Recommendation

for editing PhD thesis booklets and theses

In doctoral schools operating in the field of technical sciences, questions often arise regarding the formulation of theses that appear to be stylistic, but in fact interfere with the identification of scientific results. There was a need to issue a Recommendation on this subject. It is also worth defining the function of the thesis booklet more precisely, and harmonizing the two can help resolve some contradictions.

While there is agreement that candidates should present their scientific results in the form of theses, this requirement is mixed with the practical goal of actually evaluating candidates and awarding them scientific degrees for their scientific achievements. Due to the latter consideration, in addition to scientific achievements, theses also emphasize the formulation of the candidates' own work, which has become customary in some places, to such an extent that the formulation of the scientific achievement is often mixed with a discussion of the candidate's activities carried out for this purpose. It is also common for candidates to merely refer to their scientific achievements in their theses, without actually communicating them, but only praising them or pointing out the advantages of their application, even though there is space for this elsewhere in the thesis booklet.

In order to prevent such mistakes and ensure that theses truly fulfill their purpose, we publish recommendations on aspects to be taken into account when writing theses and thesis booklets. In addition, we illustrate well- and poorly-written theses with examples in the appendix to the Recommendations.

Of course, we only recommend the contents of the Recommendations to candidates for future theses, thesis booklets, and theses, but we also consider it appropriate to forward them to reviewers and committee members so that they can see what considerations the candidate received for the preparation of the thesis booklet.

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Recommendation

for editing the PhD thesis booklet and theses

Below, we provide recommendations for candidates on how to write their thesis booklet and theses, followed by examples of well- and poorly-written theses in the appendix.

I. Considerations for compiling the thesis booklet

The thesis booklet is a short summary of the dissertation, which, together with the theses, presents the candidate's new scientific results. It has a dual function: on the one hand, due to its larger print run and wider distribution, it gives many people an idea of the candidate's work, and on the other hand, it helps to focus attention on the theses, as they are the most important criteria for the award of the degree. The thesis booklet must be understandable on its own, without references to the relevant chapters of the dissertation.

The thesis booklet should consist of 4-6 parts and should not exceed 16 A5 pages (excluding the cover page and bibliography) (max. 64,000 characters including spaces, including lines occupied by figures and formulas). It is advisable to use the template available on the doctoral website to edit the thesis booklet, and the supervisor (if any) must also be indicated on the cover page.

I.1. Description of the topic, objectives

This chapter serves to define the topic of the research. Here you can highlight the topicality and significance of the topic.

Within the chosen research topic, it is advisable to formulate, narrow down, and specify the objectives of the research. It is beneficial if the formulation of these objectives is consistent with the thesis and in sync with the results achieved.

I.2. Background, research methods

In this chapter, it is advisable to briefly present the state of the art, referring to the literature and the role of the topic in technical development (or even market trends).

If the candidate considers it important, the research methods, materials used, etc. can be discussed here.

I.3. Summary of the research work and presentation of the theses

This chapter serves to present the results of the research work that led to the formulation of the theses and the theses themselves.

It is important that the theses, which are formulated in a concise and impersonal manner, only refer to the scientific results and are separated from the description of the candidate's work. However, this chapter of the thesis booklet also provides an opportunity for the latter, in several ways, e.g.:

a) In order to achieve a result, we describe the work performed by the candidate – even in the first person singular – and then conclude the description by stating that the subsequent thesis can be expressed as a result of this activity. The thesis is presented in bold, numbered text. This is followed by a discussion of the results leading to the next thesis (in light text) and the thesis (in bold), etc.

b) We describe the candidate's research work underlying all the theses – even in the first person singular – and then list the theses in numerical order (in bold).

c) Another option is to list the theses in numerical order (in bold), followed by a description of the activity related to the thesis or the proof of the thesis (in regular font), then the next thesis in bold, and so on.

When stating the theses, it is therefore advisable to avoid personal wording and instead describe the scientific statement concisely and to the point. The parts in regular font provide an opportunity to discuss the candidate's position on the novelty of their results and to compare their arguments with those found in the literature. This is also where the candidate can refer to the work they have done (e.g., measurements, derivations) that validates the thesis statement.

