Guidelines for written work

Bachelor thesis, master thesis, lab and seminar papers, ...

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TECHNISCHE
UNIVERSITÄT
DARMSTADT

1 Structure

1. Beginning: Cover sheet (with title, name, date of submission, type of work, reviewers), Eidesstattliche Erklärung (declaration of originality), brief summary / abstract (short summary of contents incl. objectives, procedure, results) and table of contents.
2. Introduction: Introduction to the topic, motivation, description of the works structure.
3. Main part: Detailed analysis of the topic. It is often advisable to divide this into a theory chapter, e.g. explanation of the implicit Euler method with a summary of the relevant theory, and an example chapter, e.g. application of the method to one or more examples with discussion of the results (convergence etc).
4. Conclusion and Outlook: Short summary of the most important results, a few take home messages, outlook for further work if necessary. No new results.
5. End: List of sources and appendix (supplementary information not necessary for understanding, such as code or images).

2 Design

1. The use of the TU Darmstadt Corporate Design[1] is expected and the LaTeX-Templates[2] are recommended.
2. Abbreviations must be written out and introduced the first time they are used. For example, one could introduce an abbreviation for the expression random variable (RV). The use of abbreviations can be simplified with the package `glossaries`. One should not introduce too many abbreviations, as it disturbs the flow of reading.
3. Graphs/Images:
   - Graphs/Images must be referenced in the text.
   - A good graph has labels on each axis, they include a unit (e.g. “Current (A)” or “Current in A”) and if several curves are shown, a legend.
   - Axis labels etc. must be large enough to be easily readable. For this purpose, the creation of graphs with the LaTeXpackage `pgfplots` is convenient.
   - The caption describes the graph, so that it can be roughly understood without further text. The caption is concluded with a full stop at the end of the sentence.
4. Mathematical expressions without relation signs, as well as stand-alone equations, are usually incomplete or lead to ambiguities. The velocity in free fall would be expressed as

   $$v(t) = gt$$

   and not just denoted with

   $$gt.$$

   Equations must be described and variables explained in the text (e.g. you must mention that t denotes time and g denotes acceleration due to gravity). Equations are to be treated like parts of a sentence and also punctuated accordingly (avoid colons).
5. Algorithms can either be described in the text or given by pseudo-code (whereby pseudo-code, like images, must be briefly mentioned / described in the text). If necessary, individual lines of code in the respective programming language can also be printed in the text. The package `listings` has syntax highlighting for many languages.
6. Large pieces of code usually belong in the appendix or are handed in separately. There should then be a reference to the appendix in the text. The function of the code should be described by text and demonstrated e.g. by some result plots.

[1] see `https://www.intern.tu-darmstadt.de/arbeitsmittel/corporate_design_vorlagen`
[2] see `https://www.ctan.org/pkg/tuda-ci`

3 Language

You may choose to write in American or British English. The latter is the official recommendation of TU Darmstadt but our community tends to prefer American English. In either case, your writing shall to be consistent. Make sure to use a properly configured spell checker. Especially for non-native speakers, tools like `https://www.grammarly.com` or `https://www.deepl.com` are helpful but be reminded that they may be not compatible with German privacy laws, i.e., you may want to omit protected or personal data. Note that the use of quotation marks is different in German („…“), American (“…”) and British English (‘…’).

4 Conventions

Conventions are agreements that are intended to serve readability, so that not all nomenclature has to be introduced again. Unfortunately, they are not universally valid and often also depend on the context, e.g. electrical engineers define $j = \sqrt{-1}$, but mathematicians prefer $i = \sqrt{-1}$. An author has some freedom here, so of course the symbol „−“ can be used for addition and „+“ for subtraction, but it is certainly not expedient. The following conventions are common in our scientific community:

1. Matrices and vectors are always written in bold and not in italics. This can be achieved by the command `\mathbf{}`, e.g. `\mathbf{A}` results in $\mathbf{A}$ in a math environment. Matrices are denoted with uppercase letters, vectors with lowercase letters. Scalar quantities are set lowercase and in italics, e.g. $y = 2x$.

