Ministry of Higher Education and Scientific Research

University Mohamed Boudiaf of M'sila

Faculty of Technology

Department of Electronics

Degree: Master's Degree

(Cycle: Master 2)

Course Material

Documentary Research and Thesis Design

By: Pr. Oudira Houcine

Academic Year:

Documentary Research and Thesis Design

Table of Contents

Preamble

The writing of a Master's degree thesis represents the final stage of a student's university education. The thesis serves as the means of evaluating the student's work. This document should reflect the author's effort, personality, style, dedication, etc. In other words, the members of the jury will evaluate the candidate's potential based on their written work. Writing a thesis is not an easy task; it requires a significant amount of effort, investment, dedication, and attention from the author. Sentence formulation, logical arrangement of arguments, structuring of the dissertation, and overall document presentation are all elements that highlight the rigor of the student's work. Writing sentences within the framework of a thesis is not the same as writing a simple essay. It demands more reflection, knowledge, and mastery of the subject from the student.

The author of the dissertation is required to present in a few pages the writings of other authors, along with the results they have obtained after years of research. This approach requires flexibility, an open mind, and analytical skills that allow the author to avoid simply compiling the work of others. It necessitates critical thinking to frame the study properly. Writing a dissertation calls for critical thinking and synthesis. It's evident that the research topic of a dissertation falls within a domain that has already been researched by others. The student's research contributes to explaining or advancing research in a specific area. Research becomes more intriguing when the research topic has not been addressed by other researchers. Many researchers indeed work on the same topic but approach their analyses from different angles. The student must synthesize the preceding research to properly frame their work. Not all research can be included in the dissertation, which forces the author to focus on the most important research related to the topic. In addition to the various thoughts of multiple authors on the subject, a dissertation highlights the different works carried out by the student. The various steps that led to the choice of specific methods, approaches, and the results obtained, as well as the study's limitations, are all addressed in this document. The student is then required to analyze these results and propose new hypotheses within the context of confirming or challenging initial hypotheses, or to outline future directions, as any research work cannot claim to be exhaustive. Moreover, the student's research could be continued by others. Therefore, the dissertation reflects the student's synthesis skills, their work, and their analytical ability. It should be clear, concise, and easy and enjoyable to read.

Writing a Master's 2 dissertation corresponds to a specific level of requirement. Often, it involves composing a final dissertation, and your dissertation advisor will have relatively high expectations as a result. Firstly, the volume of a Master's 2 dissertation generally consists of no less than 50 pages. The expected analysis must be more thorough, which should be reflected quantitatively as well as qualitatively. Writing a Master's 2 dissertation is a long-term endeavor that theoretically requires several months to thoroughly delve into bibliographic research and also to have enough time to conduct field studies, thereby confirming or refuting your initial hypotheses. Writing a Master's 2 dissertation is not something that can be improvised; it requires a significant personal investment and a considerable amount of time to complete. Generally, the writing methodology for a Master's 2 dissertation will differ depending on the specialty of the degree being pursued. A professional Master's 2 and a research-oriented Master's 2 will require distinct writing

methodologies: a research-oriented Master's 2 dissertation will involve more in-depth research, which will manifest in the research approach and the required volume of pages, which should also be more substantial, approaching the process adopted for writing a doctoral thesis. In fact, it is customary to consider that a research-oriented Master's 2 student is more likely to gravitate toward pursuing a doctorate and preparing a thesis [1].

A final-year dissertation is an opportunity to reflect on a specific and current topic. The objective is to demonstrate expertise in a field that interests specialists but which they generally cannot dedicate time and method to due to constraints. The topic must be precisely delimited in terms of time periods, geographical areas, business sectors, or other relevant subdivisions. Ideally, the topic should be innovative, meaning it has not been covered before. A common mistake is to choose a broad topic. However, a topic that is too broad cannot be effectively addressed in a dissertation and prevents moving beyond generalities. On the other hand, a restricted topic provides concrete answers to questions posed while also offering a comprehensive expertise. To be accepted, the topic must be related to the student's field of study [2].

A dissertation is a formal report that provides a detailed description of original research results. This dissertation must be written according to specific standards. The work can include, without being limited to:

- An investigation aimed at discovering and/or interpreting facts.
- A challenge or revision of accepted theories or laws.
- The management and synthesis of new findings that support a conclusion, which may also be the subject of further research.

1. **Definitions:**

   a) **Scientific Method**: It is a set of rules and procedures to follow to achieve objectives and conduct scientific research. In other words, the method is defined as "the set of intellectual operations allowing the analysis, understanding, and explanation of the studied reality".

   b) **Scientific Approach**: It is an intellectual process that organizes scientific activity. It is the set of steps to follow to conduct scientific research. (It's the way to progress toward a set goal or subject.)

   c) **Methodology:** It is the set of methods and approaches specific to a particular field, adopted by specialists such as researchers, publishers, teachers, etc. to conduct scientific research.

   d) Research is:

   - A search for facts or truth on a subject.
   - An organized investigation to solve problems, test hypotheses, or develop new products.
   - Research is a systematic and logical exercise related to the study of any problem.
   - Research is an effort to find something or an effort of the mind towards knowledge.

