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Advice on How to Write the Report

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Abstract

Some advices on how to write a short scientific paper is provided, with emphasis on the report for the project in TMA4215 Numerical mathematics.

How to write a scientific paper in numerics?

The report should be written as a scientific report, not as answer sheet of an assignment. In the following, we will explain what that mean in practice.

A typical paper in numerics will be organised as follows:

Abstract

a) Introduction

b) Theory

c) Numerical experiments

d) Conclusion.

e) Bibliography

In the following, some ideas on how these sections can be written (and some hints about things to avoid) is given. These should not be considered as strict instructions, they are only advices and tips. You still have to use and develop your most important resource, your common sense.

First and last: Make sure your report is readable, in the sense that it is possible for a potential reader to understand and learn something. It may help to imagine you are writing to a peer, in your case a fellow student. How will you explain the material to her/him (the page limit taken into account).

You have a limited number of pages available, in this case 12, no more! So be concise. Have enough details to make the paper readable and the results reproducible, but avoid all trivial calculations. You have to make up your mind what is trivial, what to include and what to drop. It may mean that your initial draft is too long, and something has to go. Or you have to rewrite something in a more compact way. It can be frustrating, but it is part of the process.

And again: Do not include any MATLAB code in the report.

There are a lot of excellent resources available on how to write scientific papers. I would recommend [1], available electronically from the publishers home page. If you have no time to look at it now, do it before you start writing your master project/thesis.

ABSTRACT

Give a summary of the contents and the main results of the paper. Write it as independent of the paper as possible, in the sense that it should not be necessary to read the paper to understand the contents of the abstract. Usually, an abstract should help the reader to decide whether he/she should read the whole paper or not.

In general, do not use mathematical expressions or citations in an abstract (exceptions exists)

INTRODUCTION

The introduction should help the reader to get a general impression on what the paper is about and how it is organised. All main ideas and how they are obtained should be summarised. In a journal paper (or a master thesis) it is natural to compare your own work with related works in the field, but this can safely be ignored in a project like this. Unless you have done something really innovative, of course.

* Do not overload the introduction with definitions and other technical stuff, leave that to the Theory section.

* Avoid generic sentences with hardly no content, like "Bezier curves are widely used in many areas of computer graphics and related fields." You have only a limited number of pages, use them wisely.

* Just an advice: Write the introduction *after* you have written the rest of the paper (but before the abstract). The introduction contains a description of what you have done, it is a good idea to have done it first.

THEORY

This is the place for all the nice, mathematical and technical stuff. It should include all prerequisites, in the sense of results and definitions from the literature on which your results depend. From this, you build your theory. What this means depend on the project. In our case, it means the discussion of the properties of the given Runge–Kutta methods, and the theory developed/used in Part II of the project.

⋆ Write short and correct. Include enough details to make it possible to follow the arguments, but avoid trivial computations.

⋆ Only describe or prove results are are necessary to support or reach the main results.

⋆ Results that can be verified numerically (at least the main results) should be so in the Numerical experiment section.

⋆ Use the mathematical expressions for precise descriptions, but sometimes it is appropriate to describe the meaning also in words.

⋆ Figures always help!

⋆ Use standard notation whenever available. Do not use fancy symbols, we are not impressed.

⋆ Be consistent with your notation.

⋆ Cite all sources.

⋆ Do not copy directly from other papers. You are of course allowed to use results from all published sources, but *always* cite them. When using results from other peoples work, read what you need carefully to make sure you understand, put the paper aside, and then write the relevant passage in your report. This way, it easier becomes an integrated part of your paper.

NUMERICAL EXPERIMENTS

In this section you describe your numerical experiments, that is the applications of the algorithms proposed in the Theory section. They should verify main theoretical results, in our case to show that the proposed algorithms work on some on more or less challenging problems.

⋆ All experiments should be reproducible. That means that enough details should be given so the reader can implement the algorithm and obtain the same result. If you construct your own experiments, describe them as best as you can, and make sure the data used is available on request.

⋆ Results are often presented as figures (from MATLAB). Make sure that they are readable, the text on the figure big enough, all graphs explained etc.

⋆ If you run out of space, remember that you can put figures side by side. The bullet point above remain valid. By making the figures smaller it is tempting to forget that the labels etc. still should be readable.

CONCLUSION

Well, this is the place for discussion and conclusions (if any). Do the algorithm work as expected? Are there problems for which it works better than others? Are there open problems?

BIBLIOGRAPHY/REFERENCES

Again, make sure that you cite all sources you have used in your project (the project description excluded). I strongly advice you to use BibTeX, you can find several references to it on the web. If not, make sure that all references are written in the same format.

ACKNOWLEDGEMENTS

In this project: If you have got more than expected help from someone it is appropriate to mention it here.

REFERENCES

[1] N. J. HIGHAM, *Handbook of writing for the mathematical sciences*, Society for Industrial and Applied Mathematics (SIAM), Philadelphia, PA, second ed., 1998.