UNIVERSITY OF LATVIA

FACULTY OF SCIENCE AND TECHNOLOGY

Name Surname

TITLE OF THE THESIS

Summary of the Doctoral Thesis

Submitted for the degree of Doctor of xx
Subfield of xx

Riga, 20xx

The Doctoral Thesis was developed at the [Name of Laboratory and/or Institute], the Department of Physics, Faculty of Science and Technology, the University of Latvia from 20xx to 20xx.

The Thesis contains an introduction, x chapters, a summary, key results and conclusions, a bibliography, supplemental information, and acknowledgments.

Form of the Thesis: a dissertation / a collection of articles/research papers in Physics and Astronomy, subfield of xx.

Scientific supervisor: *Dr. Phys.* **Name Surname**, degree, scientific title, institution, and country.

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Defense of the Doctoral Thesis will take place at a public session of the Doctoral Committee of Physics, Astronomy and Mechanics of the University of Latvia on xx Month, 20xx at xx (date and time) at UL House of Science in Jelgava Street 3, Riga.

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ABSTRACT

Briefly describe the essence of the research problem, goals, and tasks, and explain the key results and findings. You may mention the number of peer-reviewed articles and conference abstracts the results have been published in. The abstract should be one page at maximum. The abstract should be the same as the one submitted to the Library.

Keywords: Here you may mention keywords. Keywords describe the topic of the work, the key results and methods.

CONTENTS

LIST OF ABBREVIATIONS

All commonly used abbreviations throughout the Summary should be listed here. Although not mandatory, you may use alphabetical order.

1. LIETOŠANAS PAMĀCĪBA

1.1. Noformējums

Kad lietošanas pamācība vairs nav vajadzīga, izdzēšat gan failu *lietošanas pamācība.tex*, gan rindiņu `\include{lietošanas pamacība}` *definīcijas fails un titullapa.tex* failā.

Lai izveidotu titullapu, aizpildiet *definīcijas fails un titullapa.tex* failā doto tekstu "**Titullapa**".

Teksts tiek sadalīts nodaļās, sekcijās un apakšsekcijās. To svarīgums no augstākās ejot uz zemāko ir:

- chapters, section, subsections

Ja vajadzīga nodaļa vai sadaļa, kura netiek nummurēta, bet to vajag saturā izmantot komandas

1. \chapter*{Iedaļa}
2. \addcontentsline{toc}
3. {chapter(iedaļas veids)}{Iedaļa}.

Teksta stili ir

- **treknrakstā** ar \textbf{..}
- *slīprakstā* ar \textit{..}
- ***treknā slīprakstā*** ar \textit{\textbf{..}}.

Lai pievienotu apzīmējumu sarakstam apzīmējumu izmanto

- \nomenclature[N]{apzīmējums}{Paskaidrojums},

kur [N] parāda kam pieder apzīmējums. Pagaidām ir **Lielumu apzīmējumi** ar [C], **Fizikas konstantes** ar [F] un **skaitļu kopas** [N], ja vajag jaunu kategoriju, pie \renewcommand\nomgroup pievieno jaunu kategoriju (neaizmirst pielikt }, lai noslēgtu pievienoto kategoriju, citādi nekompilēsies).

Lai labāk sakārtots overleaf fails iesaku izmantot mapes, kur ir attēli salikti pa nodaļām, palīdzēs neapmaldīties.

1.2. Matemātiskais pieraksts

Matemātiskās funkcijas vai darbības rakstīt ar \... kā $\sin$, $\lim$ nevis sin, lim. Izmanto \mathbb, lai iegūtu $\mathbb{R}$, $\mathbb{C}$. Vektorus var apzīmēt ar bultiņu vai treknrakstā:

$$\vec{x} \quad \text{ar \vec vai ar \mathbf} \quad \mathbf{x},$$

bet tas pie apzīmējumiem jāpaskaidro.

Vienādojumus var rakstīt "inline mode" - pašā rindiņā - ar $$ vai \(... \), piemēram, $y = x \lim_{n\to\infty} x_n = x$, vai "display mode", kad vienādojums ir atseviķi no teksta

$$\int_0^\infty \frac{\sin x}{x}\,dx \quad \text{ja vajadzīgs komentārs piem. } \forall x \in \mathbb{R}. \tag{1.1}$$

