

IFMT



Guideline for writing a scientific work

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1. General

The present guideline is compiled to help students willing to write a scientific work (Bachelor/Master project, Master's thesis) at the Institute for Rock Mechanics and Tunnelling, Graz University of Technology. The following requirements are to be fulfilled, if the work is supervised by the university assistants DI Michael Henzinger or DI Alexander Kluckner. In case of another supervisor the requirements have to be previously discussed.

1.1 Word processing

The choice of a word processing programme is free. Suggested programmes are MS Word or LaTeX, since on the one hand the use of MS Word is most commonly known and on the other hand LaTeX provides professional results. Working with LaTeX may require some preparation time.

1.2 Length of the work

The length of the work depends on the topic. However, the principle of quality before quantity applies to the work, meaning that the work's length (without appendix) is of less importance, as long as the topic is properly dealt with. Usually the main sections of the work, such as the explanation of the topic, the description of the approach to the problem and the evaluation and interpretation of the results, cover 70 to 100 pages for a Master's thesis and 25 to 35 pages for a Bachelor or Master project.

1.3 Further reading

The references below provide further information for writing scientific works. They can be found in the main library of Graz University of Technology, both as eBook and print edition:

- Eco, U. 2010. Wie man eine wissenschaftliche Abschlußarbeit schreibt: Doktor-, Diplom- und Magisterarbeit in den Geistes- und Sozialwissenschaften, Facultas.WUV: Wien.
- Karmasin, M. & Ribing, R. 2012. Die Gestaltung wissenschaftlicher Arbeiten: ein Leitfaden für Seminararbeiten, Bachelor-, Master- und Magisterarbeiten sowie Dissertationen, Facultas.WUV: Wien.
- Skern, T. 2011. Writing scientific English: a workbook; [plus DVD], Facultas.WUV: Wien.
- Gockel, T. 2010. Form der wissenschaftlichen Ausarbeitung. Studienarbeit, Diplomarbeit, Dissertation, Springer-Verlag Berlin Heidelberg
- Brink, A. 2013. Anfertigung wissenschaftlicher Arbeiten. Ein prozessorientierter Leitfaden zur Erstellung von Bachelor-, Master- und Diplomarbeiten, Springer Fachmedien Wiesbaden.

2. Language and style

The scientific work can be written in German or English, according to the respective rules for grammar and spelling. German texts must comply with the latest version of the DUDEN. English texts can refer to the Oxford English Dictionary (www.oxforddictionaries.com) for British English (BE), or to the Webster's Collegiate Dictionary (www.merriam-webster.com) for American English (AE). Scientific works with serious grammar or spelling mistakes will not be assessed.

The language has to be clear, precise and understandable. This implies the use of simple phrases without subjective and normative statements (e.g. "best", "should", "enormous potential", "unforeseen opportunities").

2.1 Precise formulation

Vague statements, which allow individual interpretation, have to be avoided by quantifying them with numerical values (e.g. "the displacement increased by 20 percent within 6 hours" instead of "the displacement increased enormously").

2.2 Windy paraphrases and plattitude

Windy paraphrases and platitudes must not be used, as well as the frequent utilization of superlatives and subjective emphasis (e.g. "the only true model", "incredibly wrong approach", "most optimal alternative").

2.3 Nested sentences

Sentences with numerous subordinate clauses and complex structure tend to confuse the reader. Outlining the basic idea and then dealing with each aspect separately can help to avoid nested sentences. One sentence should cover one aspect.

2.4 Foreign words

Foreign words and technical terms should only be used as long as they accord to the commonly used terms. The wrong or frequent use makes the work incomprehensible and does not replace precise and clear explanations or statements. Newly introduced terms have to be explicitly defined.

3. Literature research

The research of literature is a fundamental and important part of every scientific work. Therefore the author can rely on various sources like scientific magazines, monographies (e.g.: books, publication series), Master's thesis', dissertations, information from brochures, websites and scientifically oriented online research engines. To gain an overview of the topic, online search engines like Google/Google-Scholar or Yahoo and online encyclopedias like Wikipedia can be used.

Many search engines provide functions to limit and concretise the research. Keywords can be combined and banned using operators like "and", "or" or "not". In addition scientifically oriented search engines allow the definition of the search area (e.g. search within Abstract, Title, Keyword) and outline the results ranked by relevance or frequency.

After having made the first selection of sources using the research engines, the first sections of the documents to be read should be chapters like "Abstract", "Conclusion", "Results" or "Outlook". Furthermore figures and tables should be taken under consideration. This approach helps to decide whether the document is relevant or not, without reading it entirely. Subsequently the chosen documents have to be downloaded and saved in the working directory.

The university acquires various scientific journals each year, which can also serve as sources. The journals are freely accessible for employees and students online, whereat direct connection to the university network is needed (e.g. university library, learning centers). The network can also be accessed from outside the university by using a VPN-client (further information is provided on the website of the "Zentraler Informationsdienst der Technischen Universität Graz", www.vpn.tugraz.at).

Establishing a database helps to maintain the overview of the different documents. Relevant information like author, title, year of publication, publishing house or type of document (e.g. article in a scientific journal or independent scientific work like a Master's thesis) should be recorded. Programmes for databases are JabRef, RefWorks, Citavi, Excel, Access or the source-management tool in Word.

3.1 Scientific journals

Descriptions and web-links of various scientific journals are listed below.