The thesis may include figures and correlations, but only if they are relevant to the essence of the thesis. After stating the thesis, the candidate must provide references to their own publications listed in point 6. A thesis point may refer to several of your own publications, and, in exceptional cases, it may also include a thesis point that does not yet have a reference.

I.4. Utilization of the results achieved (optional)

Since the results of technical sciences generally serve industrial development, the practical applications of the results that have already occurred or are expected can be described here. Although it is possible that the utilization of scientific results is not yet visible today, the candidate, as the creator of the results, can point out the possibilities and areas of utilization here.

I.5. Bibliography (optional)

Here you can list independent references to which the candidate makes new claims in their thesis. Only include references that are also included in the dissertation, but select only 10-20 of them. The candidate should not be the author of these references (the latter should be listed separately – see below).

I.6. List of own publications related to the topic of the thesis

In this chapter, list the publications that present the results of the thesis points, as well as all of the author's publications related to the topic. Do not include the candidate's publications on other topics here.

II. Considerations for editing the thesis points of a PhD dissertation

II.1. A thesis is a scientific statement.

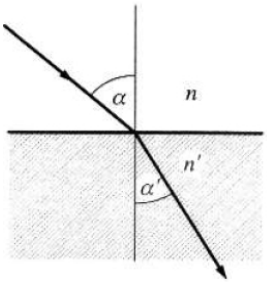
The thesis should therefore be formulated in such a way that it can be quoted in its entirety, even in a future textbook. The thesis should be **concise and to the point**. Since the thesis is a scientific statement and not a group of statements, avoid breaking the thesis down into sub-theses if possible.

II.2. The statement formulated as a thesis should be **novel** and **significant**, i.e., it should add essential knowledge to science. Avoid "l'art pour l'art" theses, which are true but uninteresting, as well as those that have already been formulated by others, albeit in a different way.

II.3. Scientificity requires **abstraction** from the concrete to the general. A good thesis **is** therefore sufficiently **general**, i.e., it should be formulated by generalizing from concrete observations and measurements. This means that although it is reasonable to expect specific parameters to be reported in a set of measurements, the results can only be significant if they lead to a generally important conclusion.
If the thesis contains a measured value, it must be specified precisely (it is not enough to state that something is, for example, 5 W; it must also be stated that it is 5.0 ± 0.5 W, at a 95% significance level,
...interpretation range).

II.4. The academic degree is awarded for the results achieved, not because the candidate has worked hard. It is therefore advisable for the candidate to separate **the highlighting of their own activities from the formulation of the scientific results achieved**. A good method for this is, for example, for the candidate to edit the activities leading to the recognition of the theses lightly, and the statements that can be expressed as theses (i.e., the theses) heavily, for example as follows:

> "At the interface between media with different refractive indices, light rays undergo refraction, the general law of which I derived using Fermat's principle of propagation of light and formulated in the following thesis:
>
> **1. Thesis**
>
> **At the boundary surfaces of homogeneous media, light passing from a less dense medium (with a lower refractive index) to a more dense medium (with a higher refractive index) changes direction and refracts according to the following relationship:**
>
> $$n \sin \alpha = n' \sin \alpha' \quad (1)$$
>
> **where α and α' are the angles between the normal to the surface at the point of incidence and the incident and refracted light rays, respectively, and n and n' are the refractive indices of the two media, as shown in Figure 1:**



1. Figure Refraction of light at the boundary between different media

Emphasis on authorship (*I demonstrated, determined, calculated, established, created, further developed, elaborated, verified with measurements, developed, designed, recognized, defined, created, validated, demonstrated, implemented, pointed out, proposed*) **should** therefore **be avoided in the thesis in bold type**. It is not enough to refer to the developed, calculated, etc. in the thesis, but it must be written there, as it is the content of the thesis – the scientific result itself.

II.5. Thesis points **do not need to** be given **titles**.

II.6. If the scientific result can be expressed in a **mathematical** formula or context, it **is advisable** to formulate and present it in the thesis, indicating its scope of validity. The thesis may also include figures, but only if they represent its essence.

II.7. The text of the thesis should not refer to any part of the dissertation or thesis booklet; **the thesis must be understandable on its own.** Therefore, if a physical quantity appears in the thesis (in the text, in context, in a table, or in a diagram), it must always be defined with the name and unit of measurement of the physical quantity, even if this has already been done in previous parts of the thesis booklet (or dissertation).