2. There are three different types of indices:
   - *Mathematical* indices are set as expected by the symbol in the index. Running indices are thus italic, e.g. $x_i, i = 1, \ldots, n$ or a_{ij} as a matrix entry in the i-th row, j-th column of a matrix $\mathbf{A}$. On the other hand, if the index refers to the scalar variable x, the vector $\mathbf{a}$, or the matrix $\mathbf{A}$, we write D_x, $D_\mathbf{a}$ and $D_\mathbf{A}$, respectively.
   - Indices representing a *word* or *word abbreviation* are not italicized, e.g. U_rms (effective value), μ_iron, i_L (L as symbol for inductance). This can be achieved with the command `\mathrm{}`, e.g. `i_{\mathrm{L}}` results in i_L in the math environment.
   - If numbers are in the index, they are never written in italics, e.g. $x_1, ..., x_{10}$. With numbers this is the automatic notation in LaTeX and therefore does not have to be influenced manually.

3. Units are not written in italics. Furthermore, between a value and a unit belongs a small space which can be added by `\,`, e.g. $10\,\mathrm{V}$ instead of $10\mathrm{V}$. This can be simplified by using an appropriate package (e.g. `siunitx`).

4. Code snippets in the text are indicated with `\texttt{}`, which produces a `typescript`. Mathematical notations should be mixed with code notations. For example `5*x*1e+6` and `A\b` is coding style, while $5x \cdot 10^6$ and $\mathbf{A}^{-1}\mathbf{b}$ is the appropriate mathematical analogue. In mathematical notation $\mathbf{a} \cdot \mathbf{b}$ corresponds to a scalar product, $\mathbf{AB}$ and $\mathbf{Ab}$ correspond to a matrix multiplication or a matrix-vector product and $\mathbf{a} * \mathbf{b}$ corresponds to convolution.

5. Longer code is often specified in the appendix. The use of the package `listings` is suitable for this. On the other hand small pieces of pseudocode are often used in the main part. There are various packages for this, e.g. `algorithmic`.

6. When referencing equations in the text, the number is given in brackets, e.g. „equation (6)“. This can be achieved with the command `\eqref{}` (for this the package `amsmath` is necessary). The word “equation” is commonly omitted and only written when starting a new sentence.

5 References

1. Statements must be correct and justified. This can be achieved by a proof, a numerical experiment or a reference, sometimes mentioning a keyword is sufficient („follows by partial integration“). Exceptions are results that may

be assumed to be known by the target group, e.g.

$$\frac{\mathrm{d}x^2}{\mathrm{d}x} = 2x$$

does not have to be proven or substantiated (the proof must of course still be known to the author).

2. Plagiarism will not be tolerated. Sources used must be cited. This also applies to scripts, websites and especially Wikipedia. If possible, stable and generally available sources with proven quality control should be used, e.g. textbooks or scientific articles.

3. Avoid literal quotations. Although these are generally allowed if you follow the appropriate citation rules (appropriate size, inverted commas, italics where appropriate and citation of the source), they are unusual in science and engineering. Citations of equations (with source citation) are accepted, i.e. equations do not have to be rewritten to avoid a "literal" citation.

4. In the natural sciences, it is customary to refer to a source in the list of sources using square brackets with a number. The reference is then usually at the end of the sentence or paragraph that you want to substantiate. For example, the text would with the help of the command `\cite{}` contain: Green horses can fly [1].
The list of sources could then for example contain:
[1] Peter Pan. *Theory about colourful horses.* Wish Publishing, 17. Edition, 2019.

5. Bibliographies can be created and integrated with the literature management system BibLatex, for example. For this purpose, the sources are first stored in a separate `.bib` file, the literature database. In the preamble, the package is included, the citation style is specified and the literature database to be used is indicated:
```
\usepackage[style=alphabetic]{biblatex}
\addbibresource{Literaturdatenbank.bib}
```
The bibliography is called up at the desired position in the document by `\printbibliography`.

6 Use of AI-based tools

Only the specified tools may be used when writing a thesis. AI-based text tools may only be used to improve sentence structure, grammar and spelling. Passages where content of the work has been edited using AI-based tools must be documented and must be checked personally by the author.

Example Generative use is not permitted. This means that the use of the result of the ChatGPT request „Please write a section about the history of Maxwell's equations." is not permitted, but the request to reformulate an existing text on the history of equations is. The acknowledgement can be made collectively, e.g. in the introduction or in the appendix: „In Section 2 ChatGPT was used to improve the text quality. For Section 3, ChatGPT was used to find suitable references. Grammarly was employed to enhance writing quality, ensuring grammar, spelling, and style accuracy. DeepL facilitated multilingual communication by translating excerpts from non-English research papers. GitHub Copilot was used to find bugs in Algorithm 1 and Algorithm 3. The polynomial equations in Section 4 have been solved using Wolfram Alpha [2]."