- Acta Geotechnica (<http://link.springer.com/journal/11440>)
- Bautechnik ([http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1437-0999](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1437-0999))
- Berg- und Hüttenmännische Monatshefte (<http://link.springer.com/journal/501>)
- Canadian Geotechnical Journal (<http://ftubhan.tugraz.at/han/4791/www.ingentaconnect.com/content/nrc/cgj>)
- Geomechanics and Tunnelling ([http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)1865-7389](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1865-7389))
- Geotechnik ([http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)2190-6653](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2190-6653))
- Géotechnique (<http://www.icevirtuallibrary.com/content/serial/geot>)
- Glückauf (<http://www.vge.de/verlag/verlagsprogramm/glueckauf.aspx>)
- Journal of Geotechnical and Geoenvironmental Engineering (<http://ascelibrary.org/journal/jggefik>)
- Rock Mechanics and Rock Engineering (<http://link.springer.com/journal/603>)
- Tunnelling and Underground Space Technology (<http://www.sciencedirect.com/science/journal/08867798>)
- Tunnels & Tunnelling International (<http://www.tunnelonline.info/>)
- World Tunnelling (<http://www.world-tunnelling.com/>)

3.2 Scientifically oriented online research engines

Descriptions and web-links of various scientifically oriented online research engines are listed below.

- Engineering Village (<http://www.engineeringvillage.com/>)
- Elsevier Scopus (<http://www.scopus.com/>)
- Elsevier ScienceDirect (<http://www.sciencedirect.com/>)
- International Construction Database ICONDA (<http://www.irb.fraunhofer.de/CIBlibrary/>)
- ProQuest GeoRef (<http://search.proquest.com/georef/index?accountid=26191>)
- Thomson Reuters Web of Knowledge (<http://apps.webofknowledge.com/>)
- Wiley Online Library (<http://onlinelibrary.wiley.com/>)
- WTI Frankfurt BERG Bergbau (<http://tecfinder.fiz-technik.de/tecfinder/faces/facelets/database/database.jsp>)

4. Use of information-generating AI-systems

At the latest since the release of the AI-based chatbot "ChatGPT" by OpenAI¹ in January 2023, which uses machine learning to generate human-like texts, it is clear that the question of how to deal with this AI software and similar programs when used in a university environment needs to be addressed. Contrary to a general ban on the use of AI software to generate information in the course of writing scientific papers and theses, we (Institute of Rock Mechanics and Tunneling) have decided to allow its use under well-defined conditions. We see the problems that arise with regard to the assessment of the originality of scientific works by means of common systems and review processes through the use of the aforementioned "AI tools". At the same time, however, we recognize the potential of supporting AI systems to pave a path to more efficient ways of working and increased scientific outputs.

4.1 Terms of use

To counteract the unreflective adoption (copying) of AI-generated information in scientific works, the following rules are to be complied with when using supporting AI systems:

- The use of any supporting AI systems must be clearly stated in the methodology section of the thesis.
- Any passages in scientific works whose foundations are based on AI-generated information are to be identified as such (textually or in terms of format).
- The responsibility for the contents of the scientific work and the resulting consequences remains with the students.
- Information from AI- systems whose origins can be seen in other sources must always be linked to the primary literature. It is not sufficient to cite the AI software.

4.2 Originality verification of scientific work

In connection with the verification of the originality of scientific works done by students, our institute relies increasingly on the reviews of the assumptions made in the works and the results obtained from them, which take place in the course of discussion rounds. The level of knowledge of the persons writing scientific works is checked by targeted and detailed questioning. If there are justified doubts about the originality of the work, a negative evaluation of the work can result as a final consequence.

¹ OpenAI, 2021, Generative Pre-trained Transformer 3 (GPT-3), URL: <https://openai.com/gpt-3/>

5. Structure of the scientific work

5.1 Structure

The work's structure should allow the reader to see, which topics are considered relevant for dealing with the scientific research question, of which importance the different aspects are and how they are connected. Each level within the structure must have at least two sub-items, whereas too many sub-items may confuse the reader. Each headline has to be followed by a short explanation of the chapter's content. Thus two headlines should never be one after another.

- Front Page
- Statutory Declaration [optional]
- Principle of equality [optional]
- Acknowledgements [optional]
- Abstract
- Kurzfassung
- Table of contents
- List of figures [optional]
- List of tables [optional]
- List of abbreviations/symbols [optional]

- Text
 - Introduction: significance and timeliness of the topic, research question and research goal, work's structure (approach)
 - Conceptual framework: definition of necessary terms, theoretical classification
 - Main part: state of research (empirical and theoretical, results, methods, limitations), positioning of one's own research question, eventually formation of new models, creative approach to the solution, eventually empirical verification of the developed hypothesis
 - Conclusion: depiction of essential results, limitation of the own work, deduction, outlook, ideas for further research

- Bibliography
- Appendix
 - Search strategy and results
 - Summary of used literature
 - Further extensive figures and tables

Headlines within the main text need to be numerically structured (e.g. 1, 1.1, 2, 2.1, 2.2), whereas headlines outside of the main text (e.g. acknowledgment, abstract, table of contents, list of literature) do not follow a numeric structure. Headlines within the Appendix are numbered using capital letters (e.g. A, B, C). The pagination of the document starts with the table of contents using lower case Roman numerals (like i, ii, iii), before being continued throughout the main text using Arabic numerals (e.g. 6, 7, 8).