II.8. Tips on the nature of theses

- establishing a new relationship or formula;
- refutation of a connection or significant view prevalent in previous literature, modification, supplementation, extension, or generalization of a prevalent connection;
- development of a new procedure, method, or technology (see section I.9);
- development of new material;
- description and explanation of a new phenomenon;
- creation of a new model (including simulation procedures and computational models);
- creation of a new measurement principle;
- new measurement methods, measurement combinations;
- new design procedure (see point I.9);
- new construction (see point I.10);
- etc.

II.9. In the case of theses describing new methods or procedures, it is advisable to describe **the procedural steps** in the thesis. This can be illustrated by listing the procedural steps, or even by using an algorithm or a flowchart-like graphical method.

II.10. Scientific results related to new equipment, structures, or constructions should be included in the thesis **by listing the** novel **structural elements of** the equipment **or the novel combination of known structural elements**, rather than simply describing its **properties** or intended **purpose.**

II.11. The potential uses and evaluation of the theses and results achieved should **not** be included **in the theses themselves**, but in another section of the thesis booklet.

Appendix

Examples of theses formulated in accordance with and deviating from the Recommendation

To better understand the above, the following examples illustrate theses formulated **in accordance with and deviating from the Recommendation**.

Examples of theses formulated in accordance with the Recommendation

1. **Thesis:** The presence of 0.5% by weight of graphene increases the static interlayer shear strength of carbon fiber-reinforced pCBT matrix composites. This is because cracks that form and propagate in the matrix must avoid the graphene nanosheets incorporated into the matrix. Above 0.5% by weight, agglomerates appear, which behave as weak points and become the starting points for cracks.

2. **Thesis:** To manufacture parabolic mirrors operating in the visible optical wavelength range on a lathe, the following structural elements must be used in the machine design:
   - the main spindle of the lathe must be designed as a pressure-stabilized hydraulic bearing,
   - the movement of the cross slide must be controlled using a laser interferometer sensor signal,
   - The lathe machine must be equipped with pneumatic vibration isolation from the environment.
   - DX 101 diamond must be used as the material for the machining tool

3. **Thesis:** Human color perception errors can be corrected using the following procedure:
   - One of the known procedures must be used to diagnose the extent to which the sensitivity functions of the deuteros or protos receptors in the eye have shifted along the wavelength axis.
   - The shifted sensitivity function must be divided by the corresponding sensitivity function of a normal eye, and the result must be normalized to a maximum value of 1 in the wavelength range of 380-780 nanometers.
   - A color filter must be made whose transmission function is the normalized function obtained in this way.
   - The color filter thus produced must be used as eyeglasses and placed in front of the color-blind eye, so that its transmission function is multiplied by the spectrum of the incoming light and the defective receptor perceives the modified spectrum.

4. **Thesis:** In cylindrical and conical worm drives, the worm gear and the worm must form a conjugate surface pair within the limits set by manufacturing tolerances.

5. **Thesis:** The chloride ion concentration in the water of the steam generator must be kept below 10 μg/kg so that it does not reach 105 μg/kg locally.

6. **Thesis:** Assuming a constant insertion speed, the autocorrelation function of the cutting force components and cutting power $R_{xx}(t,\tau)$ at any given time t is:

$$R_{xx}(t,\tau) = \sigma^2(t) \cdot e^{-\alpha(t)\tau} + C$$

, where t (s) is the time examined , τ (s) is the delay time ,
σ is the standard deviation, α (1/s) is the correlation parameter, C is the square of the time-averaged value of the probability variable $x(t)$ under investigation.

7. **Thesis:** With ATIG welding, a 2.5-3 times deeper penetration can be achieved above a welding current of 40 A than with pure argon shielding gas TIG welding, and nearly twice as deep as with 70% Ar + 30% He shielding gas TIG welding, given the same sheet thickness and welding parameters.

