

FACULDADE DE ENGENHARIA DA UNIVERSIDADE DO PORTO

<Dissertation Title>

<Author's Full Name>

VERSÃO DE TRABALHO



Mestrado em Engenharia Informática e Computação

Orientador: Prof. <Name of the Supervisor>

25 de julho de 2025

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Resumo

Este documento ilustra o formato a usar em dissertações na Faculdade de Engenharia da Universidade do Porto (**FEUP**). São dados exemplos de margens, cabeçalhos, títulos, paginação, estilos de índices, etc. São ainda dados exemplos de formatação de citações, figuras e tabelas, equações, referências cruzadas, lista de referências e índices. Este documento não pretende exemplificar conteúdos a usar. É usado o *Loren Ipsum* para preencher a dissertação. Lorem ipsum dolor sit amet, **FEUP** consectetuer adipiscing elit. Etiam vitae quam sed mauris auctor porttitor. Mauris porta sem vitae arcu sagittis facilisis. Proin sodales risus sit amet arcu. Quisque eu pede eu elit pulvinar porttitor. Maecenas dignissim tincidunt dui. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Donec non augue sit amet nulla gravida rutrum. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Nunc at nunc. Etiam egestas. Donec malesuada pede eget nunc. Fusce porttitor felis eget mi mattis vestibulum **FEUP**. Pellentesque faucibus. Cras adipiscing dolor quis mi. Quisque sagittis, justo sed dapibus pharetra, lectus velit tincidunt eros, ac fermentum nulla velit vel sapien. Vestibulum sem mauris, hendrerit non, feugiat ac, varius ornare, lectus. Praesent urna tellus, euismod in, hendrerit sit amet, pretium vitae, nisi. Proin nisl sem, ultrices eget, faucibus a, feugiat non, purus. Etiam mi tortor, convallis quis, pharetra ut, consectetuer eu, orci. Vivamus aliquet. Aenean mollis fringilla erat. Vivamus mollis, purus at pellentesque faucibus, sapien lorem eleifend quam, mollis luctus mi purus in dui. Maecenas volutpat mauris eu lectus. Morbi vel risus et dolor bibendum malesuada. Donec feugiat tristique erat. Nam porta auctor mi. Nulla purus. Nam aliquam.

Abstract

Here goes the abstract written in English. Should say the same.

 Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Sed vehicula lorem commodo dui Faculdade de Engenharia da Universidade do Porto (**FEUP**). Fusce mollis feugiat elit. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec eu quam. Aenean consectetuer odio quis nisi. Fusce molestie metus sed neque. Praesent nulla. Donec quis urna. Pellentesque hendrerit vulputate nunc. Donec id eros et leo ullamcorper placerat. Curabitur aliquam tellus et diam. Ut tortor. Morbi eget elit. Maecenas nec risus. Sed ultricies. Sed scelesrisque libero faucibus sem **FEUP**. Nullam molestie leo quis tellus. Donec ipsum. Nulla lobortis purus pharetra turpis. Nulla laoreet, arcu nec hendrerit vulputate, tortor elit eleifend turpis, et aliquam leo metus in dolor. Praesent sed nulla. Mauris ac augue. Cras ac orci. Etiam sed urna eget nulla sodales venenatis. Donec faucibus ante eget dui. Nam magna. Suspendisse sollicitudin est et mi. Fusce sed ipsum vel velit imperdiet dictum. Sed nisi purus, dapibus ut, iaculis ac, placerat id, purus. Integer aliquet elementum libero. Phasellus facilisis leo eget elit. Nullam nisi magna, ornare at, aliquet et, porta id, odio. Sed volutpat tellus consectetuer ligula. Phasellus turpis augue, malesuada et, placerat fringilla, ornare nec, eros. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Vivamus ornare quam nec sem mattis vulputate. Nullam porta, diam nec porta mollis, orci leo condimentum sapien, quis venenatis mi dolor a metus. Nullam mollis. Aenean metus massa, pellentesque sit amet, sagittis eget, tincidunt in, arcu. Vestibulum porta laoreet tortor. Nullam mollis elit nec justo. In nulla ligula, pellentesque sit amet, consequat sed, faucibus id, velit. Fusce purus. Quisque sagittis urna at quam. Ut eu lacus. Maecenas tortor nibh, ultricies nec, vestibulum varius, egestas id, sapien. Donec hendrerit. Vivamus suscipit egestas nibh. In ornare leo ut massa. Donec nisi nisl, dignissim quis, faucibus a, bibendum ac, diam. Nam adipiscing hendrerit mi. Morbi ac nulla. Nullam id est ac nisi consectetuer commodo. Pellentesque aliquam massa sit amet tellus. Vivamus sodales aliquam leo.

