

Schmalkalden University of Applied Sciences

Faculty of Mechanical Engineering

Guidelines Master Thesis



Authors

Thomas Seul, Frank Beneke, Stefan Roth

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NB

In this publication, only masculine or feminine form is used for ease of reading. Of course, the contents also apply to the other gender.

The instructions given in the guide for implementation in the word processing programme refer to the software version Microsoft Word 2016.

CONTENT

1	SCOPE	4
2	FORMALIA	5
	2.1 Layout and formatting	5
	2.1.1 Page layout	5
	2.1.2 Fonts and font size	9
	2.1.3 Tables and Figures	12
	2.1.4 Layout of tables	13
	2.1.5 Hints for creating meaningful illustrations	14
	2.1.6 Embedding and editing graphics	17
	2.1.7 Creating diagrams with Excel	19
	2.1.8 Creating technical drawings with a CAD system	22
	2.2 Formula and Equations	22
	2.3 Abbreviations	23
	2.4 Quotation and Citation	23
	2.5 Language and Style	25
	2.6 Subject vocabulary	25
	2.7 Outline, structure and heading levels	25
	2.8 Structure of the thesis	26
	2.8.1 Cover page	26
	2.8.2 Confidential agreement / blocking note	27
	2.8.3 Description of topic	27
	2.8.4 Declaration of the author	27
	2.8.5 Table of contents	27
	2.8.6 List of tables and figures	27
	2.8.7 Summary	27
	2.8.8 Main Part	28
	2.8.9 Bibliography	31
	2.8.9.1 Harvard citation style	31
	2.8.9.2 General notes on formatting and author abbreviations	32
	2.8.9.3 Artikels in a journal	33
	2.8.9.4 Monograph (book)	34

2.8.9.5	Contribution from monographs (book) and manuals	34
2.8.9.6	Articles in a conference volume	35
2.8.9.7	Standards	35
2.8.9.8	Dissertation.....	35
2.8.9.9	Theses, dissertations and research reports	35
2.8.9.10	Oral communication.....	36
2.8.9.11	Online publications	36
2.8.9.12	Patents.....	37
2.8.9.13	Unknown author.....	37
2.8.10	Appendix	38
2.9	Outer appearance.....	38
2.10	Correction	38
2.11	Submission of thesis	38
REFERENCES AND FURTHER LITERATURE.....		IV
LISTS.....		VI
List of Figures		vi
List of Tables.....		vi

1 SCOPE

Student research projects and theses are independent works in which students are supposed to show that they can work on and present a given topic using scientific means within a limited period of time.

In addition to the actual solution of a task, the path that led to this solution is also interesting for the reader. Often, much of the acquired knowledge is mistakenly not presented because "this issue is clear anyway". However, all important steps that led to the solution must be presented. It is also part of the task to get an overview of the current state of knowledge in the field. This must be presented in the paper in a suitable form and length.

A balanced structure and sensible argumentation must be adhered to in the presentation. The train of thought within the thesis must be clearly recognisable. This is best illustrated by the outline (see chapter 2.7) ("red thread"). The principle of "from the general to the specific" applies to the presentation. Furthermore, the logic of the explanations must be recognisable. Facts to which reference is made must be explained beforehand and must not appear in a later chapter. Before a complicated issue is explained to the reader, he or she should first know that it exists and in what context it stands. Likewise, nothing should be anticipated that will be dealt with at a later point. Incomprehensible jumps across the paper or frequent changes of perspective should be avoided.

This guide is intended to provide assistance for the preparation of scientific papers such as Bachelor's/Master's theses or student research projects in the field of engineering. In addition to recommendations for formatting and using the Word word processing software, general advice is also given on the structure of the paper, the presentation of diagrams and illustrations, and the correct way of citing and naming literature sources. The guidelines correspond to the required format for scientific papers and were created with the help of the format template 'BA-MA_HSM_Word - Formatvorlage V3.0_05-2020.dotx'. The format template is available for the preparation of theses. References to further literature on this topic, which are available in the university library, among other places, can be found in the appendix to this guide.

2 FORMALIA

A number of formalities apply to theses. These are explained step by step in the following sections.

2.1 Layout and formatting

First, the formatting and layout are dealt with. The basic settings required for the document are explained.

2.1.1 Page layout

Your supervisor will provide you with the format template '*BA-MA_HSM_Word - Format template V3.0_05-2020.dotx*'. The required basic settings are already available in this template.

Depending on the volume of the work, single-sided printing should be selected as standard or double-sided printing for extensive work. The following settings apply:

Page margins (single-sided printing):

- top 2.5 cm
- bottom 2.0 cm
- left 3.0 cm (larger margin for binding)
- right 2.5 cm

Page margins (double-sided printing):

- top 2.5 cm
- bottom 2.0 cm
- inside 3.0 cm
- outside 2.5 cm

Section breaks:

Main chapters always start on a new page. Sub-chapters are started in the running text on the same page. When a level 1 chapter (chapter heading, see chapter 2.7) ends, a section break must be made. Select '*Page layout* → *breaks* → *Section breaks, next page*' (see Figure 2.1).

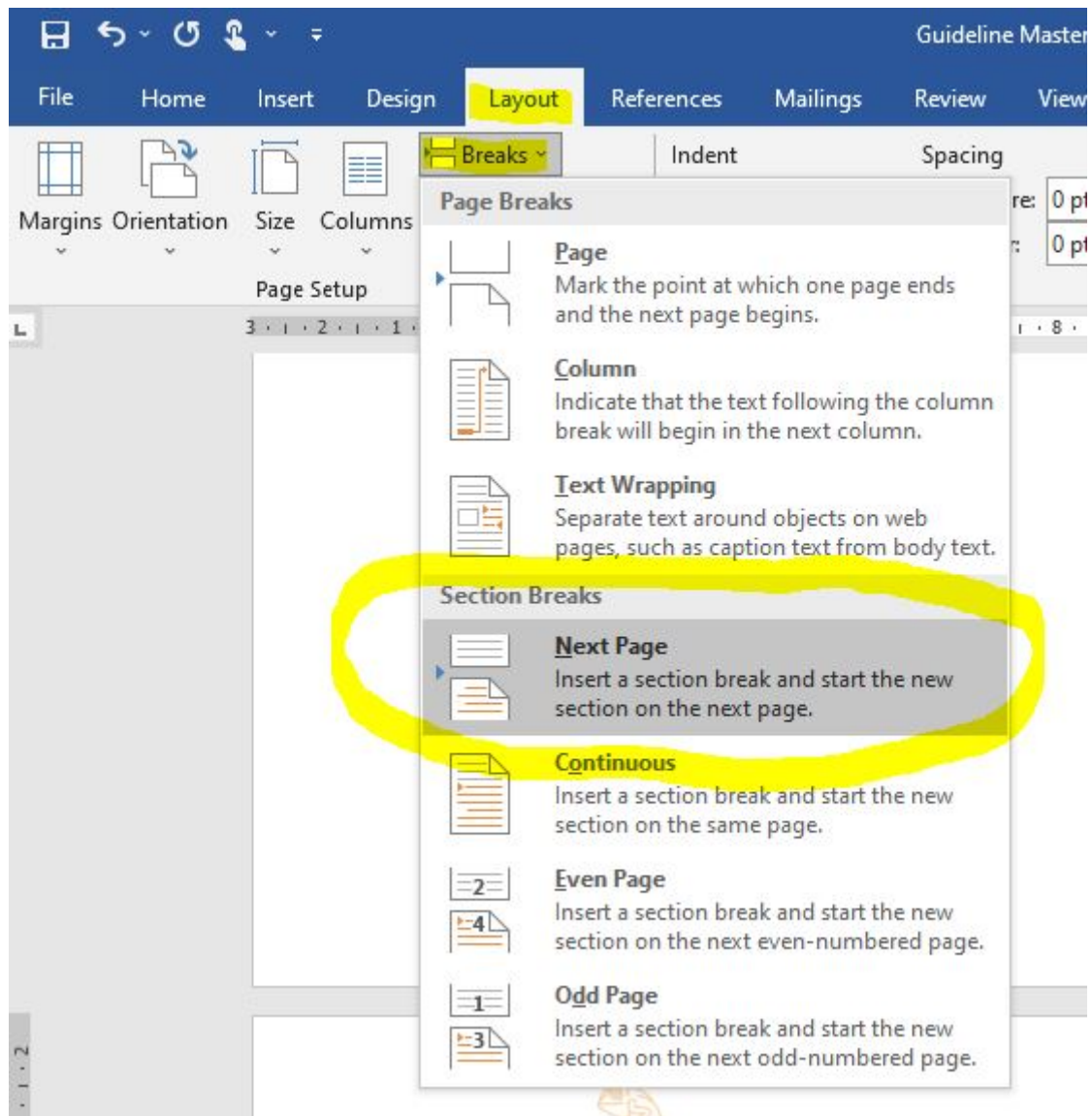


Figure 2.1: Insert section break

Header:

In the header, the page number and, from the second page of the chapter, the actual chapter are mentioned (see Figure 2.2). The distance from the edge of the page is 1.25 cm.

In the style sheet, the information on the current chapter is directly linked to the chapter heading (style sheet Heading 1) via an auto-field function.

Example first page of chapter....



2 FORMALIEN

Für Abschlussarbeiten gilt eine Reihe von Formalien. Diese werden in den folgenden Abschnitten Schritt für Schritt erklärt.

2.1 Layout und Formatierungen

Zunächst werden die Formatierungen und das Layout behandelt. Erforderliche Grundein-

.....and the following pages:



Formatvorlage eingefügt. Ein Absatz wird nach Abschluss einer inhaltlich und sinnhaft zusammengehörenden Einheit mehrerer Sätze gesetzt. Diese besteht in der Regel aus mehreren Seiten. Auf einer Seite sollten nicht zu viele Absätze gesetzt werden, damit der Text nicht zu „zerfranst“ erscheint. Als Faustregel gelten maximal 2-4 Absätze pro Seite.

Figure 2.2: Example header

The header is readjusted for each section. Editing is possible by 'double-clicking' on the header. To ensure that the naming of the chapter only starts with the second page of the chapter, the first step is to select 'Design → Different First Page' / 'Entwurf → erste Seite anders' to prepare the header for a subdivided labelling, i.e. the first page without chapter naming and the following pages with chapter naming. Then 'Design → Link to Previous'/'Entwurf → mit vorheriger verknüpfen' must be switched off. This ensures independent formatting for this section. Figure 2.3 shows the corresponding menu items. The adapted layout applies to the entire section.