Vienādojumus var arī līdzināt ar \begin{align}

$$a = 5 \tag{1.2}$$
$$b + c = a \tag{1.3}$$
$$a - 2 \cdot 3 = 5/4. \tag{1.4}$$

Līdzīgi align strādā arī gather, tur pats tex līdzina vienādojumus. Ja vairākus vienādojumus grib zem vienas references kā vienādojumā (1.5), tad izmanto aligned vai gathered, tie ir iekš begin{equation} vides:

$$\begin{aligned} (x-3)x &= 2x+1 \\ x^2 - 5x - 1 &= 0. \end{aligned} \tag{1.5}$$

Vēl vienādojumus display mode var rakstīt ar \[...]\:

$$\iiint\limits_V \nabla \cdot \boldsymbol{E}\, dV = \oiint\limits_S \boldsymbol{E} \cdot\, d\boldsymbol{A}.$$

Kad raksta vienādojumus ar iekavām izmantot \left[.. \right]:

$$\left[\frac{x+y}{x-y}\right] \quad \text{nevis} \quad [\frac{x+y}{x-y}] \tag{1.6}$$

.

Matricu rakstība ir ar pmatrix vidi (tas pats tikai citas iekavas ap matricu ir arī bmatrix, Bmatrix, vmatrix, Vmatrix):

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ . & . & . & . \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}. \tag{1.7}$$

Ja vajag figūriekavas, kur atšķir gadījumus izmanto \begin{cases}:

$$f(x) = \begin{cases} 0, & \text{ja } x > 0, \\ x, & \text{ja } x < 0. \end{cases} \tag{1.8}$$

Ja grib atsaukties uz kādu vienādojumu, tad tam ir jābūt \label{nosaukums}, un uz to atsaucas izmantojot \eqref{nosaukums}, tas dos šo (1.5).

1.3. Noderīgi instrumenti

1.3.1. Atsauču veidošana

Bibliogrāfiju veido sagatavojot .bib failu (skatīt bibliography.bib). Atsauces veido izmantojot `\cite{atsauces nosaukums .bib failā}` [1]. Ja ir vairākas atsauces, tad atdala ar komatu `\cite{pirmā, otrā}` [1, 2].

1.3.2. Attēlu ievietošana

Visus grafikus, zīmējumus, diagrammas, fotogrāfijas, ko ievieto promocijas darbā, sauc par attēliem. Attēlus, tabulas un formulas centrē, izvieto pēc iespējas tuvāk tai vietai, kur tie ir minēti tekstā. Ja tabula vai attēls aizņem visu lappusi, tam jāatbilst teksta bloka lielumam (jāsaglabā piemaļu lielums).

Attēlu un tabulu numerācija var būt augošā kārtībā vai atbilstoši nodaļu numerācijai (piem., 2.3.). Katram attēlam un tabulai ir savs unikāls numurs, nevar būt divi attēli vai divas tabulas ar vienu un to pašu numuru.

Attēlus ievieto izmantojot \begin{figure}. Ieteicams izmantot vektorgrafika attēlus (.pdf nevis .png). Piemēram, uz to var atsaukties kā \ref{..}: figure 1.1. Ja

Figure 1.1: LU logo

vēlas 2 attēlus blakus izmanto minipage

Figure 1.2: Pirmais attēls

Figure 1.3: Otrais attēls

Atsaukties uz tiem var atseviški, katram vajag tikai savu \label, figure 1.2 and 1.3. Minipage var ielikt arī gan vienu attēlu, gan otru tabulu, netikai vairākus attēlus.

1.3.3. Tabulas un saraksti

Tabulas var veidot ar \begin{table} kā table 1.1. Pārvietot \caption virs tabulas, nevis zem kā ir automātiski, jo virsrakstu vajag virs tabulas.

Table 1.1: Pirmā tabula.

Npk.	Dati 1, $\mathrm{kg\,m\,s^{-1}}$	Dati 2, μW
1.	10.14	0.89
2.	9.85	0.3
3.	11.39	0.2

Sarakstus var veidot ar \begin{.....}:

- itemize (ar punktiem)
- enumerate (ar skaitļiem),
- var taisīt arī sarakstu sarakstā
  - !– cits saraksts
  - !– ar paša izdomātu numerācijas stilu

1.3.4. Algoritmu rakstīšanas pakete

Ja vajadzīgs uzrakstīt algoritma darbības principu, kā algoritmā 1.1, var izmantot paketi algorithm2e. Vairāk par šo paketi var apskatīt [3].

Algorithm 1.1: Mans algoritms

Input: Polinoma pakāpe
Result: Atgriež polinomu, ar prasīto pakāpi n.

```
1 while Kaut kas tiek darīts do
2     foreach global statement s do ;
3     foreach function fun do
4         foreach statement s in fun do ;
5     foreach statement s in game do ;
```

2. INTRODUCTION

2.1. General introduction and motivation

Justify the chosen topic and its relevance.

