# LaTeX Lab Report Template
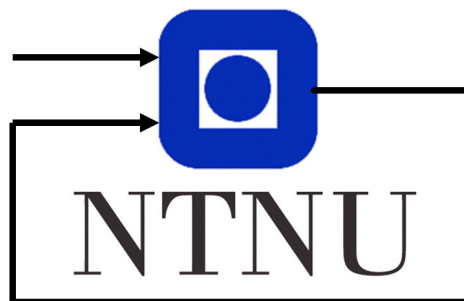
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**Abstract**

This document highlights some of the principal components your report should include from the lab, and how it should be structured. Basic tips for formatting a report in LaTeX can be found in a more extensive document which is based on work done by Tor Aksel Heirung for TTK4135, Andreas L. Flåten and Kristoffer Gryte [1].

The main file, "labreport.tex", defines the structure of the document.

When you write your own report, this section (the abstract) should contain a *very* short summary of what the lab is about and what you have done.

# Contents

# 1 Introduction

Your introduction should contain an overview of the work you were assigned, as well as a few sentences putting the work into a larger perspective. You can introduce the helicopter set-up such that it is easier to refer to specific variables later in the report. You should also give a quick description of how the report is organized.

You should of course put most of the work into doing good work in the lab and then presenting it in the report. When presenting your work in the report, both content and presentation/layout matters. Since your only way of communicating your good effort in the lab is through writing about it here, the way you write about it is essential. This means that even if you have a really good controller or an interesting experiment but describe it poorly, you will probably not be rewarded for the results. A plot showing perfect control is worth very little if it is not accompanied by a clear description of what it represents.

# 2   Part I - Monovariable control

- Introduce and motivate the task. You can include a brief summary of the different tasks in the lab-preparation assignment which was necessary to complete the lab. No extensive listing or derivation of equations are needed (you can mention, e.g., linearization and pole-placement, but don't derive the linearized equations etc.).

- Include your hypothesis/test-plan for the poles $\lambda_1$ and $\lambda_2$ and explain your thought process.

- Include the results from the experiments that were done in the lab according to the test-plan, and any other experiments you found interesting during your time in the lab. Include plots and discuss the result. This is the most important part of the report. How you structure this part of the report is up to you.

- Conclusion. Include a short paragraph summarizing the results.

# 3   Part II - Multivariable control

- Introduce and motivate the task. You can include a brief summary of the different tasks in the lab-preparation assignment which was necessary to complete the lab. No extensive listing or derivation of equations are needed (you can mention, e.g., LQR, controllability, integral effect, augmented matrices etc.).

- Include your hypothesis/test-plan for the matrices $\mathbf{Q}_{\mathrm{LQR}}$ and $\mathbf{R}_{\mathrm{LQR}}$ both with and without integral effect and explain your thought process behind it. Include it if you did any experiments with the values in $\mathbf{F}$.

- Include the results from the experiments that were done in the lab according to the test-plan, and any other tests you found interesting during your time in the lab. Include plots and discuss the result. This is the most important part of the report. How you structure this part of the report is up to you.

- Conclusion. Include a short paragraph summarizing the results.

# 4  Part III - Luenberger observer

- Introduce and motivate the task. You can include a brief summary of the different tasks in the lab-preparation assignment which was necessary to complete the lab. No extensive listing or derivation of equations are needed (you can mention, e.g., the IMU, noisy measurements, observability, state-estimation etc.).

- Did you find out the minimum set of states that if measured makes the system observable? Did you experiment with this?

- Include your hypothesis/test-plan for the estimator poles and explain your thought process behind it.

- Include the results from the experiments that were done in the lab according to the test-plan, and any other tests you found interesting during your time in the lab. Include plots and discuss the result. This is the most important part of the report. How you structure this part of the report is up to you.

- Conclusion. Include a short paragraph summarizing the results.

# 5 Part IV - Kalman filter

- Introduce and motivate the task. You can include a brief summary of the different tasks in the lab-preparation assignment which was necessary to complete the lab. No extensive listing or derivation of equations are needed (you can mention, e.g., measurement noise, process noise, optimal estimator, etc.).

- Include your hypothesis/test-plan and explain your thought process behind it.

- Include the results from the experiments that were done in the lab according to the test-plan, and any other tests you found interesting during your time in the lab (bonus tasks?). Include plots and discuss the result. This is the most important part of the report. How you structure this part of the report is up to you.

- Conclusion. Include a short paragraph summarizing the results.

# References

[1]  *Lab report template.* https : / / github . com / ntnu - itk / labreport.
     Accessed: 2021-09-13.

# A    Simulink diagrams

An appendix is not necessary. However, if you want to include some Simulink diagrams, this is the place to include them.