5.2 Composition of the scientific work

5.2.1 Abstract

The abstract's goal is to precisely summarize the scientific work as a self-standing and independent section. It is NOT an extract of the scientific work and must not refer directly to external sources or the work itself. The abstract should explain the most important topics within the work, the research purpose, the importance and the relevance of the work as well as its essential results. Although being situated at the beginning of the work, the abstract should be written after having completed the whole work.

The abstract is the figurehead of any scientific work and therefore deserves to be composed with the outmost care.

The abstract's structure depends on the nature of the work, though the following aspects should be included:

Basic idea of the work

What is the cause for the research? Why should the reader bother to read the work?

Problem

Which problem does the work deal with? Which extend does the project include?

Methodology

The abstract can include a description of essential models and approaches used in the work. Important instruments, which led to the results, can also be mentioned.

Results

Specific data can be mentioned, as long as it helps to explain the results. Results can be discussed in a general way.

Implications/conclusions

In how far does the work expand the knowledge of the topic? Are there any practical or theoretical applications, to which the results of the work can be applied in future scientific research?

5.2.2 Introduction – main part – conclusion

An appropriate structure is of vital importance for any final assignment. The work basically consists of an introduction, a main part and a conclusion.

The introduction presents the topic of the work and its environment. The explanations should be understandable for colleagues and should not contain general explications for persons, who are not familiar to the topic. By mentioning existing works on related topics, the own research question should be differentiated from them. At the same time the motivation and the importance of the work should be explained.

At the transition from the introduction to the main part the author specifies the exact scientific research question together with the approach to the solution and the methodology. This can include the underlying theories, used programs or measurement methods. The next step is the description of the actual work (e.g. the simulation model or the test setup), which is followed by the presentation of the results. In case that the work consists of several parts (e.g. simulation and experiment), it makes sense to divide them.

The conclusion summarises, discusses und interprets the results in an elaborate way. An outlook for further topics or left open questions completes the work.

5.3 Front page

The layout is given according to the template document. The front page contains the nature of the work, the title, eventually the subtitle, the name of the author and the institute, where the work is written. The supervisor is always the head of the institute or of the working group. In case of further supervision the name of the university assistant must also be mentioned on the title page. The place of the institute plus month and year of the submission is the last on the front page.

5.4 Statutory declaration [optional]

The statutory declaration is optional for Bachelor or Master projects, while it is obligatory for the Master's thesis. The language must accord to the language of the work (English or german). The declaration must be signed within the (spiral-) bound version. The text for the declaration, determined by the "Curricula-Kommission für Bachelor-, Master- und Diplomstudien" on 10-11-2008 and approved by the senat on 1-12-2008, is mentioned below in English and german.

The actual version of the statutory declaration is available at the University homepage: http://portal.tugraz.at/portal/page/portal/TU_Graz/Einrichtungen/Fakultaeten/fakbau/lehre/bau/bauma (PDF-Download: [Link](#); last access: 3-2-2015).

5.4.1 Englische version

„I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.“

5.4.2 German version (Eidesstattliche Erklärung)

„Ich erkläre an Eides statt, dass ich die vorliegende Arbeit selbständig verfasst, andere als die angegebenen Quellen / Hilfsmittel nicht benutzt, und die den benutzten Quellen wörtlich und inhaltlich entnommenen Stellen als solche kenntlich gemacht habe.“

5.5 Principle of equality [optional]

Due to reasons of legibility, this work does not include gender-specific formulations. However, the used male expressions stand for both genders.

5.6 Acknowledgements [optional]

Acknowledgements are usually mentioned in Master's thesis' or dissertations showing gratitude towards persons, who made an important contribution to the work's success. Such persons could be:

- sponsors
- superiors
- colleagues
- staff of institutes outside the university
- experts, assessors
- friends and family (an optional dedication can be mentioned on a separate page)

5.7 Abstract

The work must contain an English and a German abstract (Kurzfassung), each on a separate page. The following aspects should be dealt with:

- Occasion for the work: Why is this work written? Which problem is treated? What benefit may result from the work?
- Method/approach: What was the fundamental approach? Which methods were applied to solve the problem?
- Key results: Which are the most important outcomes resulting from the experiments, the calculations or the scientific research?
- Conclusion: Which conclusions or insights can be derived from the scientific work?

Excessive, commenting and judgemental remarks do not meet the character of an abstract. The abstract is usually written after having finished the work. Because of formal requirements regarding the digital registration of any final assignment in the TUGRAZonline system (for further information see: <http://www.ub.tugraz.at/docs/ErfassungsmerkblattHS.pdf>) the length of the abstract is limited to 4.000 symbols (including blank spaces). The possibility of writing a separate abstract for the online registration is given. However, the author should try to stick to the 4.000 symbols limitation and treat the previously mentioned aspects in a compact and precise way. The reader should be able to gain overview of the whole work by means of the abstract.

The author must avoid the use of the following elements within the abstract:

- Figures, tables and equations
- Symbols and specialized abbreviations
- References of any type (e.g. on passages, figures or tables in the work)

5.8 Table of contents, list of figures [optional], list of tables [optional]

The table of contents is necessary for every work. The lists of figures and tables must be included, if the majority of figures and tables comes from external sources – referenced in the figure label or in the table heading – and is not self-made.