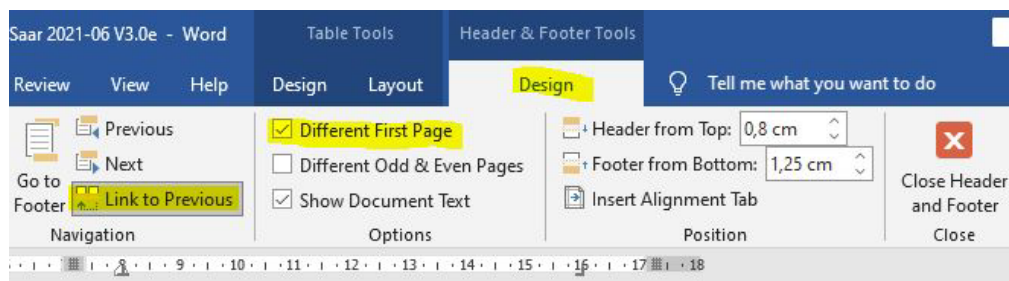


Figure 2.3: Changes in header

Now the required fields are added. Either they are inserted via 'Insert → quick blocks → Field → choose a field' / 'Einfügen → Schnellbausteine → Feld → entsprechendes auswählen' or alternatively created with 'Ctrl+F9'. If you proceed manually, enter the commands

according to Table 2.1 into the created field. With the key combination '*Alt+F9*' all fields can be switched between edit or view mode.

Table 2.1: Field functions

<i>Field function</i>	<i>Manual input</i>	<i>Field name</i>
Chapter number	StyleRef 1 \n	StyleRef + Heading 1 + paragraph number
Chapter heading	StyleRef 1	StyleRef + Heading 1
Page number	Page * Arabic Page * Roman	Page, select corresponding format

Alternatively, the selection can also be made after activating the header via '*Header and Footer Tools* → *Design* → *Document Info* → *Field*' / '*Kopf- und Fußzeile* → *Entwurf* → *Dokumentinformation* → *Feld*' (see Figure 2.4). Select '*StyleRef* → *Heading 1*' / '*StyleRef* → *Überschrift 1*' as the field. This ensures that the respective chapter heading (formatted in heading 1) is automatically inserted into the header.

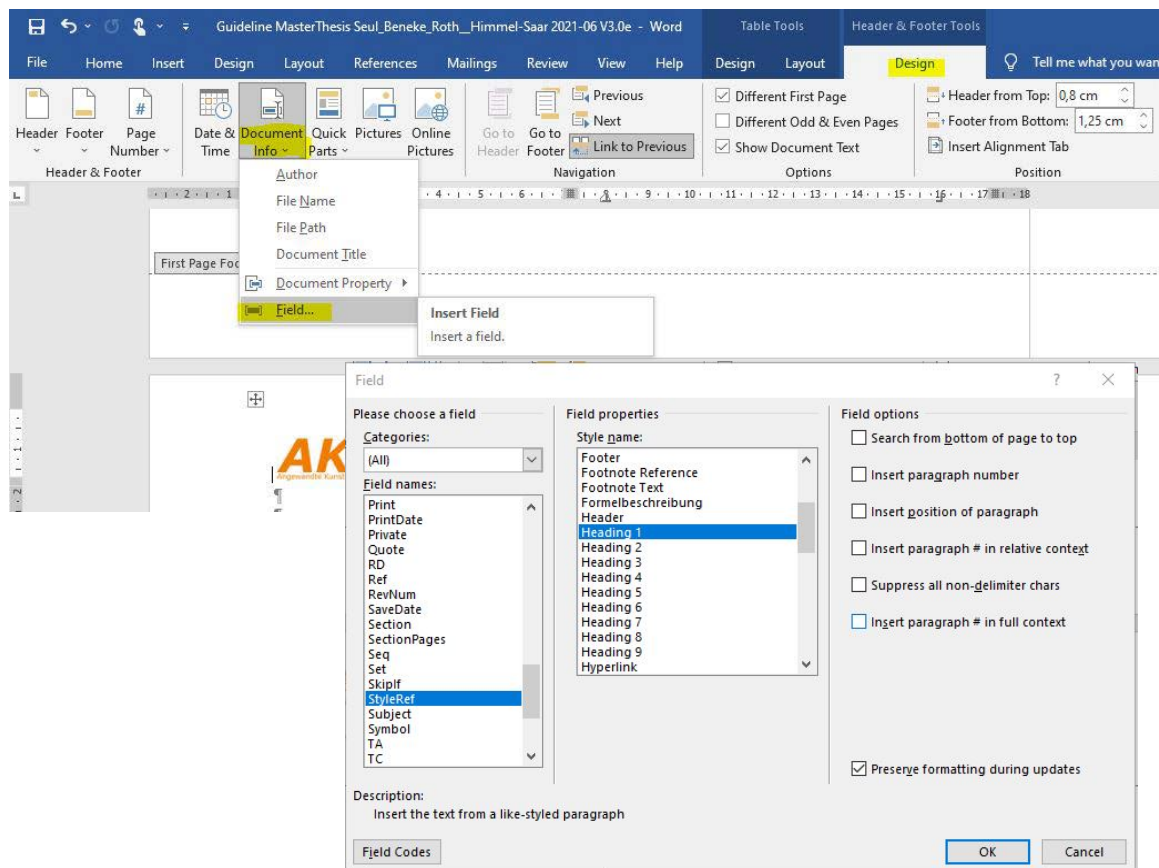


Figure 2.4: Insert the chapter heading into the header by activating a text field link

Footnotes¹:

Footnotes can be generated automatically by the key combination 'Ctrl+Alt+F' / 'Strg+Alt+F' or '*References → Insert Footnote*' / '*Verweise → Fußnote einfügen*'. Footnotes can be used to provide extended information, notes, etc. In principle, however, footnotes should be used sparingly in technical work. The footnotes must not be used to build up an extensive second level of argumentation.

Paragraphs:

Paragraphs are inserted by pressing the enter key twice. There is always a blank line between two paragraphs. A paragraph is inserted at the end of a unit of several sentences that belong together in terms of content and meaning. This usually consists of several pages. Do not place too many paragraphs on one page so that the text does not appear too "frayed". The rule of thumb is a maximum of 2...4 paragraphs per page.

2.1.2 Fonts and font size

The following presets are to be used:

Font type

Times New Roman

Font size

Standard text 12 pt.

Line spacing 1.4 times

Justification/Block set (use hyphenation → automatic hyphenation)

Enumerations

Font size 12 pt.

Line spacing 1.4 times

Justification/Block set (use hyphenation → automatic hyphenation)

Headings

Level 1 16 pt. Bold small capitals

Line spacing 1.4 times,

Left-aligned

Page break above

¹ Further necessary information can be found here.

- Level 2 14 pt. bold
 Line spacing 1.4 times
 Left-aligned

- Level 3 12 pt. bold
 Line spacing 1.4 times
 Left-aligned

- Level 4 12 pt. bold
 Line spacing 1.4 times
 Left-aligned
 → This outline level should only be used in exceptional cases; as a
 rule, it should be limited to three sub-items (e.g. 1.2.4).

Labelling

- 12 pt.
- Italics
- Single line spacing
- Left-aligned (use hyphenation)

These basic settings have already been made in the format template and are available via the quick format templates (see Figure 2.5). The settings should not be changed by the user.

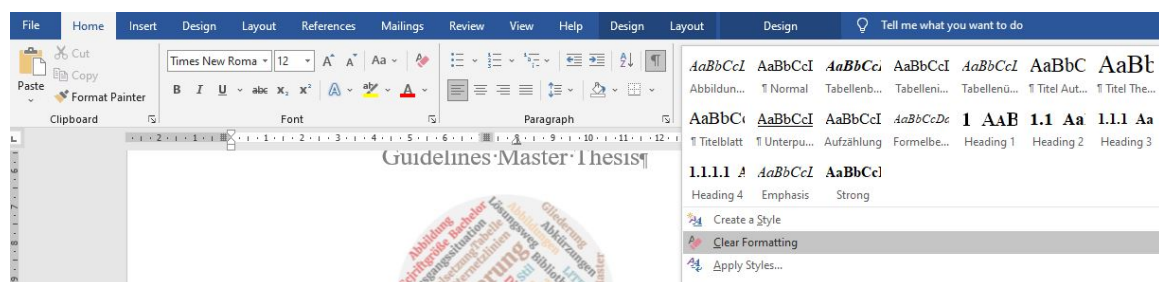
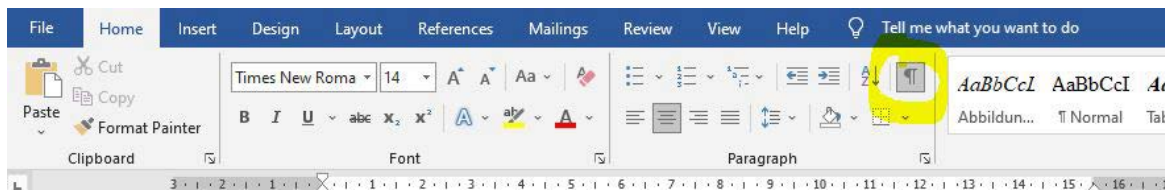


Figure 2.5: Example quick format templates

For hyphenation, there is a special conditional hyphenation character. This can be set by the user via 'Ctrl + -' for words that the programme has not automatically separated. For numbers and units, a locked space (Ctrl+Shift+Spacebar), e.g. 18 Nm, must be used so that no separation can take place at this point. By displaying the formatting characters, the protected characters can be made visible (see Figure 2.6).



Bei Zahlen und Einheiten ist ein gesperrtes Leerzeichen (Strg+Umschalt+Leertaste), z. B. 18 Nm zu verwenden, damit an dieser Stelle keine Trennung erfolgen kann. Durch Anzeigen der Formatierungszeichen kann die geschützten Zeichen sichtbar gemacht werden¶

Für die Silbentrennung gibt es als Besonderheit ein bedingtes Trennzeichen. Dieses kann vom Benutzer über ‚Strg+‘ bei Wörtern gesetzt werden, die das Programm nicht automatisch getrennt hat.¶

Figure 2.6: Display of formatting characters locked space and conditional separator

Further combinations for special characters can be found in Word under 'Insert → Symbol → More Symbols.. → Special Characters' / 'Einfügen → Symbol → Weitere Symbole → Sonderzeichen' (see Figure 2.7).