In addition, the use of AI-based tools for research purposes (e.g. programming and data analysis) is explicitly indicated in the text. In these cases, it is also to be mentioned which tools were specifically used and how they were used (if explicit inputs were made).

Example In the following enquiry, ChatGPT is used as a research tool:„I have the following data set:[1,2], [2,4], [3,9], [4,8]. Are there any outliers?" If the result of this enquiry is used in the work, then detailed documentation is required.

Irrespective of the use of tools, the author must take full responsibility for the text, including, but not limited to, any errors, unethical discrimination, copyright infringements or plagiarism introduced into this work by technical tools. The author must also comply with all laws, e.g. data protection and intellectual property, when using a tool.

7 Presentation

1. Focus on the most important content of your thesis. The given time is often not enough to present the entire work – so choose wisely.
2. Think about it in advance: Who is your audience? What prior knowledge does your audience have? What special interests does your audience have? Align your presentation accordingly.
3. Similar to a written report, the presentation follows the structure introduction - main part - conclusion:
   - Title slide with the name of the speaker/author, the institute and the work, usually the date and a visualization.
   - Outline (can be omitted for very short presentations or repeated after each section in case of longer presentations).
   - The introduction motivates the talk and arouses the interest of the audience, e.g. with a practical example that enables the listeners to create a link between themselves and the topic of the talk.
   - As in the written work, the main part contains theory and application, but can be designed more freely and creatively. For example, the basics, theory and methodology can be explained using a simple use case. It is important that the speaker consciously incorporates a structure into the presentation and conveys this to the audience.
   - The final part summarizes everything important briefly (no new information). If necessary, it gives an outlook on further research questions.
   - Closing slide, e.g. to say thank you, contact details for queries and references.
4. Make your slides clear (structured design):
   - Only one core statement per slide.
   - Not too much text on the slides: no sentences, just bullet points. Everything else will be explained in the talk. Excluded are definitions, legal texts and literal quotations.
   - Use a consistent design.
   - Make sure you use legible fonts and font sizes (a suitable size is 44 pt for headings and 28 pt for subheadings).
   - Emphasize important content with bold or italic font-styles.
   - Work with visualizations, especially to explain complicated or very abstract content.
   - Avoid bright colors, instead use colors with higher contrast, try to avoid red and green in the same figure, increase line widths and use different styles (dotted, dashed, solid) in your graphics. In the Latex template the colors TUDa-Nx ($N \in \{0, \ldots, 11\}$ and $x \in \{a, \ldots, d\}$) from Corporate Design are predefined.
   - A caption for illustration is possible on presentation slides, but not necessary.
   - Use formulas and mathematical symbols moderately. Highlighting important things in color is often useful. Also, when making presentations, stick to the conventions described above.
5. In your presentation, address each point that is on your slides.
6. Regarding the number of slides, the following rule of thumb may help: one slide per minute of speaking time.
7. Don't number your mathematical formulas unless you refer to that number on the same slide. You can't scroll backwards in a presentation, so three slides later nobody knows what equation (2) was.
8. Avoid unnecessary foreign words and abbreviations. If you use them, introduce them.
9. References in presentations:
   - Limit yourself to the 2-5 main sources.
   - Denote them once in the footer (e.g. if you explain Newton's method over 3 slides, give the main source for it on the first of these slides).

- In the end, list your sources again. Sources that have not been explicitly mentioned before can also be included.
- If you use images or similar, the sources must be given directly below the image. This should be in relatively small print. These sources do not have to be repeated at the end.

10. Practice your presentation out loud in advance – if possible in front of an audience. Make sure you keep to the allotted time.
11. Try to speak fluently and freely.

8 Thesis evaluation

The grading of theses and reports is based on the following criteria. Some criteria are omitted in certain cases, e.g. D. only makes sense if a final presentation was given. The weighting of the respective categories is indicated in parentheses.

A. Working style (0.1)	**B. Results (0.4)**
1. Independence 2. Understanding 3. Creativity 4. Diligence 5. Ability to cooperate 6. Systematics and diligence in planning and execution	1. Quantity and working speed 2. Quality 3. Completed result / Usability 4. Degree of innovation 5. Targets met
C. Elaboration (0.4)	**D. Final presentation (0.1)**
1. Outline / Structure 2. External form 3. Linguistic competence 4. Scientific approach 5. Correctness of the results 6. Completeness of the work	1. Content 2. Presentation style 3. Quality of slides 4. Presentation 5. Discussion