UN Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) provide a global framework to achieve a better and more sustainable future for all. It includes 17 goals¹ to address the world's most pressing challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice.

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The specific Sustainable Development Goals mentioned have the following names:

SDG 7 Ensure access to affordable, reliable, sustainable and modern energy for all

SDG 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SGD	Target	Contribution	Performance Indicators and Metrics
7	7.1	Enhancing the efficiency of SCADA systems can help increase the reliability of solar energy production, facilitating universal access to clean energy.	Percentage of solar plants with improved ...
	7.2	Improving the management of solar plants helps enhance the efficiency and reliability of renewable energy ...	Increase in renewable energy share ...
8	8.1	Enhancing renewable energy infrastructure promotes resilience against climate-related hazards and supports sustainable energy sources.	Increase in resilience metrics ...

¹<https://sdgs.un.org/goals>

Acknowledgements

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<O Nome do Autor>

“Our greatest glory is not in never falling, but in rising every time we fall”

Confucius

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List of Acronyms

AI Artificial Intelligence

FEUP Faculdade de Engenharia da Universidade do Porto

GPU Graphics Processing Unit

ML Machine Learning

NLP Natural Language Processing

Capítulo 1

Introduction

This document illustrates the format to be used for dissertations at FEUP. Examples of margins are given, headings, titles, pagination, index styles, etc. are given. It also gives examples of formatting citations, figures and tables, equations, cross-references, reference lists and indexes. This document is not intended to exemplify content to be used.

This first chapter illustrates the use of citations and references.

1.1 Section Example

As well as giving an example of how to use a quotation, the following paragraph introduces a reference that can be consulted, among many other interesting bibliographical references [11, 12].

“Like the Abstract, the Introduction should be written to engage the interest of the reader. It should also give the reader an idea of how the dissertation is structured, and in doing so, define the thread of the contents.” [12, chap. Introduction]

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1.2 Section Example

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1.3 Section Example

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1.4 Section Example

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1.5 Dissertation Structure

In addition to the introduction, this dissertation contains x more chapters.

In Chapter 2, the state of the art is described and related work is presented. Chapter 3, ipsum dolor sit amet, consectetur adipiscing elit.

Capítulo 2

Chapter Example

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2.1 Introduction

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¹Example of a footnote.

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Capítulo 3

Chapter WITH Examples

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3.1 Introduction

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$$CIF_2 : \quad F_1^j(a) = \frac{1}{2\pi i} \oint_{\gamma} \frac{F_0^j(x)}{x-a} dx \quad (3.2)$$

Equação 3.2 lorem ipsum dolor sit amet, consectetur adipiscing elit. Suspendisse tincidunt viverra elit. Donec tempus vulputate mauris. Donec arcu. Vestibulum condimentum porta justo. Curabitur ornare tincidunt lacus. Curabitur ac massa vel ante tincidunt placerat. Cras vehicula semper elit. Curabitur gravida, est a elementum suscipit, est eros ullamcorper quam, sed cursus velit velit tempor neque. Duis tempor condimentum ante. Nam sollicitudin. Vestibulum adipiscing, orci eu tempor dapibus, risus sapien porta metus, et cursus leo metus eget nibh.