The table of contents is the figurehead of the work's structure and is together with the abstract the most frequently read section of the work. The reader can see the emphasis and the used methods of the work. Therefore the chapter headlines have to be as meaningful as possible.

The descriptions of the figures and the tables must be clear and explicit (the same figure label for two different figures is not admissible). The use of the word processing program LaTeX offers the possibility to specify abbreviated versions of the captions for figures and tables. So the lists of figures and tables can be kept short and clear.

The table of contents includes only the sections of the document that are arranged afterwards. This means that the front page, the statutory declaration, the principle of equality, the acknowledgements and the abstract do not appear in the table of contents. The same counts for the elements between the table of contents and the full text, like the lists of figures, tables, symbols and abbreviations. The table of contents then includes again the sections coming after the full text (bibliography and appendix).

The proper use of automatic numeration for headlines, figure and table captions allows the various lists to be automatically generated with all word processing programs.

5.9 Abbreviations [optional]

If the work repeatedly (more than 5 times) contains longer expressions, it makes sense to use abbreviations instead (e.g. Österreichische Gesellschaft für Geomechanik: ÖGG; Gebirgsverhaltenstyp: GVT). Therefore a list of abbreviations, containing the abbreviations and their meaning in alphabetical order, has to be created. The list of abbreviations is optional for Bachelor- or Masterprojects. For introducing the abbreviation within the text it has to be mentioned in brackets following the whole expression. Afterwards the abbreviation replaces the expression.

„Lorem ipsum dolor Gebirgsverhaltenstyp (GVT) sit amet, consectetur adipiscing elit. Maecenas porttitor congue massa. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada Österreichische Gesellschaft für Geomechanik (ÖGG) libero, sit amet commodo magna eros quis urna.“

„Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas porttitor congue massa. Fusce posuere, magna sed pulvinar ultricies, purus lectus malesuada ÖGG libero, sit amet commodo GVT magna eros quis urna.“

5.10 Symbols [optional]

All symbols being used within the text have to be mentioned in alphabetical order in the list of symbols (optional for Bachelor- or Masterprojects). In case of a multitude of symbols, which would cause the list to extend over more than one page, sub-categories can be defined to keep the list clearly structured. Examples can be:

- Lower case letters (z. B. c_i , d , k_0 , l , m_b)
- Capital letters (z. B. C_1 , J_S , J_W , V_b)
- Greek letters (z. B. γ , λ_i , φ_i , ρ , σ^1 , σ_n , τ)

Each symbol has to be clearly described with its unit (e.g. φ_m = equivalent friction angle of the rock [°]).

5.11 Full text

5.11.1 Element labels

Figures and diagrams have to be labelled below, tables have their label above. The label text must clearly describe the content of the labelled element and consequently may extend over multiple lines. A clear and detailed description of an element within the full text allows the label to be kept short.

5.11.2 Referencing

References in the text need to be arranged according to the following examples:

- One author: ... (Schubert, 2010) ... or ... Schubert (2010) ...
- Two authors: ... (Schubert & Gaich, 2010) ... or ... Schubert & Gaich (2010) ...
- Several authors: ... (Schubert et al., 2010) ... or ... Schubert et al. (2010) ...
- Two or more sources: ... (Schubert, 2010; Radoncic, 2011) ... or ... Schubert (2010) and Radoncic (2011) ...

The notation is based on the *APA Citation Style* of the *American Psychological Association* (Link: <https://www.library.cornell.edu/research/citation/apa>; last access: 03.02.2015). The (round) brackets contain only the missing information (year, page), like Schubert (2010, p. 5).

If there are multiple sources from the same author published within the same year, the different sources need to be distinguished by adding lower case letters (e.g. (Schubert, 2010a; Schubert, 2010b)).

5.11.3 Visual design of figures, diagrams and tables

Basically the figures, diagrams and tables should be kept simple and clear.

The choice of colours for lines and curves in diagrams has to be carefully thought through. The use of the same colour for different curves in different diagrams, which do not share common abscissas and ordinates but are arranged one after another, may lead the reader to wrong conclusions.

The diagrams and figures should also be understandable if the scientific work is printed in grayscale. This should as well influence the colour choice.

The used figures, diagrams and tables should be uniformly designed within the whole work. Therefore the creation of a personal template for further figures, diagrams and tables at the beginning is recommended.

The text in figures, diagrams and tables should have the same formatting (typeface and size) as the full text. If not possible due to a lack of space, the text size can be smaller as long as it is still legible in printed form.

The creation of sophisticated tables should follow two rules (according to Fear. S. 2005. Publication quality tables in LaTeX. The document is freely accessible: <http://texdoc.net/texmf-dist/doc/latex/booktabs/booktabs.pdf>. Last recall: 29-1-2014):

- No vertical lines
- No double lines

If diagrams or tables are created with Excel, they must be converted to the uniform format in Word. The insertion of unformatted diagrams or tables as figures is not allowed. All figures, diagrams and tables must be mentioned and referenced within the full text beforehand.