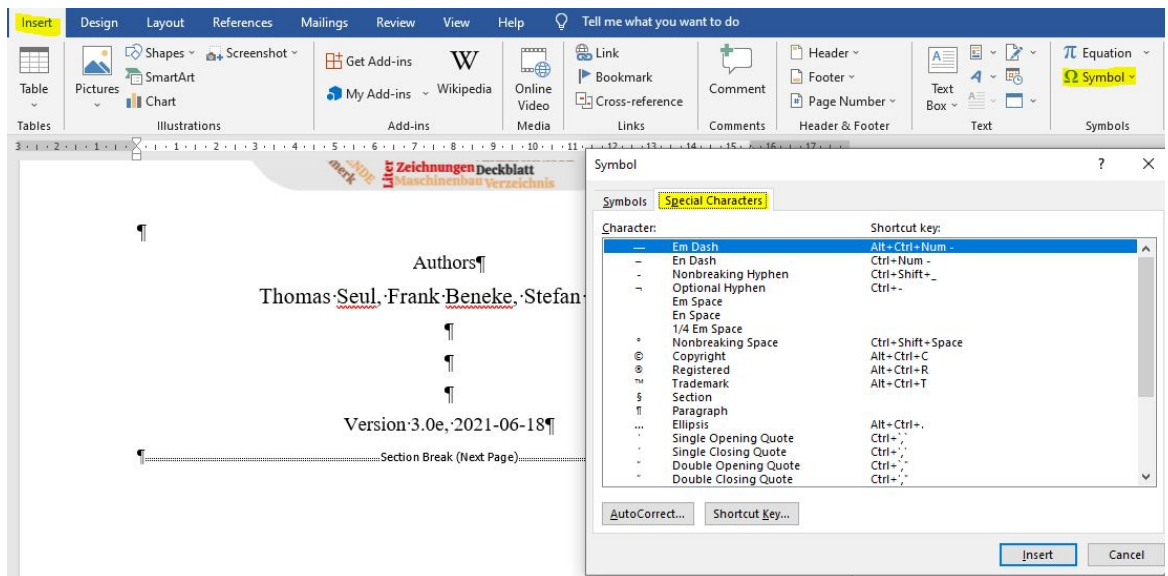


Figure 2.7: Examples of special characters in Word

2.1.3 Tables and Figures

Tables and illustrations should convey or explain further content in addition to the text. Tables and illustrations should be of good quality, clarifying the aspects presented in the text and thus complementing the text.

It is important that a figure, table or formula is related to the text (e.g. "...this relationship can be easily seen from the numerical values in Table 2.2..." or "...as can be seen in Figure 2.10...") and is therefore labelled. The caption should be as concise and meaningful as possible. The figure, table or formula should be mentioned first in the text, followed by the corresponding figure itself, not vice versa. In the case of figures or tables taken from a source, the source must be cited. For this purpose, the source is given in short form in the caption, and the cited source is included in the list of sources. How to deal with citations can be found in chapter 2.4 "Citations".

The caption belongs directly to the illustration or table. In the case of tables, the caption must always be placed above the table, in the case of figures below the figure. Separate form templates are available for the figure caption and the table heading.

The captions should always be on the same page as the table or figure. Particularly in the case of page breaks, care should be taken to ensure that this connection is maintained. The use of cross-references is recommended for text references. This ensures that all references continue to point to the correct place after changes have been made to the text. For better readability, a blank line must be inserted after each table and figure.

A summary of all tables or figures in a picture section is not easy to relate to the text and looks "lost" to the reader. Therefore, a picture section should be dispensed with and the respective figure should be placed in the text at the point where the depicted context is dealt with in the text.

The numbering of tables and figures is done in the form of *'Table or Figure Chapter Number.Counter: '* and can be done automatically by setting appropriate references in Word (see Figure 2.8). This makes it possible to set cross-references to the illustration in the text and to automatically generate a list of tables or illustrations later on. Another advantage is that when additional figures are inserted, the numbering of the existing figures is automatically adjusted. Sometimes the cross-references in the text have to be updated by selecting the cross-reference in the text and clicking on *'Update fields with right mouse button'*.

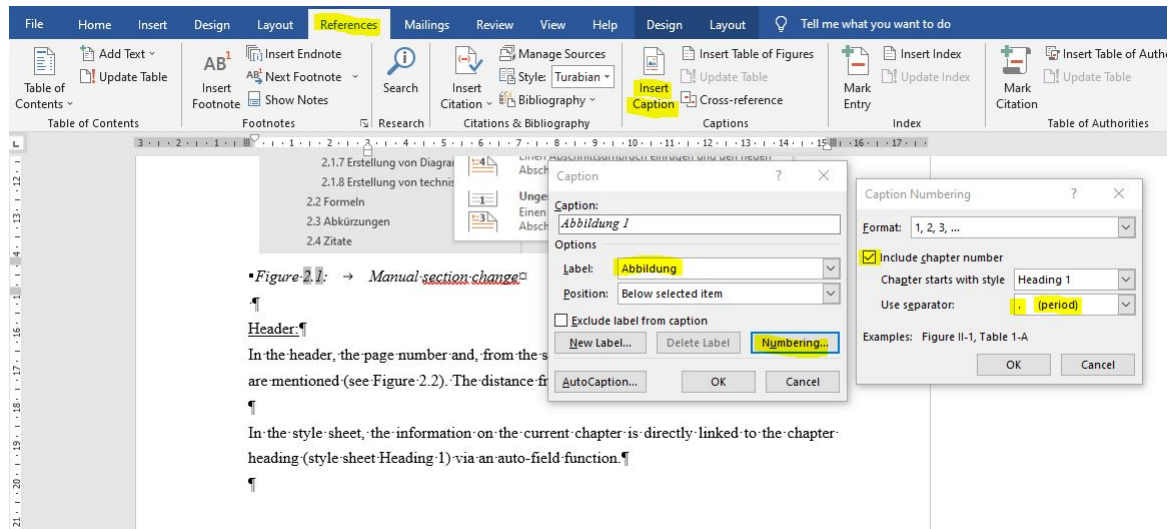


Figure 2.8: Inserting figure and table numbering in Word

2.1.4 Layout of tables

Tables should follow the example included in the template. This means that the table runs across the entire width of the page. A caption in the form 'Table Chapter Number.Counter: Title' and, if applicable, the source information should be used and positioned above the table. To ensure the correct position of the caption, an extra line should be inserted in the table and the caption placed in it. An example is shown in Table 2.2.

Table 2.2: Example table

<i>Parameter</i>	<i>Material 1</i>	<i>Material 2</i>
A [unit]	10	100
B [unit]	20	200
C [unit]	30	300
D [unit]	40	400

When designing the tables, it is also important to ensure that there is sufficient margin between the text and the bordering frames. A centred alignment of the table content is preferable. In Word, the following default setting should be selected under 'Table Tools → Layout' / 'Tabellentools → Layout' (see Figure 2.9).

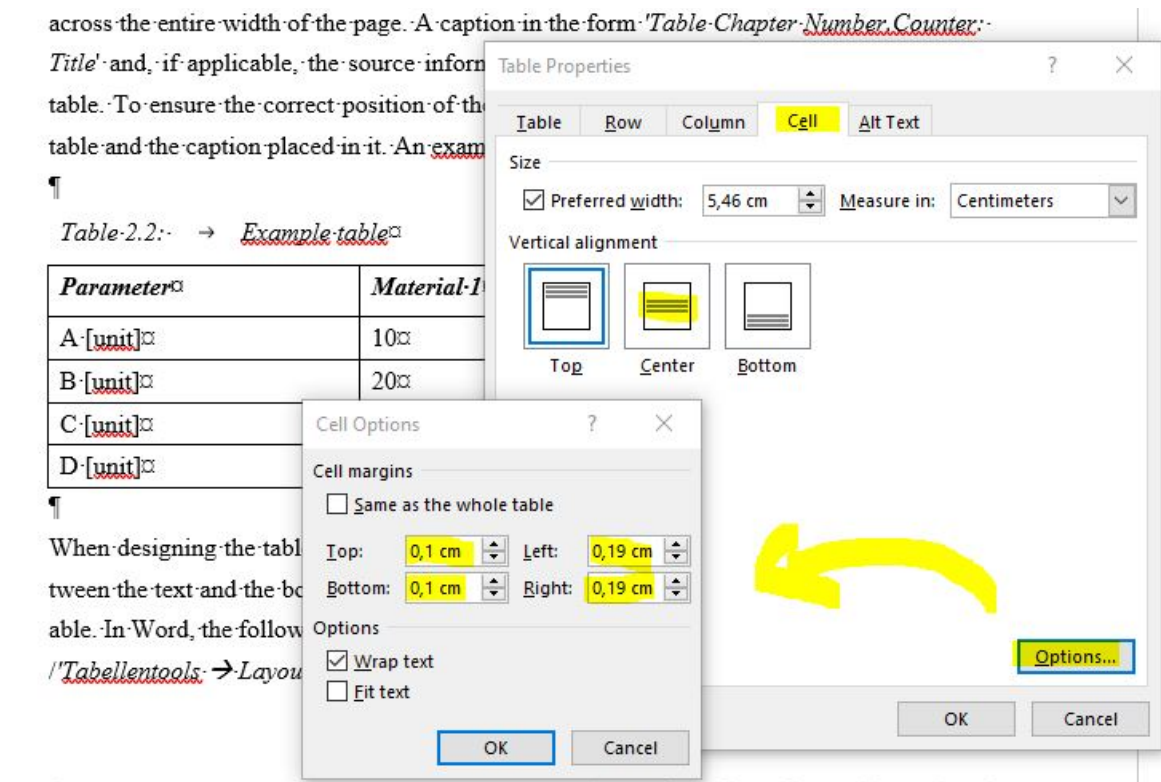


Figure 2.9: Preferred Preferences in Word for Cell Boundaries

2.1.5 Hints for creating meaningful illustrations

The aim of an illustration is to provide meaningful graphical support for a matter dealt with in the text. A graphic should be created in a suitable programme, saved as a separate file and integrated into the text as illustration. The (editable) original graphic file should be retained in any case. This means that you can make changes to the graphic at any time and also use it for presentations, for example. When creating illustrations, use the corresponding template, e.g. in MS PowerPoint. Illustrations can also be created with a spreadsheet, such as the programme Excel, if the image contents are then copied into the PowerPoint template. You will receive this template from your supervisor. When importing images into the text, care must be taken to ensure good image quality. This depends largely on the file format used. Fonts should not be too small in the graphics to ensure good readability. In particular, when inserting diagrams, care must be taken that the heading, the axis designations and the axis scaling are not too large, otherwise the actual curve will be very small. In the case of diagrams, the axis labelling, including the indication of the units used for the quantities shown, must not be forgotten.