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¹<https://en.wikipedia.org/wiki/Equation>

²https://www.overleaf.com/learn/latex/Mathematical_expressions

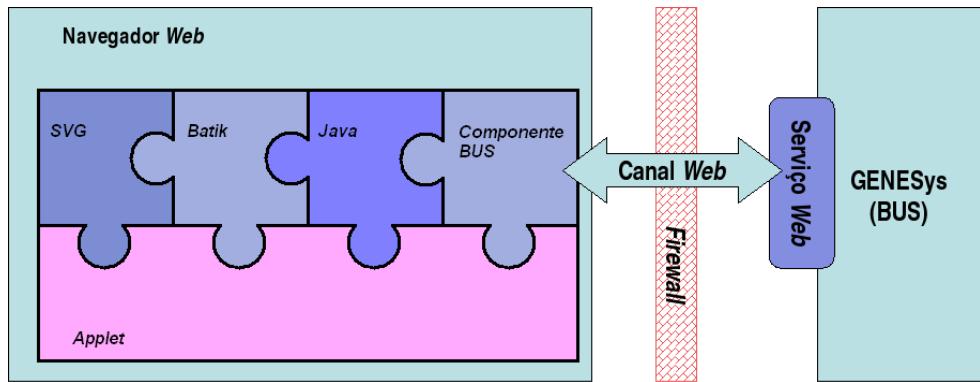


Figura 3.1: A figure, caption below

3.2 Section Example

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- **Components** — Suspendisse auctor mattis augue *push*;
- **Praesent** — Sit amet sem maecenas eleifend facilisis leo;
- **Pellentesque** — Habitant morbi tristique senectus et netus.

3.2.1 Subsection Example — Figures

Suspendisse elementum sodales felis in Figure 3.1 on page 8 is a floating figure.

Loren ipsum dolor sit amet, consectetuer adipiscing elit. Praesent sit amet sem. Maecenas eleifend facilisis leo. Vestibulum et mi. Aliquam posuere, ante non tristique consectetuer, dui elit scelerisque augue, eu vehicula nibh nisi ac est. Nullam laoreet fermentum urna.

Duis eget diam. In est justo, tristique in, lacinia vel, feugiat eget, quam. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce feugiat, elit ac placerat fermentum, augue nisl ultricies eros, id fringilla enim sapien eu felis. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Sed dolor mi, porttitor quis, condimentum sed, luctus in.

3.2.2 Subsection Example — Tables

Suspendisse elementum sodales felis in Table 3.1 is a floating table.

Loren ipsum dolor sit amet, consectetuer adipiscing elit. Praesent sit amet sem. Maecenas eleifend facilisis leo. Vestibulum et mi. Aliquam posuere, ante non tristique consectetuer, dui elit scelerisque augue, eu vehicula nibh nisi ac est. Suspendisse elementum sodales felis. Nullam laoreet fermentum urna.

Duis eget diam. In est justo, tristique in, lacinia vel, feugiat eget, quam. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce feugiat, elit ac placerat fermentum, augue nisl ultricies eros, id fringilla enim sapien eu felis. Vestibulum ante

Tabela 3.1: A table, caption on top

Iteration k de $f(x_n)$				comments
k	x_1^k	x_2^k	x_3^k	
0	-0.3	0.6	0.7	-
1	0.47102965	0.04883157	-0.53345964	$\delta < \varepsilon$
2	0.49988691	0.00228830	-0.52246185	$\delta < \varepsilon$
3	0.49999976	0.00005380	-0.523656	N
4	0.5	0.00000307	-0.52359743	
:	:	..	:	
7	0.5	0.0	-0.52359878	$\delta < 10^{-8}$

ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Sed dolor mi, porttitor quis, condimentum sed, luctus in.

3.2.3 Subsection Example — SI

Always use the `siunitx` package³ to write values, units, etc. according to the International System of Units convention rules and style conventions (see <https://physics.nist.gov/cuu/Units/checklist.html>).

For example: 50 kg, 15 °C, 20.01 m s⁻¹, 120 kB s⁻¹, 34 %, 289 300.00 €, 28.3 M€, 10 245.450 234.

Table 3.2 serves to exemplify the alignment in the columns with numbers, and has nothing to do with any numerical data associated with FEUP’s resources and investments in 2025.

Loren ipsum dolor sit amet, consectetuer adipiscing elit. Praesent sit amet sem. Maecenas eleifend facilisis leo. Vestibulum et mi. Aliquam posuere, ante non tristique consectetuer, dui elit scelerisque augue, eu vehicula nibh nisi ac est. Suspendisse elementum sodales felis. Nullam laoreet fermentum urna.

Duis eget diam. In est justo, tristique in, lacinia vel, feugiat eget, quam. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce feugiat, elit ac placerat fermentum, augue nisl ultricies eros, id fringilla enim sapien eu felis. Vestibulum ante

³Manual available at <https://ctan.org/pkg/siunitx>.