5.12 Bibliography

The bibliographical reference must be complete and carefully worked out. Depending on the nature of the referenced document the requested information may vary:

- Articles from scientific journals:
 - Author(s)
 - Year of publication
 - Title
 - Description of the scientific journal (to be in italics)
 - Volume
 - Number
 - Pages
 - Publisher
 - Place of publication
- Articles from inproceedings:
 - Author(s)
 - Year of publication
 - Title
 - Editor(s)
 - Proceeding title (to be in italics)
 - Venue of the conference/congress
 - Date of conference/congress (DD.-DD. Month)
 - Pages
 - Publisher
 - Place of publication

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- Thesis:
 - Author(s)
 - Year of publication
 - Title
 - Institution
 - University

- Standards:
 - Standard
 - Document number
 - Year
 - Title (to be in italics)
 - Publisher
 - Place of publication

- Books:
 - Author(s) and editor(s)
 - Title
 - Subtitle
 - Publisher
 - Year of publication
 - Place of publication
 - Edition

- Electronic reference:
 - Author
 - URL
 - Date checked

Depending on the number of authors, the style of reference varies:

- 1 author: Schubert, W.
- 1 author, 2 first names: Button, E.A.
- 2 authors: Schubert, W. & Button, E.A.
- More than 2 authors: Schubert, W., Button, E.A. & Pilgerstorfer, T.

The following examples display complete entries in the bibliography for different document types:

5.12.1 References for articles taken from scientific journals

- Schubert, W. 1994. Gebirgsdruck und Tunnelbau - aus der Sicht von Rabcewicz 1944. *Felsbau* 12 (5), S. 303-306, Verlag Glückauf: Essen.
- Pilgerstorfer, T. & Radoncic, N. 2009. Prediction of spatial displacement development. *Geomechanik und Tunnelbau* 2 (3), S. 250-258, Ernst & Sohn: Berlin.

5.12.2 References for articles taken from inproceedings

- Radoncic, N. & Schubert, W. 2009. Calculation of the shotcrete utilization for lining with integrated yielding elements. In: *Proceedings of the 2nd SINOROCK Symposium of the International Society for Rock Mechanics – Rock Characterisation, Modelling and Engineering Design Methods*, Hudson, J.A., Feng, X.T., Tham, G. & Kwong, A. (eds), Hong Kong, 19.-22. Mai, S. 842-846. International Society for Rock Mechanics: Hong Kong.
- Poetsch, M., Schubert, W. & Gaich, A. 2007. An innovative approach for the use of 3D images in the mechanical analysis of blocks in a rock mass. In: *Proceedings of the 11th Congress of the International Society for Rock Mechanics – The Second Half Century of Rock Mechanics*, Ribeiro e Sousa, L., Olalla, C. & Grossmann, N. (eds), Lissabon, Portugal, 9.-13. Juli 2007, S. 533-538. Taylor & Francis Group: London.

5.12.3 References for thesis

- Goricki, A. 2003. Classification of Rock Mass Behaviour based on a Hierarchical Rock Mass Characterization for the Design of Underground Structures. Dissertation, Institut für Felsmechanik und Tunnelbau, Technische Universität Graz, Österreich.
- Grossauer, K. 2009. Expert System Development for the Evaluation and Interpretation of Displacement Monitoring Data in Tunnelling. Dissertation, Institut für Felsmechanik und Tunnelbau, Technische Universität Graz, Österreich.

5.12.4 References for standards

- ÖNORM B 3124-4. 1981. *Prüfung von Naturstein; Mechanische Gesteinseigenschaften; Einaxiale Zugfestigkeit (Spaltzugfestigkeit)*. Österreichisches Normungsinstitut: Wien.
- ÖNORM B 2203-1. 2001. *Untertagebauarbeiten – Werkvertragsnorm; Teil 1: Zyklischer Vortrieb*. Österreichisches Normungsinstitut: Wien.
- ASTM D 7012-10. 2010. *Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens und Varying States of Stress and Temperatures*. American Society for Testing and Materials: West Conshohocken.
- ÖNORM A 1080. 2007. *Richtlinien für die Textgestaltung*. Österreichisches Normungsinstitut: Wien.
- ÖNORM A 2658-1. 1989. *Zitierregeln; Zitat; Grundsätze*. Österreichisches Normungsinstitut: Wien.
- ÖNORM A 2662. 1993. *Äußere Gestaltung von Hochschulschriften*. Österreichisches Normungsinstitut: Wien.
- ISO 690. 2010. *Information and documentation – Guidelines for bibliographic references and citations to information resources*. International Organization for Standardization: Genf.
- DIN 1505-3. 1995. *Bibliographic references to documents – Part 3: Indexes of cited documents (bibliographies)*. Deutsches Institut für Normung e. V.: Berlin.

5.12.5 References for books

- Pilgerstorfer, T. & Radoncic, N. 2010. *No friction, no tunnelling: Festschrift zum 60. Geburtstag von Wulf Schubert*. Eigenverlag: Graz.

5.12.6 References for electronic references

Electronic references must be quoted in the same way as printed sources. The page number from online PDF-files needs to be added. Unknown authors have to be replaced with the name of the institution, which runs the publishing website. Internet portals like Wikipedia can not be quoted.

- Waß, C. Zitieren von Werken in elektronischen Netzen, Online: URL: <http://www.rechtsprobleme.at/doks/zitieren-elektron-werke-wass.pdf>, Letzter Abruf: 05.02.2014. entsprechen
- Willamowski M. Zitierfähigkeit von Internetseiten, Online: URL: <http://www.jurpc.de/jurpc/show?id=20000078>, Letzter Abruf: 05.02.2014.