The image file should be inserted via '*Home → Paste → Windows meta file*' / '*Start → Inhalte einfügen → Windows-Meta-Datei*' or as a vector graphic in order to achieve the required quality. Note: Vector graphics usually do not look very good in screen format, but produce good results when printed. If in doubt, a test printout will help.

Technical drawings are to be created with common CAD programmes. Make sure that the font size, e.g. for dimensions, is sufficiently large and thus easy to read. Large-format drawings can also be included as a set of drawings in the appendix.

Illustrations should always be inserted in a table with the frame hidden and covering the entire width of the page. The figure should be centred and the caption always left-aligned. If there are two or more illustrations, this procedure ensures that the captions are always at the same height. To prevent the caption from being moved due to a page break, it is advisable to place the illustration in a single table cell and to prevent the line break within the cell using '*Table properties*'. This procedure only works with a caption in one line. For two or more lines, the following procedure is recommended: Mark table '*Home → Paragraph → Line and Page Break → Keep lines together (tick)*' / '*Tabelle markieren → Start → Absatz → Zeilen- und Seitenumbruch → Diesen Absatz zusammenhalten (Haken setzen)*'.

The caption of the figure is composed of '*Figure Chapter Number.Counter: Title*' (see Figure 2.10). A space must be used between '*Figure*' and '*Chapter number*'.



Figure 2.10: Here is the caption of the illustration (Fig.: [FHS12])

The source of the image must be cited in the caption, the original source must be included in the list of references and cited as an abbreviation in the caption. Own, self-created illustrations do not require proof of the image source. If the source of the image is not named, it is automatically assumed that the author created the source himself/herself.

When illustrating microscope images, make sure that the scale is always part of the image. In the case of images of technical components, a scale should also be inserted for better

recognition of the proportions or the dimensions should be illustrated by choosing a suitable background (graph paper, cm grid) (see Figure 2.11 and Figure 2.12). A qualitative size comparison can already be made by inserting a reference object, such as a person or a coin, into the image (see Figure 2.13).

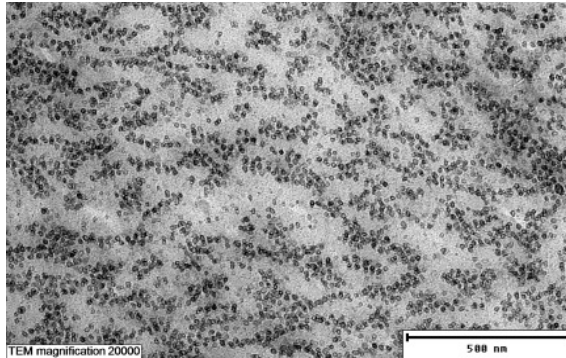


Figure 2.11: Example TEM image with scale (Fig.: [Kie19])

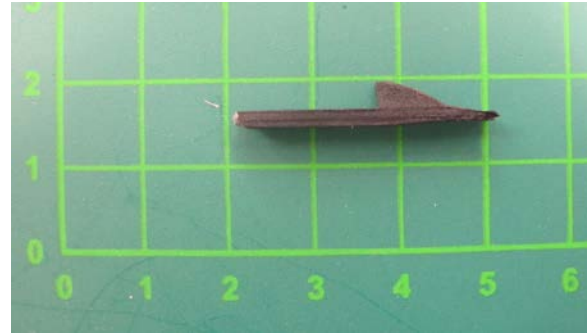


Figure 2.12: Example component with background grid

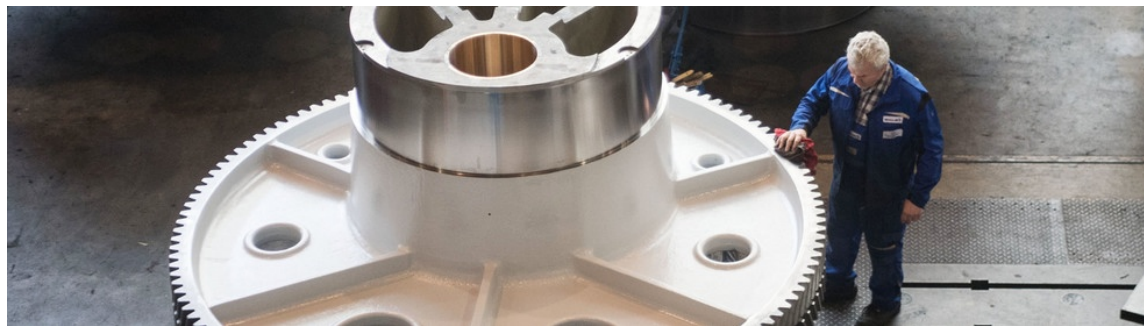


Figure 2.13: Example Size comparison of the component created by personal reference (Fig.: [URL20])

General guidelines for design of the images (line widths, font size, fonts) are given below.

Sheet layout

The image consists of a caption, border lines and the actual image content. The entire width of the text area in the document of 15.5 cm can be used for the image content, whereby the height is flexible. The image area is marked by a table with a hidden frame. All graphics, texts, etc. must be placed on this area. The frame that marks the drawing area appears dashed in Word and is automatically suppressed when printing. Generally, illustrations should not be too small so that they are still clearly visible on the printout.

Coloured images

To improve readability and recognisability, coloured image content can be used. However, care must be taken to ensure that the illustration is still meaningful and thus copyable even in a B/W representation, i.e. that no essential information is lost after copying.

Line thicknesses, fonts and heights

In general, only line thicknesses between 0.35 and 1.0 mm (1.4 pt. and 4 pt.) are permitted. When creating technical drawings, the general line guidelines according to DIN 199 [DIN 199], which has now been replaced by DIN EN ISO 10209 [ISO 10209], must be observed.

If possible, the fonts should be limited to UNIVERS or ARIAL. Captions should be 28 pt. high. The standard font height in the picture is 18 pt. and the minimum font height is 14 pt.

Simple pictures can be created directly in PowerPoint. This is particularly useful if tables or enumerated texts are to be displayed as images.

2.1.6 Embedding and editing graphics

Pictures created in Excel can be copied directly into the Word file via the clipboard. It should be pointed out again that the pasted pictures may no longer be scaled, as otherwise all line thicknesses and text sizes will change. However, it is better to use the command sequence *'Paste → Paste Special → Picture (Windows Metafile or JPEG)' / 'Einfügen → Inhalte einfügen → Bild (Windows-Metadatei oder JPEG)'*. Figure 2.14 illustrates this. Analogously, this procedure is to be used when inserting pictures into the Word document. Here, line thickness and text size can no longer change. Furthermore, the image volume is smaller.

Subsequent editing of the integrated pictures, e.g. Excel diagrams, should be avoided so that the formatting is not changed. For this reason, all images should only be edited in the original programme and then inserted into PowerPoint via the clipboard or the above command sequence.

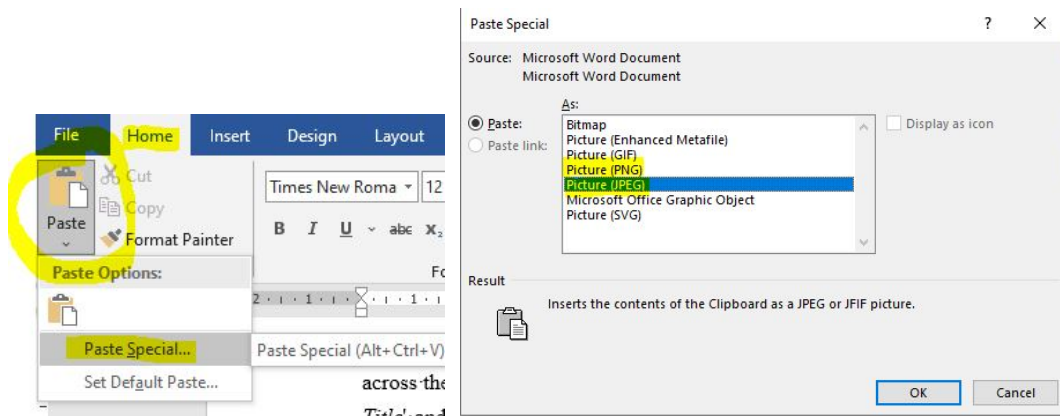


Figure 2.14: Procedure for inserting images

Other graphics (for example digital photos, graphics from the Internet, scanned images) can be read directly into Word. This is done via *'Insert picture from file'* and *'Insert graphic'*. Supported formats include *.jpg, *.gif, *.eps and *.tif.

Very large image material, especially photos, which are made smaller after insertion, and images cropped in Word increase the file size considerably. This can be avoided by reformatting the cropped and reduced image in Word (see Figure 2.15). In particular, the unused image areas should be deleted (*'Delete cropped image areas'*). The resolution for compression should be a maximum of 220 dpi, although sufficient image quality is usually possible with a resolution of 150 dpi. The formatting can be done for all inserted images at the same time or for the currently selected image (*'Format → Compress Pictures'*).