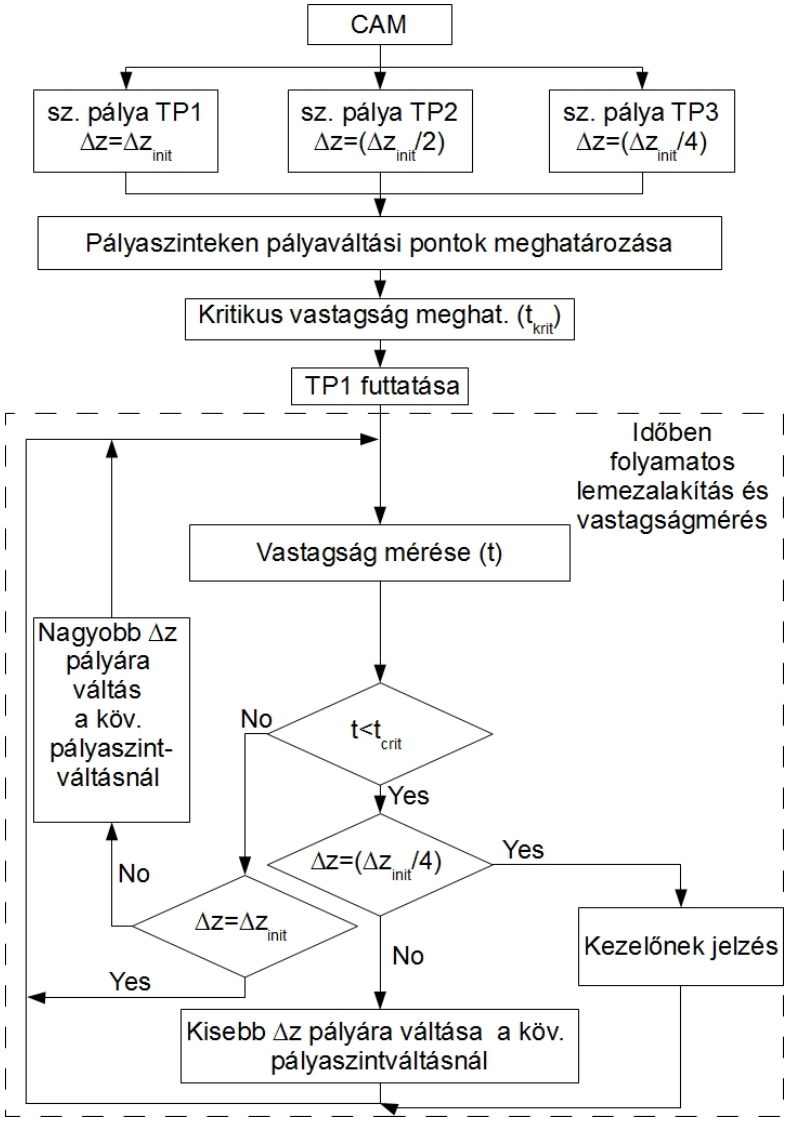
8. **Thesis:** In the case of sheet-organized holographic data storage, the security level of encryption achievable using a phase-encoded reference wave is limited: the number of independent code words is 2^{20} .

9. **Thesis**: The actual thermal resistance and real thermal impedance of high-power, high-energy-conversion-efficiency light-emitting diodes and real thermal impedance of high-power light-emitting diodes with high energy conversion efficiency can only be correctly determined using the so-called electrical measurement method commonly used in industry if the total radiated light output of the light-emitting diode is also measured simultaneously with this measurement and taken into account when calculating the thermal resistance and thermal impedance.

10. **Thesis**: A straight pipe section with a length of ten diameters is sufficient for the formation of a parabolic velocity distribution into a Womersley velocity profile and thus for the formation of a submerged velocity field.

11. **Thesis:** The warping that occurs along the sides of injection-molded products can be approximated well with a third-degree curve with a correlation coefficient of 0.99.

12. **Thesis:** Single-point incremental sheet metal forming can be achieved by combining pre-calculated tool paths with different feed rates, and tearing following contraction can be prevented up to the formability limit by applying the path control described in the block diagram below:



where ……..

13. Thesis. Realistic solutions tend towards the ideal solution state as the temperature increases. It follows that the most commonly used linear equation (1), which contradicts this principle, must be rejected and replaced with the exponential equation (2), which is consistent with it:

$$G^E = a + b \cdot T \tag{1}$$

$$G^E = c \cdot \exp(\quad T - / \tau), \tag{2}$$

where G^E (J/mol) is the excess Gibbs energy,

a (J/mol),

b (J/molK),

c (J/mol) and

τ (K) are semi-empirical parameters, T (K) is the absolute temperature.