The preferred volume of the thesis summary is 20-30 pages / 40,000 – 60,000 characters including spaces (50 – 100 thousand characters). The abstract must be submitted in Latvian and English. It may be in another EU language only if approved by the UL Doctoral Committee of Physics, Astronomy and Mechanics. In special cases, if critical for a broader and more competent evaluation of the work, the Summary can be submitted in another foreign language in addition to Latvian and English, upon the request to and approval by the UL Doctoral Committee of Physics, Astronomy and Mechanics. Summaries in different languages should have the same content. It is recommended to publish the Summary in Latvian and a foreign language as two separate booklets (they can also be published as one booklet).

2.2. Scientific novelty

Describe the novelty.

You may mention that the scientific novelty of the research findings is confirmed by x published articles in international peer-reviewed journals listed in the SCOPUS database.

2.3. Aim and objectives

The **aim** of the study is ...

The **objectives** of the study are:

1. List the main tasks of this Thesis.

2. ..

2.4. Hypothesis, research questions, and the main theses

Describe the hypothesis, the research questions, and the main theses. The theses should summarize the opinion of the Author on his/her contributions to the specific field of research. After each thesis (in brackets), list the relevant Author's publications that prove the thesis.

2.5. Short description of the methods

Briefly describe the main methods used in this study.

2.6. Author's contribution

If appropriate, list the contributions by the Author to the studies described in this Thesis.

2.7. Approbation of the results

List all scientific publications related to the Doctoral Thesis. Number each publication so that each can be referenced throughout the Summary.

List all presentations at scientific seminars and conferences, where research results were presented and discussed.

List all research projects that the work has a connection with (unless it is not allowed due to the specifics of the work including confidentiality and limited access information).

2.8. Structure of the Thesis

List the number of pages, figures, and tables, describe the structure of the work, and list the chapters.

3. LITERATURE OVERVIEW

Overview of existing knowledge in the field of research / brief theoretical justification.

3.1. Copyright

The copyright of the Summary belongs to the Author. If the doctoral student has signed an agreement with the UL to transfer any intellectual property rights created during the doctoral studies to the UL, should additionally assign the copyright of the Summary to the UL.

4. METHODS

4.1. Section title

An overview of the methods used in the study.

5. RESULTS AND DISCUSSION

5.1. Section title

List key results and conclusions, their evaluation, illustrative materials, discussion and interpretation of the results, and any limitations of the study.

SUMMARY AND CONCLUSIONS

Main conclusions and recommendations, theoretical and practical significance of the work.

BIBLIOGRAPHY

List the main sources of scientific literature referenced in the Summary, including e-resources and texts by anonymous authors. The style should be uniform throughout the Summary.

If both Latvian and foreign languages are included in one booklet, the Bibliography should be included only once at the end of the booklet.

Literature sources from different languages should be arranged in a single alphabetical list. You are allowed to arrange the Bibliography in an alphabetical order within each thematic group. Sources that are not written in Latin letters should be replaced by Latin letters and the translation of the article title to Latvian should be written in square brackets.

For websites, the name of the source (if any), the link to the website, and the date of acquisition of the website should be listed.

References in the text:

- System of listing the author and publication year: the surname of the author (or several authors), the year of publication and, if necessary, the page number should be indicated in round or square brackets. If several articles of the same author are cited, they are arranged according to the year of publication, starting with the oldest. If the article has co-authors, the articles without co-authors are indicated first, then – with co-authors in the order in which the surname of the second author is in the alphabet. If the author has published two articles in the same year, an additional designation should be used – letters, for example Hymes, 2001a, 2001b. If there are more than two authors, mention only the first author and use the abbreviation et.al., for example Wiener et.al., 1990;

- The Bibliography may be created according to the rules or recommendations by the specific science field.

BIBLIOGRAPHY

1. Dirac, P. A. M. *The Principles of Quantum Mechanics* ISBN: 9780198520115 (Clarendon Press, 1981).
2. Kohn, W. & Sham, L. J. Self-Consistent Equations Including Exchange and Correlation Effects. *Phys. Rev.* **140,** A1133–A1138. https://link.aps.org/doi/10.1103/PhysRev.140.A1133 (4A Nov. 1965).
3. *Algorithm* https://mlg.ulb.ac.be/files/algorithm2e.pdf. (Last accessed: 07.03.2024).

ADDITIONAL INFORMATION

If desired, additional information may be provided. For example, participation in international schools, popular scientific articles or oral presentations, publications not related to the Thesis, awards, etc.

If desired, data on the Author's previous education and scientific experience may be mentioned.

ACKNOWLEDGMENTS

If desired, you may acknowledge the people and organizations that contributed to the completion of the work.

All projects that financially or otherwise supported the development of the work may be listed.