2. Jury Expectations:

This modest manual offers a simplified methodology that can assist Master's 2 students in undertaking their research work more effectively. Let's examine the expectations of the jury members during their evaluation at the time of the dissertation defense. In their evaluation during the dissertation defense, the jury members will verify to what extent you are truly able to:

- Fully engage in a specific research area with a relevant and properly formulated topic.
- Frame your topic with a methodological approach specific to social anthropology.
- Fit into a coherent and rigorous writing plan that allows the reader to have a clear overview of your entire thesis.
- Collect a rich collection of insights through real fieldwork, emphasizing participatory observation.
- Intelligently utilize your corpus with appropriate theoretical tools.
- Properly document your work, drawing from a variety of sources of information, as evidenced by footnotes of interest and a relevant bibliographic selection.
- Present your own ideas and perform analysis in a clearly constructed argument (despite the complexity of the chosen topic).
- Display real synthesis and foresight simultaneously, for new research paths.
- Master a lively, fluent, and clear writing style, reflecting a constant concern for inventive sense in your writing.
- Present a document of 50 to 80 pages (excluding annexes) adhering to the current academic norms.
- Orally present the content of your dissertation, demonstrating both attentive listening and well-mannered responses to jury members' questions during the defense.

This eleven-point list is by no means exhaustive, but it certainly has the merit of allowing you to navigate the path you have to follow in order to design and complete your Master II Thesis within the framework of this training course. The defense of the Master II Thesis is public, before a jury of three members chaired by a professor of high rank.

3. Objectives of the methodology teaching

Students need to learn the scientific foundations of work methodology from the early years of university, why? In order to approach research work at any level:

- A simple presentation
- A research report
- A scientific publication

The approach to follow is almost universal. It is carried out by respecting the following successive steps:

1. The choice of the subject of work
2. The search for bibliographic references
3. The practical implementation of the research
4. The organization of the research report (thesis)
5. The oral presentation

The steps of a methodological approach, both during an initiation and during research, can be summarized as follows:

1. Justification of the choice of the research theme: its position in relation to recent data on the same subject makes it possible to clearly state the problem, which some also call the goal of work or working hypothesis.
2. Clear analysis of bibliographic data: this is, in a way, a summary of all the consulted literature related to the research topic. It must be limited to the subject in question; the researcher must be precise and concise in his writing.
3. Practical implementation of the work: this is the work carried out by the researcher himself; it is his purely personal part. It consists of performing a set of manipulations to access the expected outcomes or not (depending on the situation of the working hypothesis).
4. Exploitation and interpretation of the obtained results: this is a delicate and decisive part of the success of the research. Indeed, from it depends the drawing of conclusions allowing to affirm or disprove the hypotheses or questions raised by the researcher.
5. Writing the final research report: It can be considered as the definitive answer given by the student to his work. It often represents a challenge for young researchers.
6. Oral presentation of the work: this is the final stage of the research.

4. Choice of research domain and subject

To choose a research theme, the student must have as comprehensive knowledge as possible about the subject to be treated. This implies a detailed documentary reading, recent and old; recent to know what is still incomplete or unclear in the field of your research, and old to avoid repeating what has already been done. In all situations, the choice of the research theme must take into account:

- The historical background: to recall what is known about the research subject
- The situation of the research subject: is it at its beginnings or well advanced? In other words, is it current or old?
- The problem and working hypotheses: that is, among the questions that have remained unanswered until now (the whole determines the problem), the student or researcher chooses a few. These will constitute their working hypotheses.

Many Master II students still struggle to distinguish between the "choice of the research domain" and the "choice of the subject". Worse, some even go so far as to reverse the normal order of actions, starting with the "choice of the thesis subject" before worrying about the research domain only once the subject is chosen. Should you actually operate in this way? The answer is no! Because if you want to be systematic, you must naturally start with the beginning of the operation, namely the choice of the research domain. However, the difficulty here is that at this stage of

subject conception, you do not yet have enough elements to make a choice for one subject or another. Because you are only at the launch phase of your project. Faced with such a situation, what should you do? With a pen in hand, start by revisiting your various courses and try to focus your attention on passages that interest you the most. At the same time, support this rapid investigation approach with in-depth reading of specialized books on a research domain that you have already identified during the year. The objective is twofold: • To refresh your memory on certain questions in anthropology; • To gradually push you on the technical level in your choice which, at this stage, can only be provisional. From there, try to gain a clearer understanding of the emotional aspect that guides you in your choice. Two questions can serve as a guide in this operation: "How far are you willing to commit to this research domain, to the point of giving up everything to dedicate yourself to it entirely, day and night?" ; "Are you able to come up with three or four reasons within yourself that motivate your inspiration for this research domain, and if possible, would you be able to calmly discuss them with a third person?" The idea is to strengthen your emotional choice. Because you need to be strongly interested in your research domain to be willing to mobilize yourself body and soul in this direction, by giving the maximum and the best of yourself. When you are passionate, you are ready to make sacrifices, even the most difficult ones. But while emotional reasons are necessary, they are far from sufficient. You also need technical justifications as it involves research on a specific theme. This theme must be subject to a debate of ideas (even if only during the public defense of your Thesis).