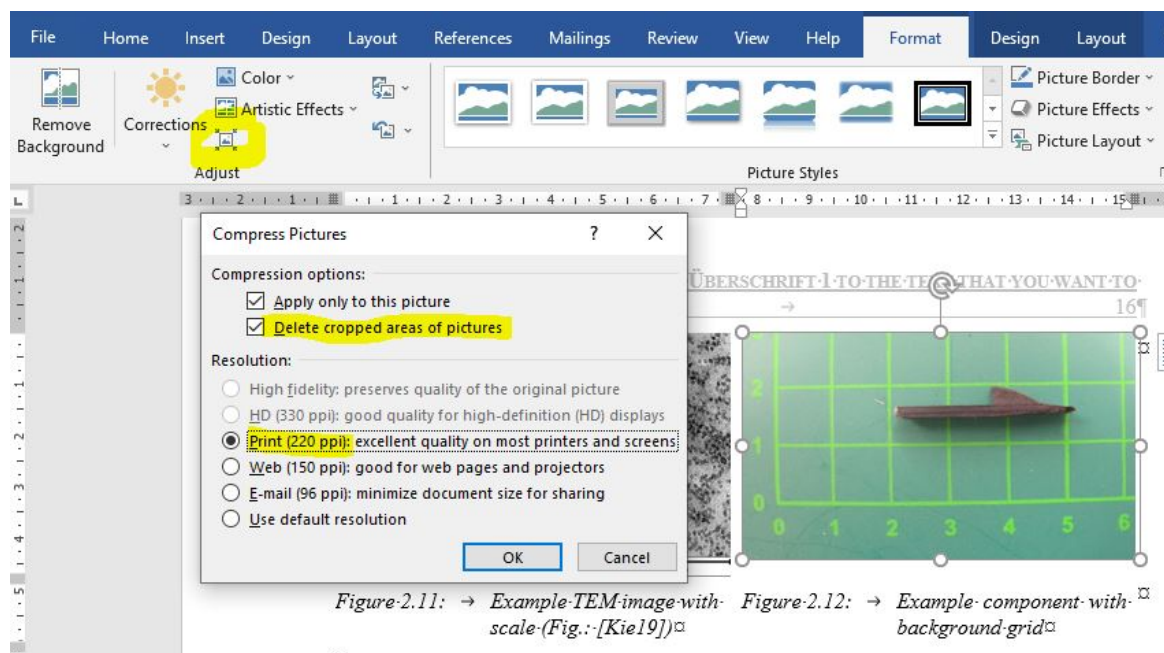


Figure-2.11: → Example-TEM-image-with-scale-(Fig.:-[Kie19])
 Figure-2.12: → Example-component-with-background-grid

Figure 2.15: Formatting images in Word

2.1.7 Creating diagrams with Excel

Diagrams are used to present the measurement results and observations obtained. As a rule, they are prepared using the Excel programme. In addition, the software Origin, among others, has established itself as an alternative for presentation in the scientific field. When creating Excel diagrams, the following settings/formats must be taken into account:

Diagram/drawing area:

without frame

without filling

Diagram axes:

Main lines: Inside and outside

Auxiliary lines: without

Graduation mark labelling: close to axis

Axis thickness: 1 pt.

Numbers: Arial, standard, 9 pt.

Axis lettering: Arial, standard, 12 pt.

The axis labelling contains both the designation of the axis and, separated by three spaces in square brackets, the unit of the displayed quantity. For better clarity, arrows can be attached to the ends of the axes if required.

Text alignment:

Automatic

Grid lines:

Line thickness: user-defined 0.75 pt.

Legend:

Frame: without shadow and without filling

Font: Arial, standard, 12 pt.

Data series:

Data label: none

Pattern: Line 2.25 pt., mark custom,

Size: 5 pt., without shadow

As an example, the required formats are shown using the sinus function in Figure 2.16.

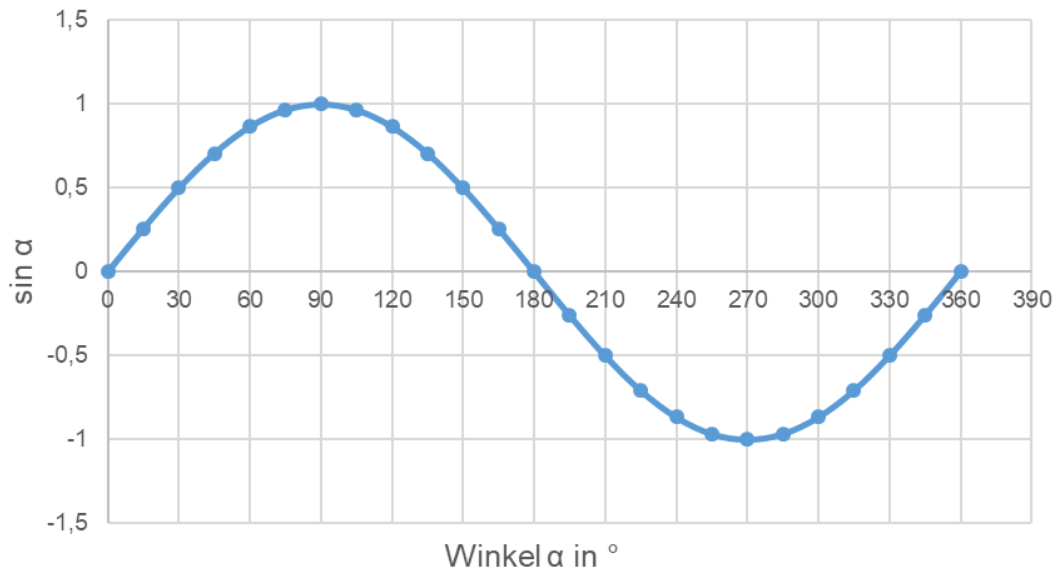


Figure 2.16: Course of the sinus function

The chart size must be selected in Excel so that it does not have to be changed in Word. The maximum size is based on the maximum width of approx. 15.5 cm. Scaling in Word changes all line thicknesses and font sizes accordingly, so scaling must be done in Excel.

It is important for the presentation of results through diagrams to maintain clarity. In principle, not too many results should be shown in a diagram. As a rule of thumb, a maximum of 4...5 curves or diagram bars can be used. Otherwise, the clarity suffers, as the negative example in Figure 2.17 shows. In many cases, final papers are printed out on black-and-white printers. Make sure that no statements are lost if no colour can be used. It is advisable to work with different symbols and types of lines for curves or to use different hatchings for the representation of slide bars. The choice of colours or types of lines and hatchings should follow a comprehensible logic, e.g. the results of materials with increasing fibre content are shown with darker and darker colours (see Figure 2.18). The legend should also always be shown.

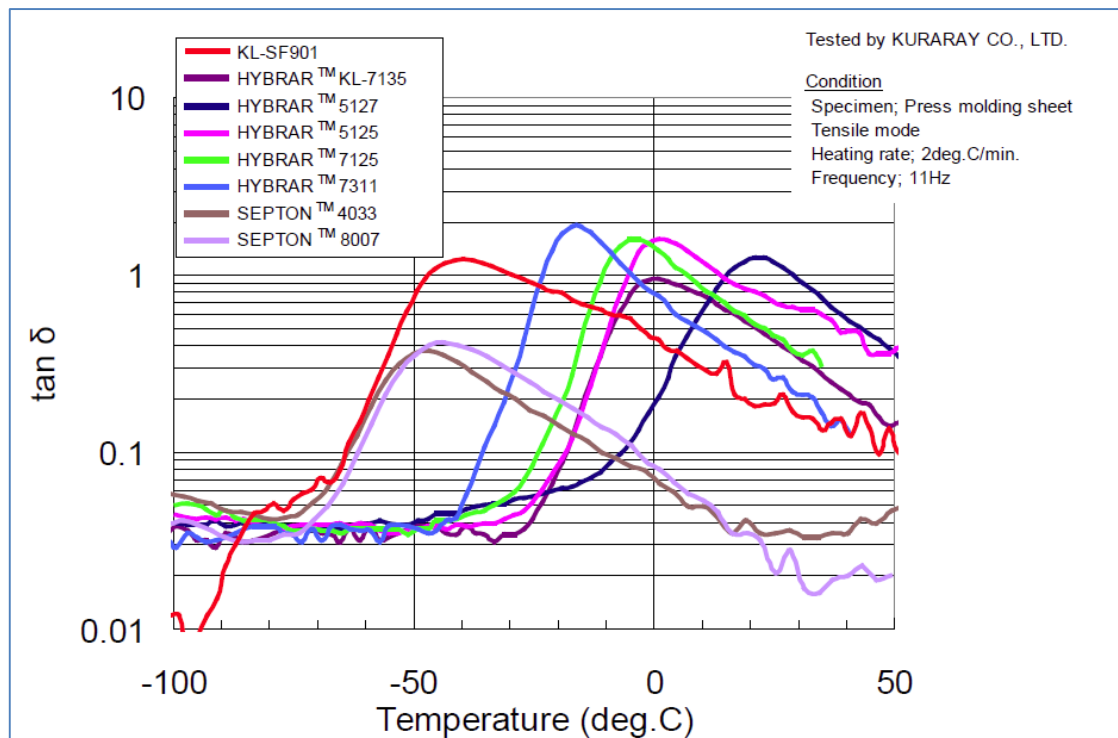


Figure 2.17: Example representation of a diagram with lack of clarity → too many curve progressions, no logical choice of colours (Fig.: [Gru14])

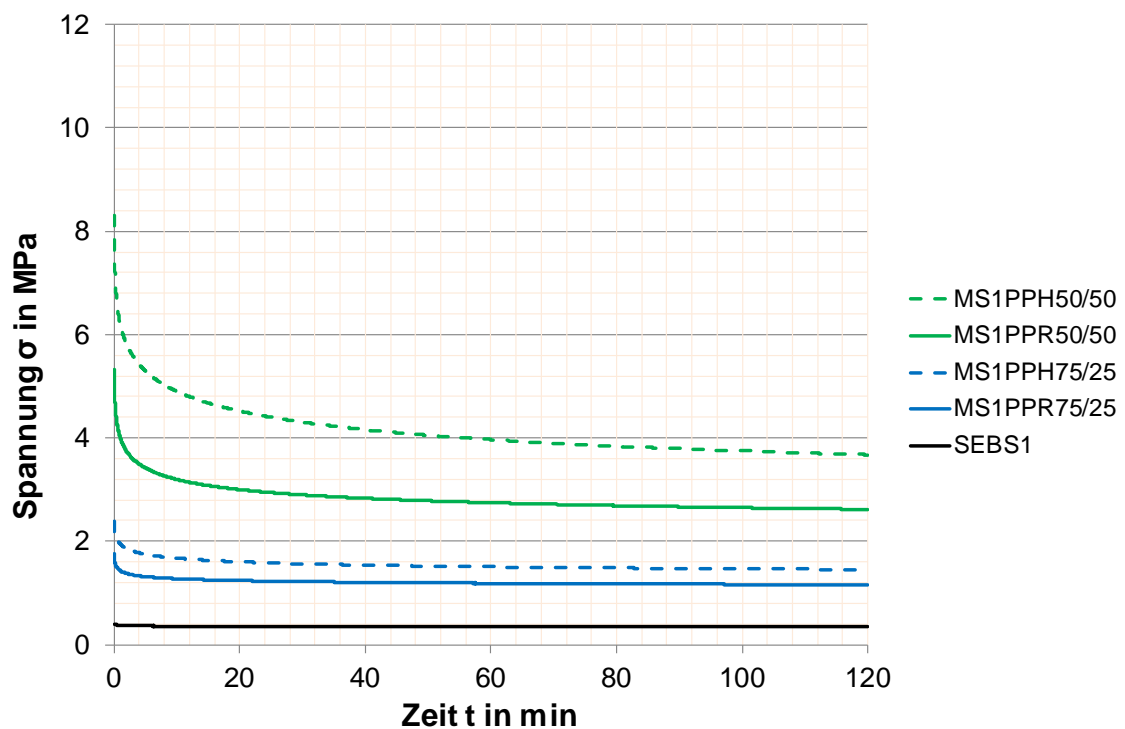


Figure 2.18: Example presentation of a clearly designed diagram → max. five curve progressions, logical choice of colour and line type according to material formulation (Fig.: [Kie19])

The figure caption should fully explain the diagram shown. As a guideline, the diagram is self-explanatory with the help of the figure caption and the diagram, i.e. it does not require any further explanation for understanding. The diagram title, as it is automatically generated in Excel, is therefore not necessary and is omitted. Likewise, no diagram frame should be used.