References must be written according to the given examples. Missing information has to be researched. In this way the cited document is clearly defined and can be easily found by an interested reader. If the type of sources varies from the given examples (e.g. books, electronic publications, personal interviews, presentations), the decisive information for the reference should be reasonably chosen.

5.13 Appendix

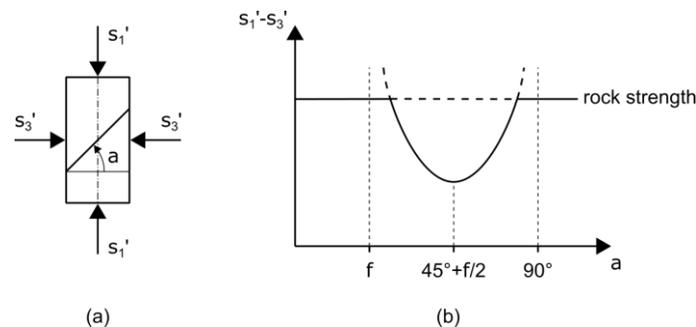
The appendix contains additional information, which would interrupt the flow of reading (e.g. evaluation of data, empirical evidence, questionnaires, large tables, long derivations of formulas). The references to the text must be located within the text (cf. appendix p. IX). If the work refers to sources like an interview, its transcript has to be included in the appendix to ensure the transparency of the scientific work.

6. Formal requirements

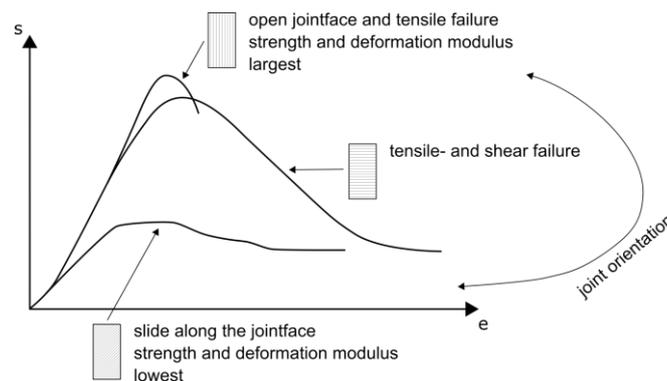
6.1 Selfmade graphics

Graphics should be designed using a vector-graphic-programme, like CorelDraw (Shareware) or Inkscape (Freeware), and not using Word or PowerPoint. Vector-graphic-programmes offer a wide range of possibilities, meaning that graphics can be effectively designed and easily edited afterwards. So the graphics may also serve as templates for future purposes.

The creation of a pattern-graphic (defining for instance the size of the graphic, the position of axis labels, the axis scaling, the line width, arrows, etc.) at the beginning can help to reduce the work for the remaining graphics. The graphics shown below are based on the same pattern:



Uniaxial compression test – (a) joint orientation α in relation to the load direction (b) strength in relation to the joint orientation (modified by Schubert 2007¹).



Uniaxial compression test – influence of the joint orientation on the stress-strain curve (modified and redesigned by Schubert 2010²).

¹ Schubert, W. 2007. Skriptum Felsmechanik und Tunnelbau. Course material, Institute for Rock Mechanics and Tunnelling, Graz University of Technology, Austria.

² Schubert, W. 2010. Skriptum Felsmechanik und Tunnelbau VA. Course material, Institute for Rock Mechanics and Tunnelling, Graz University of Technology, Austria.

The created graphics (if possible with a vector-graphic-programme) have to be exported into a suitable picture format. Such formats can be PNG (*Portable Network Graphics*) and EPS (*Encapsulated PostScript*), which have been proving themselves suitable regarding the small data size and the high printing quality. High quality formats with large data sizes (e.g. TIFF) can cause word processing programmes to work slowly, and as a consequence their use should be avoided.

The direct import of Excel-figures (e.g. diagrams) is not recommendable. These figures should always be reworked using a graphic-programme in accordance to the initially designed pattern-graphic.

6.2 Units and abbreviations

If the text is written in the justification-format, the use of a “protected blank space” between numbers and associated units (e.g. 1.300 m) helps to avoid them being widely separated. Therefore Word offers the command [Strg]+[Shift]+[Leertaste].

The use of “protected blank spaces” analogously applies to abbreviations containing blank spaces.

6.3 Punctuation

The recommended use of hyphen, dash and en dash is pointed out below.

6.3.1 Hyphen

The hyphen is used to connect words (e.g. stress-strain curve).

6.3.2 Dash

Dashes separate text insertions or mental leaps from the main text. A dash is always flanked by blank spaces

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas porttitor congue massa. Fusce posuere, magna sed pulvinar ultricies, purus – **this is a mental leap** – lectus malesuada libero, sit amet commodo magna eros quis urna.

6.3.3 En dash

The en dash is used to represent a span or range of numbers, dates, or time (e.g. 40–50 %). Before and after the en dash there is no space, as contrasted with the dash.

6.4 Footnotes

Footnotes contain secondary comments and references with regard to the content. They are depicted as superscripted continuous Arabic numerals within the text. The actual notes are located at the bottom of the page and are divided by a horizontal line (approx. 5 cm length) from the main text. Each footnote is located on the page, to which its content refers.

