actual antenna design. It was shown that power-based methods provided better performance than phase-based ones in parking garages.

For power-based vehicular localization DF systems, an antenna array that can cover the complete azimuthal plane (360°) is required. This can be accomplished using an eight-element circular array operating in a switched mode where each element covers one sector of 45° in the plane. The half-power beamwidth (HPBW) of such an array element should cover one sector only to allow for proper signal direction identification.

In [4], a four-element linear phased antenna array was proposed for an automotive DF system. The beamscanning ability of this system is limited by the linear nature of the antenna and thus cannot cover more that 180°. A printed Yagi circular antenna array for RF-DF applications was p
erated in a switched mode rather than a ph
reduce the hardware cost and complexity).
sults were provided for the gain patterns. N
tioned references have considered the effe
for such an application. In [6], a 13-eleme
array is presented that requires five elements to be active at a time to steer the beam, thus a complex activation mechanism. A six-element monopole array operating at 1.5 GHz was presented in [7]. Element heights of about 60 mm are required (nonprinted), and the array is able to steer the beam into five different angles. Array diameter was approximately 90 mm. This array suffers from a very large size compared to a printed one. In [8], a HIVE-like complex and bulky metallic structure to guide the radiation patterns of several patch-like antennas was presented. The array is to be placed on the ceiling, and the beam is steered toward the elevation angle rather the azimuthal one. Switched beam antenna systems can employ a butler matrix as in [9], but such a structure will occupy a large printed circuit board (PCB) footprint. Alternatively, using some electronic components, the beamsteering via switching the elements is achieved as in [10]. This comes at the cost of extra components and hardware, also wide HPBW were reported (approximately 120°).

In [11] and [12], a novel printed V-shaped circular antenna array was proposed for direction-finding applications. The array operated in the 2.5-GHz band, and mainly simulation results were presented with no discussion on the effect of the various design parameters or the effect of the GND plane representing the roof of a vehicle.

This letter extends the initial work in [11] and [12] and presents the design of an eight-element V-shaped printed circular array antenna for RF-DF applications operating in the 2.5-GHz band. The array is to operate in a switched-mode fashion, i.e., one element is active at a time in a rotating manner. The designed antenna was fabricated, and the measurements correlate closely with simulations. The radiation gain patterns were measured at an outdoor antenna range. A parametric study of the effect of the antenna design parameters is presented. In addition, the effect of the ground plane, modeling the roof

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Color versions of one or more of the figures in this letter are available online at http://ieeexplore.ieee.org.

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Final Version of an ACCEPTED Journal paper

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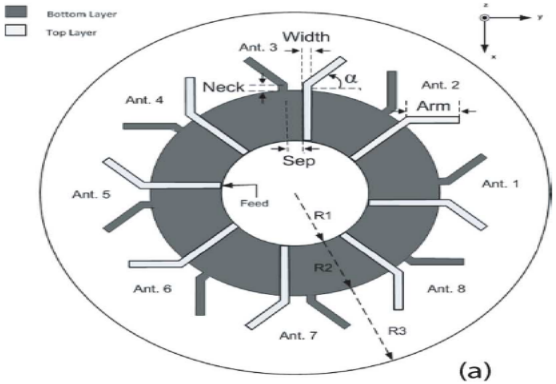

Fig. 1. (a) Geometry of the proposed eight-element V-shaped circular antenna array. Dark region is the bottom (ground) side of the PCB. (b) Fabricated prototype.

of a car, was studied, and comparisons between the radiation pattern measurements at two different antenna heights (above the ground plane) are discussed.

II. V-Shaped Antenna Array Design

The geometry of the designed V-shaped printed circular antenna array is shown in Fig. 1(a). Extensive HFSS simulations were performed to study the effects of the different design parameters on the operating characteristics of this antenna and optimize its performance. An FR-4 substrate with an $\epsilon_r = 3.8$ and thickness of 0.8 mm was used in all the simulation models. The eight antenna elements (ports) have been numbered arbitrarily from 1 to 8, and the naming convention shown in Fig. 1(a) will be followed in the rest of this letter.

The dimensions of the antenna array are (in millimeters): R1 = 25, R2 = 45, R3 = 100, Arm = 20, neck = 3, Width = 1.5, Sep = 7 and $\alpha = 30°$. A top view of the fabricated antenna is presented in Fig. 1(b). The dark elements and the circular ground plane are on the bottom side of the PCB, while the white arms are on the top side. It should be noted that the outer radius of 100 mm can be reduced to 80 mm without significant performance degradation.

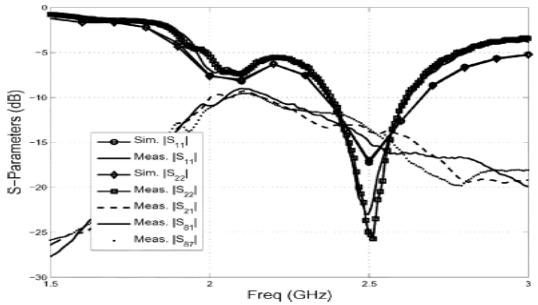

Fig. 2. Measured (meas.) and simulated (sim.) reflection coefficient and coupling curves for several array elements.