2.1.8 Creating technical drawings with a CAD system

When creating technical drawings with a CAD system, the corresponding standards according to DIN must be taken into account. In the case of larger drawings, these can be placed in the appendix of the work. If smaller CAD drawings are to be within the work and not in the appendix, they must be integrated into the work. To do this, the drawing must first be saved as a jpg file and can then be directly integrated into Word.

2.2 Formula and Equations

Formulas can be easily created with the formula editor of common word processing programmes, in this case Word. Each formula should be numbered the first time it is used in the text, so that it can be clearly referred to in the text (analogous to the illustrations). When the formula is used for the first time, the individual formula symbols must be listed and explained, including the units (see (Eq. 2.1)).

For easier formatting, tables should be used which contain the formula, the numbering and the explanations of the formula characters. For this purpose, the formula example should always be copied from the format template and inserted at the appropriate place in the text, including a blank line below the table. By 'clicking' on the formula, the formula editor opens and the desired relationships can be displayed. The field 'Equation Chapter.Counter' automatically counts up for the labelling of the formulae. Generally, a space is placed between numbers and units. Decimals are separated by a comma/dot. It is important to ensure that the numerical value and unit are not separated by a line break. This can be prevented by using the locked space character '*Ctrl+Shift+Space*'.

$F = m * a$			<i>(Eq. 2.1)</i>
<i>F</i>	<i>force</i>	<i>[N]</i>	
<i>m</i>	<i>mass</i>	<i>[kg]</i>	
<i>a</i>	<i>acceleration</i>	<i>[ms⁻²]</i>	

All formula symbols used in the work shall be listed in a directory. This list of formula symbols used shall be listed before the first chapter. The formula symbols are differentiated according to upper and lower case letters as well as Greek characters. The formula symbol,

its meaning and its unit (as used in the text) shall be indicated in the list. SI units should be chosen preferably. It is advisable to design the list as a table with hidden frames.

Example:

As an example, the weight force of one kilogram of polycarbonate in the floating field of the moon, $a=1.62 \text{ ms}^{-2}$, is to be calculated. According to equation (Eq. 2.1)

$$F = 1 \text{ kg} * 1,62 \frac{\text{m}}{\text{s}^2} = 1,62 \text{ N}$$

it can be seen that less force is needed on the moon for the movement of bodies of the same mass.

2.3 Abbreviations

Abbreviations should be used as sparingly as possible and be easy to understand. All abbreviations are introduced by writing out the full term the first time it is used and adding the abbreviation in brackets:

"The Society of Plastics Engineers (SPE) describes..."

The abbreviation can then be used in the rest of the text. All abbreviations and their meanings should be listed in alphabetical order in a list before the main text so that the reader can look them up quickly. Abbreviations in general use (e.g., etc.) are not listed and are not explained in the text.

2.4 Quotation and Citation

Quoting means reproducing text passages, statements or measurement results verbatim (direct quotation) or in spirit (indirect quotation). Quotations can be used to substantiate statements, illustrate the state of the art, etc. In principle, all sources must always be cited in scientific work so that the reader has the opportunity to view the corresponding citations in the original. This applies not only to verbatim quotations but also to quotations in spirit. Not citing the sources used is a gross violation of the rules of scientific practice.

Basic rules of citation

Basically, a distinction is made between literal and analogous citations. When citing sources, the so-called Harvard method is used (cf. also information on the bibliography, chapter 2.8.9). Here, the author and year of publication or a corresponding abbreviation is cited as a reference in the text, supplemented by the page number of the source to which reference is

made. In the bibliography, the corresponding source is then cited comprehensively. In general, citations serve to reproduce definitions, but can also be used for concise, important statements or facts.

In case of a quotation according to the meaning, the text passage is reproduced in the author's own words and the source reference is extended with 'cf.' (confer).

Example: For the reader, quotations should be comprehensible and verifiable. Only then a quotation is meaningful (cf. [Lüc02, 61]).

Direct quotations are always placed in inverted commas and the content is reproduced faithfully.

Example: "Zitierfähig ist grundsätzlich nur das, was vom Leser nachvollzogen und geprüft werden kann [...]" [Lüc02, 61].

Any deviation from the source must be marked. Omissions within a quotation are marked by three dots in square brackets '[...]'. Own additions, for better comprehensibility, are placed in square brackets '[supplementary text]'. If sources contain errors in the original, these must be adopted and marked with '[Sic!]'. Furthermore, changes, e.g. emphasis in the text (omitted/added), must be pointed out.

Example: "Zitierfähig ist *grundsätzlich* nur das, was vom Leser nachvollzogen und geprüft werden kann [...]" ([Lüc02, 61]; without emphasis in the original).

Example: "Auf dem Mond isst [Sic!] die Wirkung der Schwerkraft deutlich geringer" [Mei78, 102]

If extensive quotations are used which extend over at least two pages, 'f.' (following page) or 'ff' (following pages) should be added to the page number. Quotations from other languages are taken over unchanged and should be translated in the subsequent text.

As far as possible, the original text, the primary source, should be cited. Only if this is not accessible may a secondary source be cited. In this case, inaccessible means that the original source has been destroyed or can only be obtained from abroad at considerable expense. If a source can only be obtained at a cost, this does not mean that it is inaccessible.

2.5 Language and Style

Scientific papers should use appropriate language. Overly flowery or colloquial language is inappropriate. The ever-popular "one" should be avoided. Likewise, report from a neutral position, not from the first-person perspective.

The thoughts should be clearly structured and comprehensible. Long, snaking sentences and multiple nesting of sentences within one another are not advisable. Short, clear sentences are better. As a rule of thumb: One information, one sentence. The use of synonyms is not necessary in the case of clearly clarified facts, and the repetition in the text can improve the presentation of the facts described. Illustrations are often helpful when describing complex issues.

2.6 Subject vocabulary

As a rule, a study paper or thesis will contain a certain amount of subject-specific vocabulary. Here, a sensible balance should be maintained between presupposable basics and context that require explanation. It is not the intention to "encode" the content with technical terms. The work should be written in such a way that interested laypersons can follow the train of thought. Consequently, terms and contexts that need to be explained should be explained briefly. For this purpose, there is a basic section in each paper. If necessary, smaller explanations can also be given in a footnote.

2.7 Outline, structure and heading levels

The outline of a scientific paper is the basic structure that will be filled in over time by your text. A continuous thread, so called "red thread" should be recognisable from the outline. This can be achieved by keeping headings short and meaningful. As a rule, a three-level outline system is sufficient. In exceptional cases, a fourth level can be added. Too fine a subdivision is not recommended and quickly becomes confusing. Headings should never stand alone at the bottom of a page. There is always text after the last heading. If this is not possible due to lack of space, the heading should be moved to the next page. A subdivision of a chapter into subchapters is only made if there are at least two subchapters. Each subchapter should fill at least half a page. Sub-chapters should not repeat chapter headings verbatim. Similarly, abbreviations should not be used in the heading unless the meaning is explicit. A chapter heading (level 1) is followed by text, not directly by the next heading level (level 2).

The style sheet contains a quick style sheet for each outline level. Manual numbering of headings is no longer necessary and also facilitates the creation of the table of contents.

2.8 Structure of the thesis

The structure of theses and dissertations should generally be based on the following scheme:

Cover page

Confidential Clause (optional)

Description of topic: Copy of original topic sheet or assignment

Declaration of the author

Foreword (optional)

List of abbreviations, formula symbols and indices used

Abstract & Summary (descriptors, keywords, table of contents)

Table of contents

Main part:

- Introduction
- Initial situation (introduction to the research objective, state of the art)
- Description of methods
- Objective of the work
- Solution approach
- Results and discussion
- Summary, conclusion and outlook

List of tables and figures

Bibliography

Appendix (if required).

This scheme, as well as the following information, should be used to help structure the work and also as a final checklist.

2.8.1 Cover page

For the cover page, the format template is to be used and adapted to the work to be prepared. Please note that for the title of the paper and the name of the author the corresponding format templates '*Title Author*' and '*Title Subject*' are used. This ensures that both details are transferred directly to the footnote of the paper.

2.8.2 Confidential agreement / blocking note

The Confidential Clause serves to protect the scientific work produced from unauthorised use by third parties. The Confidential Clause regulates the duration of the embargo and the exploitation rights. A Confidential Clause is not mandatory, but should be written in both German and English if used.

2.8.3 Description of topic

The topic to be worked on is explained in more detail in the topic description. Objectives, non-objectives and the period of time to be worked on are also regulated in accordance with the applicable examination regulations. In the format template, a placeholder is provided at this point, which is replaced by the topic description before binding.

2.8.4 Declaration of the author

A signed declaration must be included in the thesis stating that the thesis has been written independently and that all sources used have been cited. This declaration is also included in the format template.

2.8.5 Table of contents

The table of contents is mandatory and is created automatically when using the format template. The entire directory should be updated before printing (select the directory *'right mouse button → Update fields → Update entire table'* / *'Anwählen des Verzeichnisses 'rechte Maustaste → Felder aktualisieren → gesamtes Verzeichnis aktualisieren'*).

In the table of contents all chapters of the actual work are marked with Arabic page numbers. Indexes, such as bibliography or list of figures, as well as preface, blocking notes, etc. and appendix are marked with Roman page numbers. The table of contents of this guideline serves as an example for this.