5. Formulation of the problem statement

- Behind the term "problem," there is the idea of an obstacle that complicates the normal course of things.
- Confronting a problem triggers total mobilization to propose a solution to it.
- The effective solution to a problem depends heavily on the degree of understanding of its nature.
- The problem statement is a fundamental step in a thesis since it determines;

    - ✓ The orientation of the subject,
    - ✓ The ordering of tasks,
    - ✓ Experimental/Simulation work,
    - ✓ The consistency and vitality of the entire work

6. Relationship with the thesis advisor

The choice of the thesis advisor is an important step for the realization of your project. Some questions can help you during this choice:

- Does he work in the research domain that interests you? And does he master it?
- Is he qualified to supervise your research? (University teacher?)
- Is he interested in the subject you want to address?
- Did he encourage you to do research with him?
- Is he available enough to supervise you well?
- Is he serious in his role as an advisor? (Does he pay enough attention to the work submitted to him?) The role of the thesis advisor is to guide you by providing certain advice (helping

to establish the central question, providing bibliography, methodology, document review, etc.). Remember that his remarks are meant to help you rather than hinder you. But be careful not to confuse a teacher with a tutor. When you have an appointment with him, you must prepare for the interview by formulating specific questions. Get into the habit of regularly communicating with them (plan together the different stages of the work and the meetings). This can prevent unpleasant surprises (e.g., having to redo a section already written).

7. Determination of the research subject

The choice of the subject is the first fundamental step in the thesis work. Its determination depends on several things:

- The author's area of interest
- Previous readings
- Professional objectives
- Discussion with teachers
- Discussion with students who have already written a thesis

Once the research field has been defined, it is still necessary to ask yourself a number of questions before diving headlong into this work.

- Does this subject correspond what I need? (Does this subject fulfill a need?)
- Is there sufficient literature? (Sources must be accessible and manageable)
- Are the required research methods suitable for my capabilities? (The method used must be manageable)
- Can it be completed within a reasonable timeframe?
- What are the expected outcomes?
- With whom should it be carried out? It is therefore essential not to rush into a topic that seems interesting before evaluating the feasibility and placing it within a general problem. It is necessary to gather information, seek advice from competent individuals.

To better understand the research subject, the WH questions method can be used: it's a memorization technique to retain a set of simple questions that will be used to identify, specify, and delve into a subject: Who? = Who are the key figures, people involved? What? = What aspects interest me? When? = What time period is involved? Where? = Is the subject limited to a specific geographical area? How? = What approaches or perspectives need to be considered? Why? = What is the significance of the subject in the current context?

References

[1] http://blog.expertmemoire.com/methodologie-redaction-memoire/

[2] http://www.objectifgrandesecoles.com/etudiant/conseils/sujet.htm

Chapter 1
Writing a Master Thesis

1.1 Introduction

It is essential to know the target audience. Think a lot, speak a little, and write even less, as what is written is written...

A master's thesis must:

- Have a scientific nature,
- Be based on theoretical foundations,
- Follow a mandatory methodology.

1.2 Writing Structure

The writing structure is a guide that can be revised regularly. Creating a writing structure is essential because it:

- Greatly facilitates the writing process,
- Ensures coverage of key points,
- Ensures the organization of ideas,
- Ensures coherence between different parts of the document.

1.3 Title Page

The title page is the first visible page of the thesis. A thesis becomes a valuable source of consultation only if it can be easily found. Therefore, it is essential that the title offers a relevant description of the content. The template provided by the Department of Electronics is given below. The title page should include necessary information such as:

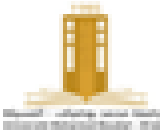
- Department and university names,
- Program and specialization names,
- Brief but informative thesis title,
- Author's full name,
- Supervisor's name,
- Order number, reserved by the administration. The space fixed for this template is a single page. It is also advisable to add the university's logo.

REPUBLIQUE ALGERIENNE DEMOCRATIQUE ET POPULAIRE

MINISTERE DE L'ENSEIGNEMENT SUPERIEUR ET DE LA RECHERCHE SCIENTIFIQUE

UNIVERSITE MOHAMED BOUDIAF - M'SILA

FACULTE DE TECHNOLOGIE
DEPARTEMENT D'ELECTRONIQUE
N° :.....



DOMAINE : SCIENCE ET TECHNOLOGIE
FILIERE : ELECTRONIQUE
OPTION : .....

Mémoire présenté pour l'obtention
Du diplôme de Master Académique

Par:

Intitulé

.....

Soutenu devant le jury composé de:

	Université Mohamed Boudiaf M'sila.	Président
	Université Mohamed Boudiaf M'sila.	Rapporteur
	Université Mohamed Boudiaf M'sila.	Examinateur

Année universitaire : 2022 / 2023

1.4 Abstract

The organization of the thesis should be clear and evident in the manuscript. The abstract, which is relatively short (up to half a page), is always welcome if the thesis exceeds 60 pages. It concisely recaps the scientific context of the study, presents the main results, and highlights the major conclusions. The abstract should serve as a concise summary of the thesis and contain a maximum of 150 words. An abstract includes an exposition of the problem, methodology, results, and conclusions. Additionally, the reader should find all the information they are looking for on the topic. Negative results are preferably mentioned, as this might prevent someone else from choosing the same approach and losing time. Remember that a sentence starts with a capital letter and ends with a period, which follows the standard construction of subject + verb + complement. When possible, avoid nominal sentences (those without verbs).

1.5 Keywords

Based on the topic addressed, I choose keywords (distinctive elements that specify the subject, meaningful words) and main ideas that will guide my research, creating an ordered list. Avoid using overly general terms.