Tabela 3.2: Physical Resources of FEUP [3].

Some Values
2.3456
34.2345
-6.7835
90.473
5642.5
1.2×10^3
10^4

ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Sed dolor mi, porttitor quis, condimentum sed, luctus in.

3.2.4 Subsection Example — Acronyms

This section shows how to use the acronyms Artificial Intelligence (**AI**) and Machine Learning (**ML**). Later we can simply refer to **AI** or **ML** without expansion.

In modern technology, Natural Language Processing (**NLP**) plays a crucial role in virtual assistants and chatbots. We also rely on Graphics Processing Unit (**GPU**) hardware for deep learning models.

3.2.4.1 Special use in titles as **FEUP**

Acronyms can also be made plural: **GPUs** are widely used in high-performance computing. Possessive forms are supported too: **AI**'s impact on society is profound at Faculdade de Engenharia da Universidade do Porto (**FEUP**).

3.3 Summary

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce feugiat, elit ac placerat fermentum, augue nisl ultricies eros, id fringilla enim sapien eu felis. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Sed dolor mi, porttitor quis, condimentum sed, luctus in.

Capítulo 4

Another chapter

Integer nec quam. Sed fermentum. Nunc vitae leo. Etiam sit amet quam. Nunc vestibulum massa in mauris. Duis eget nulla.

4.1 Section Example

Fusce ultricies arcu eu nibh volutpat feugiat. Maecenas urna pede, commodo quis, porta eu, bibendum elementum, pede.

4.2 Section Example

Sed eros massa, molestie eget, mattis non, rutrum ac, magna. Duis dui. Maecenas eget tortor ut dolor semper mattis. Maecenas auctor, tellus et ultricies tempor, elit est placerat lacus, in posuere mauris lorem et arcu.

4.2.1 Subsection Example

Nulla nec eros et pede vehicula aliquam. Aenean sodales pede vel ante. Fusce sollicitudin sodales lacus. Maecenas justo mauris, adipiscing vitae, ornare quis, convallis nec, eros.

4.2.2 Subsection Example

Pellentesque pulvinar fringilla dolor. In sit amet pede. Proin orci justo, semper vel, vulputate quis, convallis ac, nulla. Nulla at justo. Mauris feugiat dolor. Etiam posuere fermentum eros. Morbi nisl ipsum, tempus id, ornare quis, mattis id, dolor. Aenean molestie metus suscipit dolor. Aliquam id lectus sed nisl lobortis rhoncus. Curabitur vitae diam sed sem aliquet tempus. Sed scelerisque nisi nec sem.

4.3 Section Example

Sed eros massa, molestie eget, mattis non, rutrum ac, magna. Duis dui. Maecenas eget tortor ut dolor semper mattis. Maecenas auctor, tellus et ultricies tempor, elit est placerat lacus, in posuere mauris lorem et arcu.

4.3.1 Subsection Example

Nulla nec eros et pede vehicula aliquam. Aenean sodales pede vel ante. Fusce sollicitudin sodales lacus. Maecenas justo mauris, adipiscing vitae, ornare quis, convallis nec, eros.

4.3.2 Subsection Example

Aliquam id lectus sed nisl lobortis rhoncus. Curabitur vitae diam sed sem aliquet tempus. Sed scelerisque nisi nec sem Khakipoor, Khani e Karimian [6] e Liu et al. [8].

4.4 Section Example

Maecenas urna pede, commodo quis, porta eu, bibendum elementum, pede. Sed eros massa, molestie eget, mattis non, rutrum ac, magna. Duis dui. Maecenas eget tortor ut dolor semper mattis. Maecenas auctor, tellus et ultricies tempor, elit est placerat lacus, in posuere mauris lorem et arcu [2, 4, 10, 15].

4.4.1 Subsection Example

Nulla nec eros et pede vehicula aliquam. Aenean sodales pede vel ante. Fusce sollicitudin sodales lacus. Maecenas justo mauris, adipiscing vitae, ornare quis, convallis nec, eros.

4.4.2 Subsection Example

Aliquam id lectus sed nisl lobortis rhoncus. Curabitur vitae diam sed sem aliquet tempus. Sed scelerisque nisi nec sem Khakipoor, Khani e Karimian [6] e Liu et al. [8] scelerisque.