6.5 Equations

Equations can either be located (indented) within the text (e.g. $\sigma_c = \frac{2 \cdot c \cdot \cos \varphi}{1 - \sin \varphi}$) or left-aligned on a separate line. The use of a formula editor is recommended.

$$\sigma_1' = \sigma_3' \cdot \frac{1 + \sin \varphi}{1 - \sin \varphi} + \frac{2 \cdot c \cdot \cos \varphi}{1 - \sin \varphi} \quad (1.1)$$

6.6 Additional formalities

For obtaining a properly and uniformly structured work, the following points should be taken into consideration:

- Subject-specific expressions have to be used uniformly and correctly (regarding their meaning and spelling) throughout the whole document.
 - sample or specimen;
 - uniaxial or mono-axial;
 - displacement and deformation are not the same;
 - the moduli for deformation and elasticity are not the same;
- The symbols for variables, vectors, matrices, scalars, etc. must be used uniformly (e.g. decide between “F” or “P” to symbolize force throughout the whole document).
- Figures, diagrams and tables must not be wider than the continuous text (type area).

7. Template for scientific works

Specific templates for writing scientific works have been set up for Microsoft Word and LaTeX containing the required page layout and the style sheets for headings, lists, text, etc.. The templates are available in German and English and can be downloaded from the institute's homepage (link: <http://www.tunnel.tugraz.at> menu point *Downloads*). The use of style sheets is highly recommended (formatting with "styles and templates"), since a "direct" formatting may not guarantee the uniform design of the work and makes formatting errors hard to find. Information regarding "direct" formatting and the use of "styles and templates" can be found in the *Apache Open Office wiki* (link: <https://wiki.openoffice.org/wiki/Documentation/UserGuide/Formatting>, last access 05.03.2015).

7.1 Page layout

The following chapter briefly describes the required layout for the document. Assuming that the print is one sided, the left and right type areas equal.

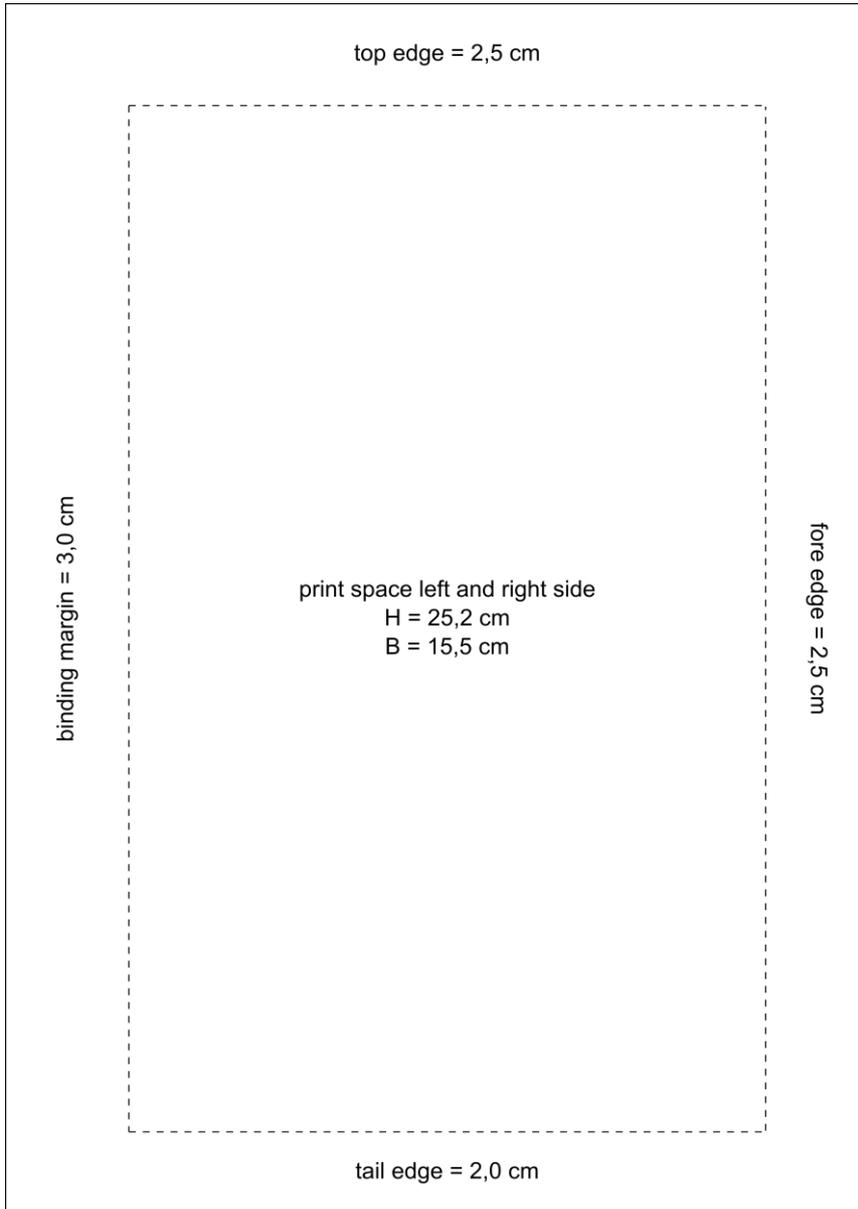
7.1.1 Header

The header is situated with an offset of 1.27 cm from the top margin.

7.1.2 Footer

The footer is situated with an offset of 1.27 cm from the bottom margin.