Below is an example of the abstract and keywords:

Abstract

In industrial applications, AC/DC converters (rectifiers) are commonly used to vary the speed of direct current machines. This change requires controlling power devices with a signal in the form of a delayed pulse train at an angle relative to the input alternating voltage. Indeed, there are several ways to obtain this control signal, such as analog control cards (old technique), DSP cards, FPGA cards, and microcontroller-based cards. The latter ensure a more cost-effective design compared to others. For this reason, we propose using the PIC16F877A microcontroller as a signal generation component based on user-imposed input signals. These control signals drive the triggers of single-phase semi-controlled rectifier thyristors. This implementation involves several stages, starting with theoretical study, simulation using MPLAB, CCS PICC, and Proteus software, and leading to the final circuit implementation. Experimental tests showed results similar to those of theoretical study and Proteus and Matlab simulations.

Keywords: Implementation, Rectifier, Control, PIC16F877A, CCS PICC code.

An English abstract is generally required since the thesis may be deposited in either of the university's libraries, classified, and added to international databases. To maximize visibility, students are encouraged to include an English abstract and keywords, regardless of the language of the thesis. Libraries impose strict limits on the length of the abstract, usually up to 150 words. A maximum of English keywords should accompany the English abstract to facilitate indexing. These keywords are selected based on their relevance and the terminology in the field of study. Significant words in an English title are automatically used for cataloging the thesis.

1.6 Acknowledgments

The acknowledgments page is directed towards individuals who, directly or indirectly, contributed to the research work. The content of this page is at the author's discretion. In this section, one can highlight the contributions of their advisor, committee members, or other individuals and institutions that provided significant assistance during the thesis's development. Contributions from organizations that provided scholarships, research funds, or grants can also be recognized.

1.7 Dedication

The dedication is an inscription to honor family members. It is usually placed on a separate page without any other inscription.

1.8 Table of Contents

The table of contents lists all the elements of the thesis and provides page numbers. It includes the divisions and subdivisions of the document, such as titles, subtitles, and sections, along with their respective numbers as they appear in the document. The numbering and format should accurately reflect the presentation of the material. Pagination should be right-aligned. The table of contents is presented concisely, including only major divisions – usually three to four levels are sufficient. Preliminary pages (dedication, acknowledgments, abstract, etc.) are not included. It begins with the introduction and includes appendices. Typically, the same formatting style used in the main text (font, capitalization, bold, underline) is applied to subdivisions. Each subdivision should include the page number where the section begins. Since the page numbers for each subdivision cannot be determined in advance, the table of contents is completed last. Word processing software is very helpful in accurately reflecting chapter and division titles as they appear in the final text.

1.9 List of Abbreviations and Acronyms:

An abbreviation involves omitting letters from a word to save space in the text (e.g., "ex." for "example"). An acronym is an abbreviation formed from the initials (or first letters) of multiple words and is spelled out letter by letter (e.g., "SISCOM" for "Signal and Systems of Telecommunications Laboratory"). The list of abbreviations, acronyms, and their specific designation is included on separate pages following other lists, if applicable.

Abbreviation List :

Abbreviation	Notations
AC	**Alternative Current**
DC	**Direct Current**
EP	**Electronic power**
MLI	**modulation de largeur d'impulsions**
D	**Diode**
D_{RL},D_L	**Diode de roue libre**
A	**Anode**
K	**Cathode**
PWM	**Pulse Width Modulation**

1.10 List of Symbols

The terminology for all symbols used in the equations (electrical, mechanical, etc.) and mathematical expressions in the manuscript should be compiled to facilitate the explanation and understanding of each parameter. The author must adhere to the writing standards for symbols and their units. It is advisable not to include complete equations in this list. This citation can extend up to three pages.

List of symbols :

Symbols	Notations
V_e, u_E	**La tension d'entrée/Input Voltage**
V_m	**La tension maximale**
V_{Lmoy}	**La tension moyenne/ The average voltage**
i_G	**Courant de la gâchette du thyristor**
i_L, i_S	**Courant/ Current**
u_L	**La tension au bornes de l'inductance**
u_R	**La tension au bornes de l'inductance**
T	**Période**
W	**pulsation**
α	**L'angle d'amorçage du thyristor**

1.11 List of Tables and Figures

When the thesis includes tables and/or figures, a comprehensive list identifying them clearly must be written on separate, titled pages. The first list compiles all the tables that appear in the document.

Each table is identified by its number, full title, and the page where it appears in the text. The list of figures is presented in the same manner. Figures include graphs, diagrams, photos, sketches, illustrations, etc. The list of tables is placed on a separate page following the table of contents. This list includes the number of each table, its title, and the page number. The list of figures follows the list of tables on a separate page and must adhere to the same format as the table of contents. The list should include the number of each figure accompanied by its title and page number.

In some cases, the thesis or internship report may include images, photos, tables, etc., that are protected by copyright. Therefore, written permission from the author is required. If permission has been obtained from multiple copyright holders, a list must be provided. This list is placed after the list of figures and should include the title of each copyrighted item, its source, and the page number that refers to where it is located in the thesis or internship report.

1.12 General Introduction

The general introduction must be able to answer the question, "WHY?"