2.8.6 List of tables and figures

A list of figures and tables is placed at the end of the paper after the text. These can be created automatically in Word by *'References → Insert Table of Figures'* / *'Verweise → Abbildungsverzeichnis einfügen'* and selecting the appropriate type (table or figure). Automatic creation only works if cross-references are used conscientiously.

2.8.7 Summary

The summary aims to inform the reader about the main aspects of the work:

- problem,

- objective of work,
- approach to solution,
- main results and
- benefits, application of the results.

It should therefore arouse the reader's interest offer an orientation as to what the reader can expect and enable a decision as to whether the work is important for him or her.

Many professionals spend about 30% of their time reading. Since they are confronted with a flood of reading material every day, e.g. in the form of newspapers, professional publications, circulars, letters, memos, etc., it is becoming increasingly important to be able to select essential information in a goal-oriented manner and to rationally compile the relevant texts. This is where the summary comes in. The summary should not exceed one page in length.

The summary should be preceded by so-called keywords, also called descriptors. These can be understood as keywords or a kind of search term that can be used to classify the content of the work. Terms relating to the processes, materials or also research methods or the application can be used, whereby only the generic terms should be mentioned, such as injection moulding, finite element method, thermoplastics, polypropylene, packaging machine, tensile tests, etc.

2.8.8 Main Part

The main part of the paper should follow the following scheme, regardless of the type of paper:

Introduction

How can I pick up the reader and introduce him/her to the situation?

How should the resulting problem be described?

The introduction introduces the reader to the problem. It also briefly explains the context and describes the current situation. With the help of the introduction, it should be possible for the reader, as a "non-specialist" with a technical background, to understand the initial situation from which the task of the work ultimately results.

The length of the introduction as an explanation of the problem depends on the type of work (theoretical or experimental/constructive) and can therefore vary in length. The company can also be introduced in the introduction. The introduction of the company should be brief

and the reference to the thesis should already be established. The introduction should always be written in a short, concise form. The aim is to enable the reader to get to grips with the problem.

Initial situation (introduction to the research objective, state of the art)

What is the starting point?

What is known?

What is the state of research, e.g. results of a literature search, existing problems or unsolved tasks?

The initial situation is described by the state of research/technology. The current international status should be reflected by researching national and international specialist publications. It can serve as a limitation that only those topics are described that are necessary for the work, i.e. those that will be used in the further course or on which the work will be based.

Objective

What does the author specifically want to work on, achieve or know?

The formulation of the objective is to be understood as a derivation of the task. Against the background of the state of the art, the author of the thesis formulates the goals of the thesis in concrete terms. Aspects of the task can be further refined, narrowed down and explained in more detail.

Description of methods

Which test methods were used for the work?

How does the method work in principle?

What means (machine, apparatus, devices, materials, etc.) and procedures were used to achieve the research objective?

Especially in the case of experimental work characterised by practical trials, a separate chapter on the methods used precedes the results section. This includes a brief explanation of the methods and tests used. On the one hand, the procedure is described in principle (e.g. tensile test, procedure, characteristic values from the test, etc.) and on the other hand, the implementation is explicitly explained. This also includes the naming of the systems and equipment used (e.g. tensile testing machine Zwick Z10) as well as the parameters (e.g. test speed 200 mm/min) and, if applicable, a derivation of how the characteristic value was determined.

Solution path

What is the procedure for achieving the objective?

The description of the solution takes up the objectives of the work formulated in the chapter Objectives and outlines the further procedure. In the case of experimental work, this also includes, for example, the experimental design and the production of the test specimens and the preparation for the investigations.

Results and discussion

What results have emerged from the research?

What are the core statements developed (only own contribution)?

Which boundary conditions must or must not be taken into account?

What uncertainties and errors do the results contain?

Comparison with results from other experiments or from the literature.

What are the benefits of the results for the work and for operational practice?

The results section forms the core of the scientific work. In the first step, the results are presented in the form of diagrams, design drafts, etc. In the second step, the results are discussed and evaluated. This can be done by comparing the results with the state of the art described at the beginning of the paper or with the results from other papers or from the literature. The discussion should also include attempts to explain the observations and results.

It should be noted that the results are always presented first, followed by the discussion. Often these two points are mixed up and the structured layout suffers as a result. The discussion therefore always takes place at the end of the chapter. In the case of extensive investigations (e.g. influence of injection moulding on the geometry of the moulded part), sub-chapters can also be formed (e.g. influence of cooling, influence of temperature, etc.) and the discussion can take place at the end of the respective sub-chapter.

Summary, conclusion and outlook

How can the work be summarised?

What are the core statements, the main theses of the work?

What connections could be found?

How should the results be evaluated (from the author's point of view)? Have the goals formulated at the beginning been achieved?

What open questions remain?

What further work should be done?

In the last chapter of the work itself, the main results are summarised once again. It is limited to the core statements of the thesis. The results obtained, the correlations found and the explanatory approaches are briefly discussed and an assessment is made of the extent to which the goals formulated and derived from the task were achieved. The outlook, based on the essential, newly acquired knowledge, is intended to show which open questions still exist and which aspects should be taken up in further work.

2.8.9 Bibliography

The last chapter deals with the handling of citations and the correct indication of the sources used.

2.8.9.1 Harvard citation style

In the bibliography, all sources used are listed in order to identify any use of other people's intellectual property. The so-called "Harvard method" is used for this purpose. This is a name-date system, i.e. the cited resource is clearly assigned in the text via the name of the author and the year of publication. For this purpose, each source is given a unique abbreviation for this work, consisting of the author and the year of publication (e.g. [Ben09], [Seu00], [Rot70]). In the bibliography, the sources are sorted alphabetically according to the author abbreviations.

In practice, numerical source references are also used (e.g. [1], [2] ... [49]). In this case, the sources used in the text are numbered consecutively according to the order in which they are cited in the work and listed in the bibliography under this number. However, this has the disadvantage that if sources are inserted later in the text, the numbering must be updated continuously and thus ultimately bears the risk of incorrect references. For this reason, the procedure described here of citing with the help of author abbreviations is to be preferred.

The Harvard citation method is not regulated down to the last detail, and slight variations can always be found in scientific publications. The citation method described below is based on DIN ISO 690 "Information and documentation - Guidelines for title information and citation of information resources / Information und Dokumentation – Richtlinien für Titelangaben und Zitierung von Informationsressourcen" [ISO 690], which in 2010 replaced DIN 1505-2, which was valid until then but is still frequently encountered [DIN 1505 T2].

Further information on correct bibliography is compiled by the German Institute at RWTH Aachen University at <http://www.germilit.rwth-aachen.de/tippaix/> [EP20]. A generator for creating literature references according to the Harvard principle can also be found on the homepage sribbdr.de at <https://www.scribbr.de/zitieren/harvard-generator/#/sources/new/webpage>. When writing scientific papers with a large number of citations and references, for example over a hundred sources and more, it is advisable to use programmes for managing and integrating literature sources into the word processor, such as citavi (Link: www.citavi.com).

2.8.9.2 General notes on formatting and author abbreviations

The bibliography should be sorted alphabetically. It makes sense to use a table with hidden lines as a formatting aid for the bibliography as well.

The reference to a literature passage in the text consists of two, three or four letters and the two-digit year. It is enclosed in square brackets. If there is only one author, the first three letters of the surname are used.

Maier, 1998 → [Mai98]

If several sources from one year are used by one author, the year is counted up alphabetically. This also applies if different authors are given the same abbreviation and the publication took place in the same year.

Maier, 1998 → [Mai98a]

In the case of several authors, the initial letters of the surnames are used (all in capital letters), also the designation 'et al.' (and others) may be used. For more than four authors, only the first three surnames are used in the reference and a '+' is placed in the fourth position, the use of 'et al.' is also permitted.

Maier, Schmidt, 1998 → [MS98]

Maier, Schmidt, Schulz, 1973 → [MSS73]

Maier, Schmidt, Schulz, 1973 → [M et al. 73]

Maier, Schmidt, Schulz, Braun 1973 → [M et al. 73] oder [MSS+73]

Alternatively, it is also possible to name the main author (first name) in capital letters and the year in square brackets:

Maier, 1998 → [MAIER 1998]

This notation is then retained for a source even if there are multiple authors:

Maier, Schmidt, Schulz, 1973 → [MAIER 1973]

Which spelling should be used is to be clarified with the supervisor.

If several references are made, the references are separated by commas.:

„...see also [MS98, Mai98, MMS73]...“

If necessary, the exact page cited can also be given. If the exact page numbers are to be given, the references must be separated from each other by a semicolon.:

Maier, 1998 Seite 25 → [MAIER 1998, 25]

„...see also [MS98, 25; Mai98, 73; MMS73, 52]...“

Whether page numbers are to be given must be clarified with the supervisor.

In the actual bibliography, the names of the authors are entered in CAPITALS and separated by a semicolon. The first name is abbreviated accordingly with the initial letter:

MAIER, T; SCHMIDT, A.; SCHULZ, W.

The following information is given for the individual entry types, the structure of the citation method and notes on formatting. It is not absolutely necessary to mention the ISBN or ISSN designation of the sources and is only optional.

As a general rule, bibliographic information, footnotes and endnotes always begin with a capital letter and always end with a full stop (or another punctuation mark)!

In the bibliography, *italics* are used depending on the type of entry:

Article:	journal title
Book:	title of book
Conference proceedings:	name of the conference
Handbook:	title
Dissertation:	title
Project thesis/final paper:	title

2.8.9.3 Artikel in a journal

Articles from magazines, journals, etc. should be cited with the name of the author, the title of the article and the journal. In addition, information on the issue and a reference to the page

should be given. The title of the journal is preceded by 'In:'. The volume of the journal is printed in bold, the issue number of the respective volume in brackets is placed behind it.

Structure: AUTHOR: Title. In: *title of the journal*, year, **volume or volume number** (issue = week or month, put in brackets), pages.

Optional: Note, ISBN identifier

Example:

[SHK98] SODEN, P.D.; HINTON, M.J.; KADDOUR, A.S.: Lamina properties, lay-up configurations and loading conditions for a range of fibre-reinforced composite laminates. In: *Composite Science and Technology*, 1998, **58** (7), pp. 1011 – 1022.

2.8.9.4 Monograph (book)

Structure: AUTHOR OR EDITOR: *title*. Volume number, Edition, Place of publication: Publisher, Year.

Optional: Note, ISBN identifier

Example:

[MW90] MICHAELI, W.; WEGENER, M.: *Einführung in die Technologie der Faser-verbundwerkstoffe*. 2nd edition, Munich: Carl Hanser Publishing House, 1990.