7.1.3 Type area



7.2 Style sheet

All style sheets includes the typeface “Times New Roman” and the standard line spacing of 1,5. The remaining properties vary and are listed in the table below. The style sheets can be modified after having agreed on it with the assistant. If the word processing program is for instance LaTeX, other typefaces than “Times New Roman” can be used.

Name	Script			Paragraph			
	Font	Height [Pt.]	Orientation	Indent left [cm]	Special indent ²	Space before[Pt.]	Space after [Pt.]
Figure caption [#]	normal	11	justification	0	none	6	12
List of figures	normal	11	justification	0	none	0	6
Enumeration level 1 ^{1,#}	normal	11	left	0,63	0,63 cm	6	6
Enumeration level 2 ¹	normal	11	left	1,27	0,63 cm	6	6
Cover page bold	bold	12	centered	0	none	0	0
Cover page centered [*]	normal	11	centered	0	none	0	0
Cover page date	normal	8	centered	0	none	0	0
Cover page name	normal	12	centered	0	none	0	0
Cover page title	bold	14	centered	0	none	0	0
Equation number [#]	normal	11	centered	0	none	12	12
List ^{1,#}	normal	11	left	0	2,5 cm	0	0
Numbered list ¹	normal	11	justification	0,63	0,63 cm	6	6
Bibliography	normal	11	justification	0	none	0	0
Name	bold	14	centered	0	none	0	0
Preamble ^a	bold	16	left	0	none	24	12
Standard	normal	11	justification	0	none	0	0
Table caption ^{b,#}	normal	11	left	0	1,6 cm	12	6
Table content ^b	normal	11	left	0	none	0	0
Heading 1 ^{a,b}	bold	24	left	0	0,76 cm	24	12
Heading 2 ^b	bold	16	left	0,5	1,02 cm	18	12
Heading 3 ^b	normal	12	left	0,75	1,27 cm	6	12
Heading 4 ^b	italic	11	left	0	1,52 cm	18	12
Heading 7 ^{a,b}	bold	24	left	0	2,29 cm	24	12
Directory ^a	bold	24	left	0	none	24	12
a	Pagination: page break above						
b	Pagination: not divided from next paragraph						
1	Space: no space between equally formatted paragraphs						
2	Special indent: hanging						
*	Font effect: small caps						
#	Tabstop: figure caption (2,5 cm, left); enumeration 1 (1,27 cm, left); equation number (15,5 cm, right); list (2,5 cm, left, fill character 2); table caption (2,5 cm, left);						

8. Submission

Bachelor- and Masterprojects need to be spiral-bound and handed to the assistant (one copy). The Master's thesis has to be bound and handed to the assistant in form of two copies.

Additionally all data, which is needed for the elaboration of the scientific work, must be copied onto the institute server under „M:\FMT\2010_Students\Surname“. The provided data should have the following structure:

- Folder “Work”: The folder contains the Word-document (*.docx) and the PDF-version of the work (*.pdf). Both documents should contain all figures and tables and are named:
 - Surname_2014_Master's thesis_Work title.docx
 - Surname_2014_Master's thesis_Work title.pdf
- Folder “Presentation”: The folder contains all data, which is needed for the interim and the final presentations (e.g. *.pptx, *.jpg, *.png, *.pdf).
- Folder “Figures”: The folder contains all figures, which are part of the final version of the scientific work. The labels of the figures have to match the descriptions used within the work (e.g. Fig_001.jpg, Fig_002.png, Fig_003.eps). Both the original and the edited versions (lower file size) of the figures must be included:
 - Subfolder „edited“: Contains the figures used within the work.
 - Subfolder „original“: Contains the original figures at their best quality.
- Folder “Tables”: The folder contains all tables, which are part of the final version of the scientific work. The tables can for instance be created with Excel (e.g. Tab_001.xlsx), edited with a vector graphic program (e.g. Tab_001.xlsx) and exported as a figure (e.g. Tab_001.png). Again, the labels of the tables have to match the descriptions used within the work. Both the original and the edited versions (lower file size) of the tables must be included:
 - Subfolder „edited“: Contains the tables used within the work.
 - Subfolder „original“: Contains the original tables at their best quality.
- Additional folders and subfolders may be necessary for calculations (UIDEC, FLAC3D, GeoFit, Phase2, Matlab, R, Excel, Abaqus, etc.), photos or further documents. The structure and labelling of the additional folders should follow the same logic as mentioned above.

The unattached work must be handed in at least 4 weeks prior to the intended date of submission of the study section for correction and assessment. The corrections have to be incorporated until the submission date, where the bound work is finally handed in, in order to obtain the grade.

All final assignments can be handed in once for correction beforehand. This should avoid misunderstandings and false interpretations regarding the structure and the formulation of the work.

9. Assessment criteria

The assessment of the scientific work is based on different criteria, not only including the final work but also taking into consideration the approach to the problem and the working method. The exact criteria are listed below:

1. Content
 - Fulfillment of objectives
 - Usability of the results
 - Application of theories (literature, methods) to a certain problem
 - Ideas
2. Approach
 - Problem assessment
 - Procedural stages (structured working)
 - Independence
 - Time management (scheduling and keeping deadlines)
 - Contact, reports, meetings
3. Elaboration of the report
 - Structure of the work
 - Scientific working
 - Layout of text, figures and tables
 - Grammar and spelling
 - Clear formatting of the work
4. Presentation
 - Clarity
 - Commitment to defending the work