The general introduction is essential as it represents the first contact with the reader. It consists of a single part (no sub-chapters) and is structured like a funnel: it should gradually guide the reader toward the essence of the topic (beginning with fairly general terms and gradually moving towards a more detailed understanding of the subject). The organization of the general introduction should be clear and evident when reading the manuscript. The introduction should set the stage for the work and pique the interest of the readers. It outlines the thesis's plan. It is written in clear language to be understandable to non-specialists in the field. In this section, the author should provide a detailed presentation of the scientific context (previous work), the originality, and the objective of the work undertaken. It also outlines the structure of the thesis, without presenting all the results. Additionally, the thesis must be written with impeccable spelling and grammar. Repeated errors can frustrate the reader, who may focus more on language mistakes than on the scientific results. Most modern word processing software offers spell and grammar checks, and there are also various online tools available.

The general introduction consists of 2-3 pages and is typically written when the body of the thesis is complete. While there is no specific template, you can consider dividing it into up to five sections to outline the thesis's skeleton. The general introduction ensures that the main points to be developed are not forgotten, and the sequence of ideas follows a clear and structured logic. Subsequently, the author can focus on the following sections:

(i) Definition of ambiguous terms in the subject: In this section, start by briefly providing some definitions related to the field of application of the topic. Then, present several paragraphs defining the research focus of the author's subject.

(ii) State of the art: This section should be a maximum of one page. To position the scientific work to be carried out effectively, the author must cite, with comments, existing literature publications related to the research topic. This involves specifying the theoretical framework in which the work falls and conducting a scientific literature review on the subject. You should cite your reference sources in the text, typically articles, but also books, and occasionally unpublished documents

(theses, dissertations, etc.). The state of the art provides a synthesis of relevant readings for your issue. It is structured like a funnel, moving from the general to the specific. It introduces all the necessary knowledge for the reader to understand the context in which the work is situated (previous work) and the limits of current knowledge (which introduces the issue). The author then relies on a few reference documents and indicates the main results and explanatory models already established in the field, providing an update on research progress in the field. Only documents useful for understanding your study should be cited.

Be cautious about plagiarism! You rely on previous work, but you present it in a personal way. Any sentence borrowed from an author should be presented as such. In general, you should rephrase and synthesize the thoughts or conclusions of one or more authors. Various writing methods can be used to reference authors in the text.

(iii) The problem statement: This section is very short (half a page to one page). To do this, the author should clarify the relevance of the research issues addressed. Generally, this section includes a clear definition of the issues to be investigated or the central question. The literature review leads to the definition of the problem statement. Begin by summarizing the elements of the state of the art that lead to formulating a question to be answered. A hypothesis (or a small number of hypotheses) is formulated as the expected response to the question asked. This part clearly explains the reasoning that, based on the literature data, leads to asking an original question. The hypothesis proposed in response to this question is derived from the literature data and can be validated or invalidated by the results of your work. It is essential not to rush into a seemingly interesting topic before evaluating its feasibility and locating it within a general problem. It is necessary to research, seek advice from competent individuals, and document oneself for this purpose.

(iv) Motivation: In this section, propose solutions to address the issues mentioned in the previous section. Once the topic is chosen, it must be clarified by formulating a single central question summarizing the entire issue of the work! Be precise and avoid vague topics. The formulation of the research question is a crucial step. The research problem must lead to the central question of the research. The uniqueness and significance of the research are certainly mentioned. Explain the specific point at which it appears that all previous studies have not provided an answer. Remember, when making your choice, that you will be more motivated if you are passionate about the topic, and the final thesis can be a gateway to the professional world. The methodology chosen depends on the research objectives. You must convince the reader that the choices you have made are relevant in relation to the question asked. The presentation of this part can vary significantly depending on the methodology adopted.

(v) Organization of the document: Developing the outline (thesis skeleton) is an essential step because it facilitates the writing of the document. It ensures that the main points to be developed are not forgotten, and the sequence of ideas follows a clear and structured logic. In this section, present the objective of each chapter in the thesis and the general conclusion.

At the end of the introduction, the reader should have a precise understanding of the question the author intends to address in the thesis.

In the following section, we will see an example of a general introduction and its essential parts.

General Introduction:

Photovoltaic solar energy comes from the direct conversion of a portion of solar radiation into electrical energy. This energy conversion takes place through a photovoltaic cell (PV cell) based on a physical phenomenon called the photovoltaic effect, which produces an electromotive force when the surface of this cell is exposed to light. The generated voltage can vary depending on the material used in the cell's manufacturing. The combination of several PV cells in series/parallel results in a photovoltaic generator (PVG) with a non-linear current-voltage (I-V) characteristic that has a maximum power point [1].

In most photovoltaic energy production systems, a specific technique or algorithm called "Maximum Power Point Tracking" (MPPT) is employed. This technique, as the name suggests, tracks the MPP over time and allows for extracting the maximum power that the panel can provide. MPPT aims to enhance and optimize the operation of photovoltaic systems. It can lead to an efficiency gain of up to 25%, highlighting its significance. Technically, MPPT involves an interface between the panel and the load, typically a power conversion device [2].

In this context, the goal of this work is to provide detailed design information for the control of a DC-DC converter adapted using the Perturb and Observe (P&O) technique. This converter will enhance the control of the power interface and optimize energy transfer in a photovoltaic system.

In addition to a general introduction and a general conclusion summarizing our study, this work is divided into three chapters organized as follows:

In the first chapter, we covered concepts related to energy and the operating principles of a silicon photovoltaic cell, as well as the various types of cells. Next, we discussed the different possible configurations of cells (PVG) and defined their efficiency and the form factor.