Nulla nec eros et pede vehicula aliquam. Aenean sodales pede vel ante. Fusce sollicitudin sodales lacus. Maecenas justo mauris, adipiscing vitae, ornare quis, convallis nec, eros. Etiam laoreet venenatis ipsum. In tellus odio, eleifend ac, ultrices vel, lobortis sed, nibh. Fusce nunc augue, dictum non, pulvinar sed, consectetur eu, ipsum. Vivamus nec pede.

4.5 Listing example

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce feugiat, elit ac placerat fermentum, augue nisl ultricies eros, id fringilla enim sapien eu felis.

Listing 4.1: Python example

```
1 # Take the user's input
2 words = input("Enter the text to translate to pig latin: ")
3 print(f"You entered: {words}")
4
5 # Break apart the words into a list
6 words = words.split(' ')
7
8 # Use a list comprehension to translate words greater than or equal to 3 characters
9 translated_words = [ (w[1:] + w[0] + "ay") for w in words if len(w) >= 3 ]
10
11 # Print each translated word
12 for word in translated_words:
13     print(word)
```

Listing 4.1 uis eget diam. In est justo, tristique in, lacinia vel, feugiat eget, quam. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Fusce feugiat, elit ac placerat fermentum, augue nisl ultricies eros, id fringilla enim sapien eu felis. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Sed dolor mi, porttitor quis, condimentum sed, luctus in.

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Anexo A

Lorem Ipsum

After the conclusions and bibliographical references, the text used to complete the dissertation is presented in this numbered annex.

A.1 What is *Lorem Ipsum*?

Lorem Ipsum is simply dummy text of the printing and typesetting industry. *Lorem Ipsum* has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularised in the 1960s with the release of Letraset sheets containing *Lorem Ipsum* passages, and more recently with desktop publishing software like Aldus PageMaker including versions of *Lorem Ipsum* [7].

A.2 Where does *Lorem* come from?

Contrary to popular belief, *Lorem Ipsum* is not simply random text. It has roots in a piece of classical Latin literature from 45 BC, making it over 2000 years old. Richard McClintonck, a Latin professor at Hampden-Sydney College in Virginia, looked up one of the more obscure Latin words, *consectetur*, from a *Lorem Ipsum* passage, and going through the cites of the word in classical literature, discovered the undoubtable source. *Lorem Ipsum* comes from sections 1.10.32 and 1.10.33 of “*de Finibus Bonorum et Malorum*” (The Extremes of Good and Evil) by Cicero, written in 45 BC. This book is a treatise on the theory of ethics, very popular during the Renaissance. The first line of *Lorem Ipsum*, “*Lorem ipsum dolor sit amet...*”, comes from a line in section 1.10.32.

The standard chunk of *Lorem Ipsum* used since the 1500s is reproduced below for those interested. Sections 1.10.32 and 1.10.33 from “*de Finibus Bonorum et Malorum*” by Cicero are also reproduced in their exact original form, accompanied by English versions from the 1914 translation by H. Rackham.

A.3 Why is *Lorem* used?

It is a long established fact that a reader will be distracted by the readable content of a page when looking at its layout. The point of using Lorem Ipsum is that it has a more-or-less normal distribution of letters, as opposed to using “Content here, content here”, making it look like readable English. Many desktop publishing packages and web page editors now use Lorem Ipsum as their default model text, and a search for “lorem ipsum” will uncover many web sites still in their infancy. Various versions have evolved over the years, sometimes by accident, sometimes on purpose (injected humour and the like).

A.4 Where can you find examples?

There are many variations of passages of Lorem Ipsum available, but the majority have suffered alteration in some form, by injected humour, or randomised words which don’t look even slightly believable. If you are going to use a passage of Lorem Ipsum, you need to be sure there isn’t anything embarrassing hidden in the middle of text. All the Lorem Ipsum generators on the Internet tend to repeat predefined chunks as necessary, making this the first true generator on the Internet. It uses a dictionary of over 200 Latin words, combined with a handful of model sentence structures, to generate Lorem Ipsum which looks reasonable. The generated Lorem Ipsum is therefore always free from repetition, injected humour, or non-characteristic words etc.