TABLE I
Comparison of Simulated and Measured Data for the Array Excited Without Ground Plane

Element	f (GHz)		BW (MHz)		$\lvert S_{11}\rvert$ (dB)	
	Sim	meas	Sim	Meas	Sim	Meas
1	2.5	2.51	304	240	-17.3	-25.7
2	2.5	2.51	300	238	-17.0	-25.3
3	2.5	2.51	300	240	-17.1	-25.6
4	2.5	2.5	301	235	-16.9	-26.3
5	2.5	2.51	300	233	-17.1	-26.2
6	2.5	2.51	302	240	-17.7	-25.6
7	2.5	2.5	301	235	-17.2	-25.2
8	2.5	2.51	301	238	-17.8	-25.8

III. Performance Results: Simulations Versus Measurements

Each port of the antenna array was tested individually using an Agilent HP8510C vector network analyzer. Each of the eight ports of the array was excited individually, while were terminated with 50 Ω. Since there are eight spanning 360° in the azimuth plane, each eleme rective radiation pattern along its azimuthal dire ering a sector of 45° (i.e., element 1 is directe element 2 toward 135°, and so on). Simulatio compared against measured values. For all ele nant frequency of about 2.5 GHz and approxima −10-dB BW were measured. Fig. 2 shows the reflection coefficient curves ($|S_{11}|$, $|S_{22}|$) as well as the measured coupling ($|S_{21}|$, $|S_{81}|$ and $|S_{87}|$) curve for elements 1 and 2. Table I summarizes the results.

Examining the values within the table, good correlation can be observed between simulated and measured parameters. The measured BW is believed to be reduced due to the fabrication process, the presence of the SMA connectors, and the hand soldering of the connectors to the feeds of the antennas.

IV. Parametric Study of the Printed V-Shaped Antenna Element

The proposed printed V-shaped antenna array is the first to appear in literature in this configuration and for this application. Unlike the one in [13], which covers wire-based V-shaped antennas in air, the proposed one is more compact and covers higher frequency bands. In order to understand the effect of the antenna design parameters on its operation, a comprehensive

Final Version of an ACCEPTED Journal paper

PRESENTATION SCOPE

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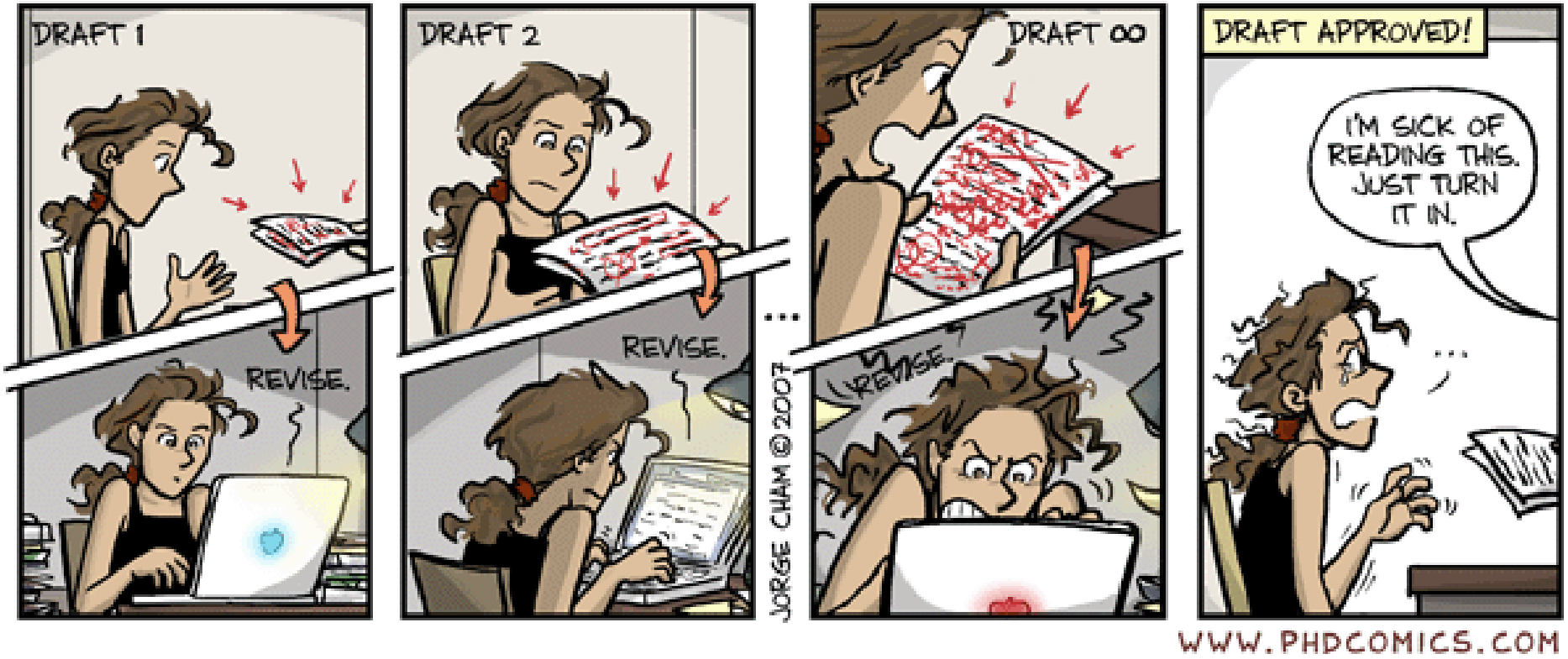
REMARKS

- **Becoming a good writer needs practice and time**

  → Be patient and focus

- **Becoming a good writer comes with being a good reader (a good reader will catch the way article, reports, papers and books are written, and then he can imitate the style)**
- **It is natural and OK to <u>have 5 corrected versions of your first paper/report</u>**
- **It is expected that the mistakes you make the first time to be avoided in ALL FUTURE WRITUPS!**

THE END!!!



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