In the second chapter, we presented the mathematical modeling of the cell and the photovoltaic generator. We then used MATLAB software to study the behavior of a photovoltaic cell and a photovoltaic generator (composed of 46 cells connected in series) under standard conditions (G=1000 W/m² T=25°C). We also studied the influence of temperature and illumination on the energy produced by the PV cell, as well as the impact of cell arrangement (series, parallel, and series/parallel) on energy production.

The study of DC-DC converters (boost converters) and their MPPT control to find the point where the photovoltaic generator's power is maximized will be the subject of the final chapter.

1.13 Chapter 1

A work is often judged based on a few key chapters. Therefore, it is necessary to invest a lot of care and attention in writing these chapters. Typically, Chapter 1 is intended to provide a brief overview of the subject's content as well as the mathematical and algorithmic

developments of the classical approaches that have already been used. Subsequently, flowcharts and the presentation of some results with comments on these procedures are also discussed to draw the main comparisons with the methods proposed in the following chapters. The page count can range from 15 to 20.

1.14 Chapter 2

In this chapter, the author presents the practical part of their work. This chapter is strictly personal, unlike the previous chapter. It provides a detailed description and mathematical developments of the new methods suggested in the motivations part of the general introduction by the author. Some equations given in Chapter 1 may be referenced to construct the procedures created by the author.

Mathematical Equations:

In mathematics, variables are written in italics, while known functions (such as log, sin, cos, etc.) are written in Roman (straight) type. An equation is an element of a sentence, so punctuation is applied to it.

$$\textbf{Ex: } I = I_{ph} - I_0 \left[\exp\left(\frac{q(V+R_S I)}{nkT}\right) - 1\right] - \frac{V+R_S I}{R_{sh}}$$

1.15 Chapter 3 (Simulation and/or Experimental Results)

This chapter deals with all the results found by the author (figures and tables). Comments on these results should be written based on physical phenomena. As an example, figures with their number, title, and caption are represented as in Figure 1.

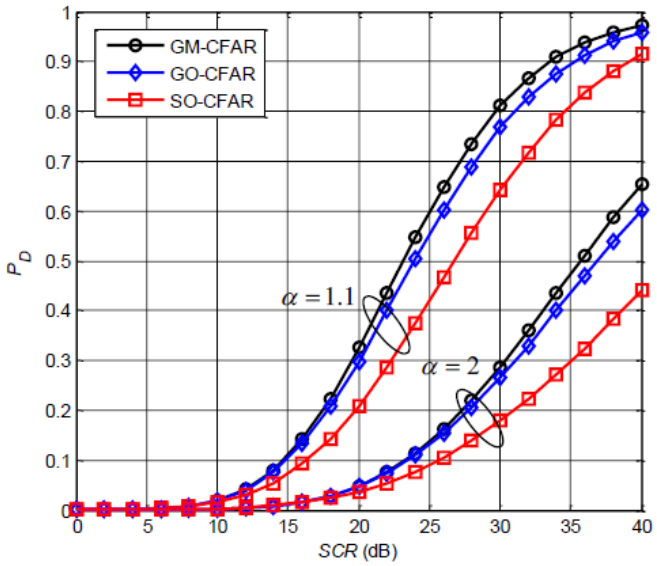


Fig. 1 Probability of detection against SCR of the GM-CFAR, GO-CFAR and SO-CFAR detectors in a homogeneous Pareto clutter for M = 24, NL=1 and P_{fa}=10^{-4}

Figures should be consecutively numbered according to their order of appearance in the text (Figure 1, Figure 2, etc.). Reference to a figure is always made by its number. Figures should not be referred to with expressions like "above" or "below." Each figure should have a number, a title, and a caption. The caption should allow understanding the figure without having to read the text. All graphical elements present should be clearly identified and described (color, line thickness, etc.). Each curve should be accompanied by a legend. The axes (x and y) should also have a legend with the appropriate units in parentheses or brackets. If the figure contains an image found on the internet, its source must be specified (the exact address of the web page, not www.google.com or www.wikipedia.org). Finally, size your figures so that they are easily readable. Adjust the font size and line thickness if necessary.

Tables are also consecutively numbered, and they are accompanied by a title and a caption. The caption should include all the necessary elements for understanding the table, including symbols (*, y, z) or possible references [1, 2].

1.16 General Conclusion and Outlook/Expectation

The general conclusion aims to summarize the essential results and findings developed in the chapters of the thesis. Additionally, it is in the general conclusion that the author provides an evaluative assessment of their work and makes recommendations or suggestions that could contribute to a future research project addressing the same issue. The conclusion is usually brief, typically between 4 and 6 pages.

General Conclusion:

In our project, the study is based on the analysis of the modeling and simulation of the electrical operation of a photovoltaic system (PV) adapted by digital control (MPPT control) ensuring the tracking of the maximum power provided by the PV generator.

Firstly, we covered concepts related to solar energy, the operating principle of a silicon photovoltaic cell, as well as the generator (PVG). We also discussed the different possible cell arrangements and defined their efficiency and the form factor.

Next, we presented the mathematical modeling of the cell and the photovoltaic generator. We used MATLAB software to study the behavior of a photovoltaic cell and a photovoltaic generator (composed of 46 cells connected in series) under standard conditions (G=1000 W/m² T=25°C). We also studied the influence of temperature and illumination on the energy produced by the PV cell, as well as the impact of cell arrangement (series, parallel, and series/parallel) on energy production.

Finally, we presented the operation of the Buck DC-DC converter and MPPT control, and simulated the Buck converter.

