

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

FACULTY OF MECHANICS

DEPARTMENT OF MECHATRONICS, ROBOTICS AND DIGITAL MANUFACTURING

Student’s Name and Surname

**TITLE OF THE FINAL MASTER’S THESIS IN ENGLISH**

Final Master’s thesis

Study programme MECHATRONIC SYSTEMS,

Code 6211EX053

Vilnius, 2020

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

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APPROVED BY

Head of Department

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 (Date)

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**Supervisor:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_

 (Title, Name, Surname) (Signature) (Date)

Vilnius, 2020

**DECLARATION OF AUTHORSHIP IN THE FINAL MASTER’S PROJECT**

(Declaration of authorship must be printed out from the system *mano.VGTU.lt*)

**TASK TO PREPARE FINAL MASTER’S PROJECT**

(Supervisor of Final Master’s Project fill task and give for student)

**ANNOTATION**

(Student completes and prints an annotation in English and Lithuanian languages from the system *mano.VGTU.lt*

**Before printing annotation text must be approved by supervisor**)

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# INTRODUCTION

Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text. Text.

**Object of Research.** Present the object of research.

**The aim and tasks of the project.** The aim should be clear formulated in 1-2 sentences and should present all work done and especially achieved results. For example: The aim of this work is to perform research of ….. system and improve it’s characteristics implementing new design/features/control algorithm.

In order to achieve main aim, smaller tasks should be formulated according to the work which should be done. For example:

The tasks of the project:

1. To perform overview of literature related to the research topic (The physical basics of the problem, similar researches, methods, methodology, equipment.)
2. To perform theoretical research on….(modelling)
3. To perform experimental research on…. (experiments with real object).
4. To formulate conclusions and recommendations.

**The novelty of the theme.** Presentation of the novelty.

**The relevance of the theme.** Presentation of the relevance.

**Methods of research.**

**Scientific value.**

**Work approbation.**

Presentation at Conference for Junior Researchers “Science – Future of Lithuania”

All of the sections described above are compulsory and they must be included in the introduction.

# LITERATURE REVIEW

This chapter can be divided to smaller subchapters according to type of presented information (methods, equipment, similar researches) as shown below.

The review should be written in accordance with the general rules of the writing scientific reports: the sub-section cannot start or end with a table or picture, each picture or table should be mentioned in the text. If the information presented in text, picture or table is not original, the **source must be specified**.

Example made by using Mendeley (Reference Management Software): While the toxicity of water is one of the main problems in the world, the re-searchers studied it while using microorganisms as the indicators (Krikstolaityte et al. 2013; Kisieliute et al. 2019). Unicellular organisms, like yeast, is as an early toxicity warning device because of the yeast respiratory function (Liu et al. 2004). It depends on oxygen concentration in the solution. As it is known, quinones cause oxidative stress which causes the death of the cell (Monks and Lau 1992). The following Table 1 gives a summary of quinones.

**Table 1.** Table captions should be placed above the tables.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Title** | **Type** | **Comment** |
| 1. |  |  |  |
| 2. |  |  |  |

**In the table should be used same font and style as in main text.**

Electrodes’ surface was analysed before and after modification with yeast cells. AFM results show that the graphite electrode was successfully modified with yeast and it can be used for further investigation (Fig. 1). {in the text before figure, table, equation should be included reference to this element, example is seen in the last sentence before - (Fig. 1.)}.



**Fig. 1.** Topographical images: A. Topography of the non-modified graphite electrode; B. Topography of the yeast-modified graphite electrode (in case if figure is taken from some source reference should be placed here, and source should be included into reference list)

If picture contains some technical information each component should be numbered and noted in figure name. If picture presents some dependencies each line should be explained.

## Overview of scientific literature related to….

Overview of scientific literature is compulsory; it should be reviewed not less than 5 scientific papers.

### 1.1.1. First important subchapter

There is one of sub-subchapters text.

### 1.1.2. Second important subchapter

There is second of sub-subchapters text. Subchapters and/or sub-subchapters should include least two paragraph, otherwise separate sub-subchapter not needed.

## 1.2. Overview of research methods/methodologies/equipment

Text.

# THEORETICAL RESEARCH

Here the aim of theoretical research and other important information related to the modelling process should be presented.

## 2.1. Theoretical model of…

Here all information related to the creation of mathematical model (equations, assumptions, process of model creation) should be presented.

## 2.2. Methodology of theoretical research of…

Here what type of research will be performed using above described model (what cases will be simulated, which variables will be changed, in what ranges, which parameters will be measured, to that physical features they correspond) should be presented.

## 2.3. Results of theoretical research

Here results obtained using above described model and methodology should be presented and analysed. Results should be presented in clear understandable form (in most cases graphical form) in case if huge amount of information from model is obtained it should be summarized defining similar comparable cases.

# 3. EXPERIMENTAL RESEARCH

Here aim of experimental research and other important information related to the research process should be presented.

## 3.1. Description of experimental setup

Here information related to test rig and used equipment should be presented. Should be listed and described all main parts of test rig and used equipment. Should be presented characteristics of used measuring equipment.

## 3.2. Methodology of experimental research

Here information in details how experiment was performed, what was measured, in what conditions, what was changed between measurements and etc should be presented. Also in case if results are processed using some algorithms or filters it should be specified.

## 3.3. Results of experimental research

Here results obtained using above described equipment and methodology should be presented and analysed. If it is possible theoretical and experimental results should be compared. Results should be presented in clear understandable form (in most cases graphical form), in case if huge amount of information from experiments is obtained it should be summarized defining similar comparable cases.

# CONCLUSIONS

1. This section contains specific conclusions from work. Conclusions should be numbered. **At least one conclusion must be formulated for each chapter**.

.

# LIST OF LITERATURE

**(In this section is written in alphabetical order all used literature)**

Algoritmas [interaktyvus]. 2016. [žiūrėta 2017 05 07]. Prieiga per internetą: https://lt.wikipedia.org/wiki/Algoritmas

Bakšys, B., Federavičius, A. 2005. *Robotų technika*. Kaunas: Technologija. 494 p.

Bakšys, B. 2008. *Robotizuoti technologiniai kompleksai.* Vilnius: Vilniaus pedagoginio universiteto leidykla. 168 p.

Kisieliute A, Popov A, Apetrei R-M, et al. (2019). Towards microbial biofuel cells: Improvement of charge transfer by self-modification of microoganisms with conducting polymer – Polypyrrole. *Chem Eng J* 356:1014–1021. https://doi.org/10.1016/J.CEJ.2018.09.026

Krikstolaityte V, Oztekin Y, Kuliesius J, et al. (2013). Biofuel cell based on anode and cathode modified by glucose oxidase. *Electroanalysis* 25:2677–2683. https://doi.org/10.1002/elan.201300482

Liu H, Ramnarayanan R, Logan BE. (2004). Production of Electricity during Wastewater Treatment Using a Single Chamber Microbial Fuel Cell. *Environ Sci Technol* 38:2281–2285. https://doi.org/10.1021/es034923g

Monks TJ, Lau SS. (1992). Toxicology of quinone-thioethers. *Crit Rev Toxicol* 22:243–70. https://doi.org/10.3109/10408449209146309

3-ašių tiltinis robotas [interaktyvus]. 2016. [žiūrėta 2017 02 15]. Prieiga per internetą: <http://www.hahnautomationplastics.com/proline-3-axis-robots>

**THE ANNEXES**

Here are all the annexes.

Each annex is numbered and started on a new page.

In annexes should be presented date which is important, but not suitable for main text: (long identical calculations, raw data from experiments, program code, similar graphs and etc.