When indicating the publisher, the name is followed by the suffix: '(ed.)'.

2.8.9.5 Contribution from monographs (book) and manuals

If the book consists of several contributions, e.g. chapters with their own thematic content and/or different authors, and if the chapter is to serve directly as a bibliographical reference, the chapter is named first, followed by the monograph from which the chapter originates, together with the authors or editors. Analogous to the procedure for journals, the monograph is preceded by 'In:'. The same procedure is followed for a literature reference to a selected chapter in a handbook.

Structure: AUTHOR OF CHAPTER: Title of chapter. In: EDITOR/BOOK AUTHOR: *Book title*. Volume number, edition, place of publication: publisher, year, number of pages.

Optional: Note, ISBN identifier

Example:

[KR90] KREMSEER, T.; ROTH, S.: Sterilisationsverfahren für Medizinprodukte. In: SEUL, T.; ROTH, S. (ED.): *Kunststoffe in der Medizintechnik*. Munich: Carl Hanser Publishing House, 2020, pp. 165 – 174.

- [Row85] ROWLANDS, R.: Strength (failure) theories and their experimental correlation. In: *Handbook of Composites*, Vol. 3, Chapter II: Failure Mechanics of Composites. Amsterdam: Elsevier Science Publishers, 1985, pp. 3434-3533

2.8.9.6 Articles in a conference volume

In the case of references to articles from conference proceedings, the title of the conference proceedings is mentioned with a prefix 'In:'. Further information on the conference, such as place, date, etc., and on the conference proceedings is possible.

Mandatory: AUTHOR: Title of the article/lecture. In: *Title of the conference volume or event*, year

Optional: Editor, volume or number, pages, place of event, date of event, organiser, place of publication, publisher, annotation, ISBN identifier

Example:

- [Har97] HART-SMITH, L.J.: The first fair dinkum macro-level fibrous composite failure criteria. In: *Proceedings of the 11th ICCM Conference*. Sydney, Australia, 1997.

2.8.9.7 Standards

Structure: The word 'STANDARD', the standard number (part, if applicable) and the edition: *Title*.

Example:

- [DIN 1505-2] STANDARD DIN 1505 PART 2, 1.1984.
- [DIN 1505-2] STANDARD DIN 1505- 2:1984: *Titelangaben von Dokumenten – Zitierregeln/ Title information of documents - Citation rules*.

2.8.9.8 Dissertation

Structure: AUTHOR: *Title*, University, Dissertation, year.

Example:

- [Zac98] ZACHERT, J.: *Analyse und Simulation dreidimensionaler Strömungsvorgänge beim Spritzgießen*. RWTH Aachen University, Dissertation, 1998.

2.8.9.9 Theses, dissertations and research reports

Structure: AUTHOR: *Title*, Institute and university, type of thesis (Master's thesis, Bachelor's thesis, research report, etc.), year.

Optional: Supervisor (for in-house theses)

Example:

- [Hra97] HRASTNIK, J.: *Modellbildung und Experimente zur Erfassung der werkstofflichen Nichtlinearitäten bei unidirektionalen Schichtverbunden*. Institute for Plastics Processing, unpublished diploma thesis, 1997, supervisor J. Kopp.
- [Mic00] MICHAELI, W.: *Entwicklung einer Berechnungsprozedur für ein FE-Programm zur Berücksichtigung der nichtlinearen Spannungs-/Verzerrungs-Zusammenhänge bei der Auslegung von Bauteilen aus Faserverbundkunststoffen (FVK)*. Institute for Plastics Processing, RWTH Aachen University, Final Report on AiF Research Project No. 11479 N, 2000.

2.8.9.10 Oral communication

Structure: COMMUNICATOR: Personal message, company, place, year.

Example:

- [Cun98] CUNTZE, R.G.: Personal message, MAN AG, Karlsfeld, 1998.

2.8.9.11 Online publications

Citing information from websites or online publications is done in the same way as described above for analogue media. It must be recognisable that the source reference was made online.

The following procedure is defined:

Structure: AUTHOR (ALTERNATIVE INSTITUTION providing the website): Title of the article [online], date of the article. URL: Link name, retrieved on yyyy.mm.dd.

Example:

- [URL20] SCHMALKALDEN UNIVERSITY: Studienangebot der Hochschule Schmalkalden [online], 2020. URL: <https://www.hs-schmalkalden.de/studium/studienangebot-hs-schmalkalden.html>, retrieved on 16.04.2020.
- [Sep19] SEPE, T.: Harvard Zitierweise: Das musst du wissen! [online], 04.11.2019. URL: <https://www.unicum.de/de/erfolgreich-studieren/hausarbeit-co/harvard-zitierweise>, retrieved on 05.02.2020.
- [Mas19] MASUCH, T.: 3D-Druckkopf mit stählernen Spinnenbeinen [online], 19.09.2019. URL: <https://fon-mag.de/highlight-storys/2019/metrom/>, retrieved on 19.04.2020.
- [URL18] MEDIZIN & TECHNIK: Dr. Katrin Sternberg übernimmt F&E-Ressort bei Aesculap [online], 12.07.2018., URL: <https://medizin-und-technik.industrie.de/top-news/news/dr-katrin-sternberg-uebernimmt-fe-ressort-bei-aesculap/>, retrieved on 17.03.2020.

The author (or the institution providing the information) is named first. If the author is known, the abbreviation is formed analogously to the specifications for monographs or journals. If the date of the creation of the online article is known, this is also stated and the year for the author's abbreviation is formed accordingly.

If an author cannot be clearly assigned to the website, the author abbreviation is formed by the letters URL and the year of retrieval. If several URLs with the same year appear in the bibliography, they are listed alphabetically in the order in which they were used.

Internet pages are ephemeral sources and must be archived. This is done either by printing or saving the page.

2.8.9.12 Patents

Patent specifications are cited by naming the applicant or patent proprietor, the patent title and the number of the patent specification. Optionally, further information such as the name of the inventor may be added.

Mandatory: PATENT OWNER or APPLICANT: Title of the patent specification, number of the patent specification

Optional: Inventor, date of patent application, date of patent grant

Example:

[Fei01] C. & E. FEIN GMBH: Elektrischer Antrieb, European patent application EP 2 426 815 A3, Inventor: Dietl, L., Registration date: 16.08.2001.

[MWS10] MWS SCHNEIDWERKZEUGE GMBH & CO. KG: Sicherheitskupplung, Patent specification DE 10 2010 045 496 B4, Inventor: Johannes, H.; Tröger, H., Registration date: 15.10.2010, Grant of patent: 02.04.2015.

2.8.9.13 Unknown author

In cases where the author is unknown, "N.N." or "a.u." (author unknown) is written instead of the name. If the year is unknown, "d.u." (date unknown) is written.

Example:

[NN08] N.N.: Untersuchungen zur Wasserqualität. In: *Wasserwerk heute*, 2008, **21** (7), pp. 100 – 102.

2.8.10 Appendix

Information supplementing the work is collected in the appendix. The appendix may consist of several parts, which are identified by a consecutive alphabetical nomenclature, e.g. Appendix A: Material data sheet, Appendix B: Rolling bearing design, Appendix C: Technical drawings etc. A list of the individual appendices shall be given at the beginning of the appendix, whereby the naming of the page numbers can be dispensed with in this case.

The function of the appendix is to provide only additional and supplementary information. This avoids the main part of the paper becoming too extensive. However, the work itself should be readable and understandable without studying the appendix. The text of the main part should refer to the appendices. Otherwise, this can serve as a strong indication that the appendix is not necessary for the work either. As soon as contents and parts of the appendix, such as diagrams from the appendix, are discussed explicitly and in more detail in the main part, these parts should also be presented in the main part and thus not in the appendix.

2.9 Outer appearance

The work is to be submitted on white paper with a firm binding. The sheets are normally to be written on one side. In the case of extensive papers, the sheets may be written on both sides in consultation with the supervisor. The main text of the paper (i.e. without indexes and without appendices) should not exceed 80 pages.

2.10 Correction

Use the spell-checking facilities during the writing process. **The unavoidable spelling mistakes should not be removed in the correction by other persons or the supervisor.** The work should be proofread by other people (friends, relatives, fellow students). In addition to spelling and grammar, especially punctuation, attention should be paid to the style and comprehensibility of the statements. If there are any filler words, e.g. so, somehow, also, now, known, etc., they can be deleted. It is not a disadvantage to give the work to readers from outside the subject area for correction. The submitted version of the work must be free of spelling mistakes. An overview of the most important spelling rules can be found in the appendix.

2.11 Submission of thesis

The thesis must be submitted in written form as well as in electronic form and must be handed in by the agreed deadline.

Written format

At least one copy must be submitted to the Dean's Office (Secretariat) of the Faculty. The number of copies to be submitted to the Dean's Office (Secretariat) depends on the examination regulations at the time of enrolment.

Electronic format

In addition to the written paper, the work must be submitted by electronic file. This contains the complete paper in Word format, the presentation for the colloquium and the illustration file in PowerPoint format.

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LISTS

List of Figures

Figure 2.1:	Insert section break	6
Figure 2.2:	Example header	7
Figure 2.3:	Changes in header	7
Figure 2.4:	Insert the chapter heading into the header by activating a text field link .	8
Figure 2.5:	Example quick format templates.....	10
Figure 2.6:	Display of formatting characters locked space and conditional separator	11
Figure 2.7:	Examples of special characters in Word	11
Figure 2.8:	Inserting figure and table numbering in Word.....	13
Figure 2.9:	Preferred Preferences in Word for Cell Boundaries	14
Figure 2.10:	Here is the caption of the illustration (Fig.: [FHS12])	15
Figure 2.11:	Example TEM image with scale (Fig.: [Kie19]).....	16
Figure 2.12:	Example component with background grid	16
Figure 2.13:	Example Size comparison of the component created by personal reference (Fig.: [URL20])	16
Figure 2.14:	Procedure for inserting images.....	18
Figure 2.15:	Formatting images in Word	18
Figure 2.16:	Course of the sinus function.....	20
Figure 2.17:	Example representation of a diagram with lack of clarity → too many curve progressions, no logical choice of colours (Fig.: [Gru14])	21
Figure 2.18:	Example presentation of a clearly designed diagram → max. five curve progressions, logical choice of colour and line type according to material formulation (Fig.: [Kie19])	21

List of Tables

Table 2.1:	Field functions.....	8
Table 2.2:	Example table.....	13