The main elements to which this work has led are:

- The current delivered by the PVG is directly proportional to sunlight, while the voltage at the PVG terminals is relatively little affected by its increase.
- An increase in temperature leads to a clear decrease in open-circuit voltage, a slight increase in short-circuit current, and a decrease in maximum power.
- To harness the maximum power delivered by a solar panel, the use of an adaptation stage between this panel and the load is necessary.

For a possible continuation of this work, several perspectives can be mentioned, including:

- Exploration of new MPPT algorithms.
- Introduction of other types of DC/DC converters.

1.17 Bibliography

Under this section, the author provides the complete references for books, journal articles, and other documents used in the thesis. References should be given in full. Readers should receive all the necessary information to locate an article, thesis, book, or scientific report. Internet links can also be cited. If the information is well-located, page numbers should also be provided. For IEEE journals, bibliographic references are given in the following format:

Article:

[1] Mezache, A., Sahed, M., Laroussi, T., and Chicouche, D.,

Two novel methods for estimating the compound K-clutter parameters in presence of thermal noise. *IET Radar, Sonar and Navigation*, **5**, 9 (Dec. 2011), 934–942.

Conference :

[2] Watts, S. The performance of cell-averaging CFAR systems in sea clutter. In *Proceedings of International Radar Conference*, Alexandria, VA, May 7–12, 2000, 398–403.

Theses:

Pearson, J.: 'Computation of hypergeometric functions', Master Thesis, University of Oxford, 2009, http://people.maths.ox.ac.uk/porterm/research/pearson_final.pdf

Books:

[4] Long, M. W.*Radar Reflectivity of Land and Sea* (3rd ed.). London: Artech House, 2001.

Internet Link:

[5] Hypergeometric Functions. Available: http://functions.wolfram.com/HypergeometricFunctions/Hypergeometric2F2/17/02/01/0003/.

1.18 Appendices

The appendices include all technical documents or additional explanatory texts that would not fit into the main text, as they might unnecessarily burden it. For example, letters of authorization, participant consent forms, solicitation or support letters, questionnaires or measurement instruments, and additional tables may be included in the appendices. The appendices are announced in the table of contents and then in the body of the text, where the reader should refer to the appendix for a better understanding of the text. Additionally, to guide the reader towards the final expressions, detailed mathematical developments are preferably presented in the appendices. The appendices are numbered A, B, C, and so on.

1.19 Typing

Regarding typing, following the standards below:

- Right margin: 3.5 cm (according to SSP regulations)
- Left margin: 2.5 cm
- Top and bottom margins: 2.5 cm
- Font: Times New Roman or an equivalent font
- Font size for the body of the text: 12 points
- Font size for footnotes: 10 points
- Line spacing: 1.5 cm
- Printing: single-sided for the thesis
- No single lines (isolated from the rest of the paragraph) at the beginning or end of a page.
- Text format: Justified (not Left-aligned) Pagination starts from the first page of the introduction. Cover pages, title pages, dedications, acknowledgments, table of contents, list of diagrams and tables, should have separate pagination in lowercase Roman numerals (i, ii, iii, iv, etc.). Within an appendix, pages are numbered A-1, A-2, etc., and for the second appendix, B-1, B-2, etc. There are, therefore, three paginations:
- Pages before the introduction
- From the introduction to the bibliography

- The appendices
- Chapters should always start on a new page.
- No single lines (isolated from the rest of the paragraph) at the beginning or end of a page. For the presentation of a thesis page, follow these steps:
- Set to "Justify" mode (text aligned to the left and right)
- Header: Chapter title (font size = 10)
- Footer: Page number (font size = 10) To avoid errors in form and content, before printing the thesis, the author should review their manuscript carefully and then submit it to a third party for a final proofreading.

Chapter 2: Preparation for the Thesis Presentation "Defense"

2.1 Introduction

The thesis defense is not an easy task, as it requires the ability to combine practical and theoretical content. This exercise often marks the culmination of your undergraduate or master's years, and it is crucial to prepare for it effectively. The defense is the final test. It involves presenting your work before a jury composed of three or more members and subjecting yourself to their critiques, suggestions, and questions. The student prepares a summary of their work for an oral presentation lasting about fifteen to twenty minutes. In this summary, they present the problem statement, the methodology, the progress of the work, data processing, results, and discussion. They also present their recommendations and discuss the difficulties encountered.

In the introduction, as in any composition, a catchy opening sentence is important. Its purpose is to engage your examiners in the topic you have worked on. The thesis defense is both a rite of passage, an unforgettable moment, and a source of intense stress. To help you prepare and overcome this "challenge," we will provide advice on all aspects of the thesis defense.

2.2 Purpose of the Defense

The purpose of the defense is to present your work and respond to questions from the jury members. For the candidate, this serves to:

- Showcase their research work.
- Highlight the knowledge acquired during their years of study.

For the jury, this serves to:

- Evaluate the candidate's work and competencies.
- Gain a better understanding of certain points presented in the thesis.
- Assess the candidate's ability to clearly present ideas and respond to questions.

The competencies being evaluated include rigor, a commitment to quality, initiative, originality, planning, communication skills, and subject knowledge.

2.3 Practical Organization

- Ensure that a room has been reserved for your thesis defense.
- Visit the location to become familiar with the space and check the room's arrangement. If the room is not typically set up for a thesis defense, inform the relevant department.