14. Thesis. The chemical potential (partial Gibbs energy) of components dissolved in nanoscale phases is proportional not to the curvature of the phase, but to its specific surface area, according to the following equation:

$$G_i = G_i^o + A_{sp} \cdot V_m \cdot \sigma \quad ,$$

where G_i (J/mol) is the chemical potential of component i in a solution,
G_i^o (J/mol) is the chemical potential of component i in a single-component solution of the same composition,
A_{sp}(1/m) is the specific surface area of the phase (the ratio of its surface area to its volume), V_m(m^3/mol) is the molar volume of the phase,
σ (J/m^2) is the interfacial energy between the phase and its environment.

Thesis formulations to be avoided

1. Thesis: I have established a system theory decision scheme aimed at optimizing the operation of existing ground probe electric compressor-driven heat pump heating systems.
(The decision scheme should have been included here!)

2. Thesis: I compiled the input and output variables and decision variables of the decision model. I used the dynamic programming method for optimization. To do this, I set up recursive function equations expressing the optimization of each decision level.
(The function equations should have been included here!)

3. Thesis: I developed a procedure suitable for evaluating fault diagnosis tasks, which separately evaluates the efficiency of fault detection and the performance of fault magnitude estimation.
(The procedure itself should have been described here!)

4. Thesis: I systematized the development process of hand tools and presented the process steps and their objectives in a novel way. I summarized the new development tools currently in use for hand tools in a systematic and applicable description in the correct order.
(The focus should be on the scientific results, not the work performed!)

5. Thesis: In the case of the axisymmetric stability task of a perforated circular plate reinforced on both sides (on one side) with a circular shell at the edge, I examined the effect of the change in the inner edge radius on different support cases using numerical examples.
(I should have written down what I found!)

6. **Thesis:** My measurement results and theoretical considerations support the assumption that the AKOT technique is a suitable method for measuring the mechanical impedance of acinus-sized lung areas. No other method has previously been able to achieve this level of spatial resolution. Compared to the most sophisticated measurement technique known (retrograde catheterization), which has a lower diameter limit of 2 mm, the AKOT procedure operated by the algorithm I developed is able to penetrate 10 airway generations further toward the terminal bronchioles.
(This is not the place to praise the results!)

7. **Thesis:** I determined a machine-specific empirical correlation between the technological data and cutting efficiency for the machined materials examined.
(The correlation should also have been reported.)

8. **Thesis:** The results of plastic forming experiments performed on 0.6 mm aluminum (A1 1050) sheets confirm that ... the formation of a rim with a depth of nearly 20 mm ... *(The generalization based on the specific case is missing!)*

9. **Thesis:** Localized heating-assisted single-point incremental sheet metal forming in the case of thermoplastic polymers was achieved using a clamp that could be mounted on the processing machine and a device (hot air blower) that could be attached to the clamp to convey hot air, which heated the opposite side of the sheet. * (Density: 0.947 g/cm^3 , Melting temperature range start: 126°C-130°C, Flexural modulus 900 MPa, Hardness: ShoreD64). The experimental equipment can also be replaced by two robots/machine tools, which are controlled synchronously and where one device moves the device that transmits the hot air flow.
(This is a description of a specific experiment, lacking scientific claims!)

10. **Thesis:** Introducing and interpreting two related versions of the technology graph, the state change graph and the transition graph, I developed a two-step optimization method for determining the best machining sequence for stepwise technological processes, building on the work of Mátyás Horváth. The two steps are necessary due to the decomposition of large-scale real-world tasks and are based on heuristic considerations. The essence of the method is as follows: at the first level, we select the clearly necessary and operationally optimal machining operations for each technologically independent surface group and each surface, and then at the second level, we arrange them in such a way that the sum of the so-called transition costs is minimized. The resulting sum of the costs incurred is close to the theoretical optimum. From an operations research perspective, the first solution step, which can be formulated using the state change graph, leads to the shortest path problem, while the second step, which can be formulated using the transition graph, leads to the traveling salesman problem with strict precedence conditions. I developed a precise mathematical model for both levels and provided a technological interpretation of them. I developed the solution method in collaboration with László Eszes. A very fast, interactive computer program was developed for the procedure.
(It is unclear what he wants to have accepted as a scientific result!)