- Prepare small bottles of water for the jury members. Normally, this is not your responsibility, but it's better to be prepared to avoid last-minute issues.

2.4 Presentation of Your Work

Your oral presentation should last between 15 and 20 minutes before a jury consisting of 3 to 4 specialists in your subject. However, during your presentation, jury members are expected to know nothing about your topic. You must explain, comment on, and convince the jury and the audience.

The first step is to clearly present the outline of your oral presentation, preferably on a separate transparency or board so that it can be projected throughout the defense and serve as a guide for the jury.

Your presentation should include a brief introduction with the presentation of the topic, the significance of the subject (possibly with a literature review), the methodology, the main results, the discussion, and a conclusion.

It is recommended to use presentation software like PowerPoint. The number of slides should not exceed 45 because, on average, it takes 30 seconds to a minute for the audience to read and understand each slide. The slides should be typed, clear, legible, and free from text overload. Under no circumstances should a slide be a copy of the pages from your thesis, not even the table of contents.

2.5 Additional Tips

a) Prepare thoroughly for the thesis defense, as it is as important as the thesis itself in evaluating the candidate.

b) Prepare the intervention plan in advance, emphasizing how to start and conclude your speech.

c) Pay attention to your speaking pace, avoid speaking too quickly, use appropriate language, refrain from using informal expressions and abbreviations.

d) You can have notes to assist you in case of forgetfulness or hesitation, but do not read your presentation from these notes. Maintain eye contact with the jury.

e) If you experience extreme stress, request a moment of reflection, breathe, and only resume speaking when you are relaxed.

f) Keep your presentation concise and precise, avoiding improvisation.

g) Adhere to the timing. The presentation should last between 15 and 20 minutes, maximum.

h) Practice in front of a "mock" jury of peers, etc. This is excellent preparation and can lead to questions you may not have considered.

i) If you discover significant errors between submitting the thesis and the defense, humbly acknowledge them at the beginning of your presentation to prevent the jury from pointing them out during questions/remarks.

j) Prepare a list of potential questions that the jury might reasonably ask you in advance.

2.6 How to Prepare a Slide or Poster

- **Preparing a Slide**: To create a slide, you should first summarize the idea you want to convey in short sentences, tables, and graphs. Avoid overloading the slide (maximum 4 to 5 titles). Use large and bold fonts, and if possible, use colors.
- **Creating a Poster**: A poster is a summary with illustrations that allows students to make a simple and clear presentation, giving the audience plenty of time to read and ask questions. Therefore, the poster should be attractive and interesting. Use large fonts for key points, ensure that the poster is readable from a distance of 2 meters, use visually appealing figures, and keep the content concise and precise.

2.7 Answering Questions

The jury members will ask you questions to make you explain your choices, justify certain explanations you provided, and revisit the text itself (e.g., "On page X, you wrote that..."). Be aware that everything you wrote in your thesis should be explainable and justifiable. If you chose to reference an article or an author, it's assumed that you found value in it. Therefore, do not try to avoid the question by saying it's someone else's idea.

It's important to actively listen to the jury, ensuring you understand the questions asked and taking time to think before responding. If you don't understand a question, it's acceptable to ask the jury to clarify. Some students may be tempted to answer a different question if they find the one asked uncomfortable, but the jury members are not fooled, even if they don't say anything. It's best to stay honest. If you don't know the answer, it's better to admit it. Remember, the jury is not there to unsettle you but to assess whether you have the necessary knowledge for your thesis to be accepted. Also, keep in mind that no one can know everything.

2.8 Oral Presentation

When it comes to managing nervousness and delivering your oral presentation (during the defense or any other type of oral presentation), here are some phrases to begin an oral defense:

- Start by thanking the jury members for their presence and your thesis advisor for their guidance. Here are a few examples:

  Ex1: Generally, you should start with: "Honorable members of the jury, honorable audience, good morning. Today, I will present my work on..."

  Ex2: Always begin with a greeting like "good morning" with a smile and direct eye contact. Then, express gratitude to the audience. For example: "First of all, I would like to thank Mr./Ms. X for being here, as well as Mr./Ms. Y for their guidance and valuable advice..." (X being the invited jury member and Y your advisor). Afterward, present the purpose of your defense. For example: "I would like to present a summary of the Master's thesis I had the pleasure of preparing on the topic..." while showing the cover page of your thesis on a PowerPoint slide. Then, switch to the next slide and proceed with your introduction and the presentation outline.

  Ex3: Before I begin, I would like to express my gratitude to the jury members for their presence today, as well as my thesis advisor, Mr. XXX, for their support and guidance throughout this thesis...

  Ex4: First and foremost, I would like to thank the jury members gathered here for agreeing to participate in this defense...

  Ex5: The thesis I am submitting for discussion today, titled "...," represents the culmination of a personal and academic journey, in which I would like to briefly highlight the main points of our work plan as follows:

  Ex6: This defense marks the culmination of research on the issue of "...," a journey I have been pursuing since my Master's preparation. Under the guidance of Professor Mezache, I worked on target detection systems using radar... The primary contributions of this work are...

Don't forget to express gratitude at the end of your presentation. Here are two examples:

- Ex1: I am available to answer your questions and receive your feedback.
- Ex2: I would like to thank the jury members once again for their participation in this defense, and I look forward to hearing their insights and engaging in discussions on these topics. I also extend my gratitude to those present in the room for attending the defense.