

Guidelines for MSc projects at Automatic Control KTH

Formal Requirements

A master thesis project (exjobb) is an independent investigation or a design work dealing with engineering scientific problems. The work has to be a direct application of the knowledge and skills assimilated by the master student during his/her engineering studies and be oriented toward the area defined by the specialization block chosen by the student. The level of difficulty of the master thesis work should satisfy the normal requirements of a master of science in engineering (civilingenjör). A Master thesis project should deal with direct applications of the latest developments within the area. It has to contain a certain novelty with a reasonable amount of literature study, appropriate models and assumptions, methods to be used, own analysis, and/or systematic problem solving. Straightforward design or measurements performed according to some given specifications, simple modifications of existing designs and programs or pure summary of earlier work does not meet the requirements of a master thesis (exjobb) at the master of Engineering (civilingenjör) level.

The master thesis project should also give the student skills in how to independently structure, plan, and carry out a large project. A special emphasis is put on the establishment and follow up of the thesis work as well as its time plan.

The oral presentation of the results and the written report play a central role in the master thesis work. The organization of the written report should follow the structure of the technical and scientific publications usually used in the actual area covering the thesis work. The master thesis report is usually written in English.

The master thesis work is an individual work. The work load of a master thesis project should correspond to one period fulltime.

The examiner evaluates the thesis work and makes a decision on whether the master student has fulfilled all the necessary scientific requirements. To be able to start a master thesis, the student should accumulate at least 60 credits at the master level, 240 credits if you are a *Civilingenjör* student.

1. Examination and Requirements

The following four elements has to be carried out in an adequate manner. The Examiner evaluates each element and assigns a grade of "pass" or "fail" to each of the elements. In the case of grade "fail" in a given element, the student will be given an opportunity to do corrections if the element is a written document or the possibility of a new oral presentation if the element is an oral examination.

1.1. Written Report

The written presentation of the results as well as the oral presentation play an important role in a master thesis project. The written report has to fulfill the structure, of technical/scientific reports and articles, used in the respective area. In the evaluation,

requirements are set on the pedagogical presentation, the content as well as the language quality.

1.2. Oral Presentation

The thesis work has to be presented and defended in a public seminar at KTH. This presentation should, in principle, also be subject to the same criteria as the written report. The oral presentation will be evaluated and graded by the Examiner or the person replacing him. If the presentation is judged unsatisfactory by the Examiner, the student will be invited to redo the oral presentation of the thesis in a new occasion.

1.3. Opposition

To widen the student knowledge and give additional training in oral and written presentation, he/she should critically review another master thesis project ('`Opposition``'). The opposition consists of two parts: A written opposition report ('`Review Report``') and an oral account of the opposition. The latter occurs directly after the oral presentation of the evaluated master thesis. In this part, the opponent gives a short oral review of the thesis work just presented and then leads a constructive technical discussion with the author. The review and the discussion with the author should clearly show that the opponent read the report and familiarized him/her-self with the content of the thesis report. The opposition is evaluated and graded by the examiner or the person replacing him/her. If the opposition is judged unsatisfactory by the examiner, the student will be asked to redo the opposition report and/or be ready for a new oral opposition.

1.4. Attending Other Oral Presentations

Besides his/her own presentation and opposition, the master student should attend at least two other master thesis presentations. This can even be done in other departments. It is the obligation of the student to bring a written certificate, from the Examiner of that master thesis, showing that he/she has attended.

2. Examiner and Advisor

The department appoints an examiner for each master thesis project before it can start. The examiner has to be employed by the department and should have significant experience in research and research advising.

The examiner can, if he/she wishes, appoint an advisor from the department to answer to the guidance needed by the student under the duration of the master thesis work. Thesis work performed outside KTH has also an advisor appointed from the company or the external university where the thesis work takes place. Note that, even in this case, an advisor from the department is usually also appointed. The examiner makes sure, in the latter case, that the student gets advising of at least the same quality as that of a master thesis carried out within the department.

3. Confidential Master Thesis Projects

The following policies apply for master thesis projects carried out within the industry and Dep of Automatic Control:

- Once graded, the final report of the master thesis becomes a public document (grading date).
- Other documentation and information that, under the progress of the thesis work, have reached Dep of Automatic Control can, if the company wishes, be treated as confidential.

A good advice in cases where one suspects that one will be forced to hold certain parts of the thesis work secret, is to try in the very beginning of the thesis work, to identify and explain which parts that possibly will be confidential. Such material has to be removed from the main work and can be reported in a separate report or in an Appendix that exists only in the company version of the report. Note that the discussion in the final report should not be dependent on such an appendix. To solve this problem, it is often suitable to study a more general case in the report and leave that specific analysis (that includes all parameters and sensitive data) that may affect the company products. The evaluation of the report and project is only based on the public part of the thesis.

In the case of a patent application, it is important to start the process as soon as possible to make sure that the registration is complete early and allow the final oral presentation of the thesis work to take place in time.

4. A Possible Thesis Work Routine

4.1. Problem Definition (before thesis start)

The student finds a suitable and interesting problem. This can be own proposal, a proposal from the department, from a company, or an external university. As a starting point for further discussions, a short preliminary problem definition should be written (max 1 A4).

4.2. Preliminary Discussions (before thesis start)

The student then contacts examiner(s) from the research group (usually the problem definition defines which group from the department you should contact). The student discusses the thesis work and the problem definition with the potential examiner before the start of thesis work. The examiner checks if the proposed problem is suitable as a master thesis and if our department/his research group is the right one to advice/examine this thesis work. If the examiner accepts the master thesis work, he/she assigns an advisor from the department (the examiner can also act as advisor).

4.3. Registration for Master Thesis (before thesis start)

The registration of the master thesis need to be done before the start of the actual thesis work. This is done using the appropriate Registration Form and collecting the necessary signatures; see department home page/Studies.

4.4. Work Plan - Master Thesis Proposal (6-8 weeks after start)

Within 6-8 weeks after the start of the master thesis project, a master thesis proposal should be ready. The plan should contain the following:

- A specific problem definition.
- A description of goal, methods to be used, and limitations.
- A time plan with measurable milestones.
- A proposal for the thesis outline.

The aim of the work plan is to guarantee that the master student understood the problem correctly, that the problem and the proposed methods are carefully specified, and that stopping conditions have been defined to limit the work effort to a reasonable volume with relation to the total duration of the master thesis work. An example on how to organize and plan a master thesis proposal can be found in Appendix A.

The examiner can demand an oral presentation of the work plan in a master thesis proposal seminar. The examiner and the advisor should in that case receive a copy of the master thesis proposal, at latest, **3 working days** before the seminar. The work plan may need some corrections and has to be approved by the examiner and the external advisor if the thesis work is being performed outside KTH (industry or other external university). The thesis advisor at the department is responsible for filing the work plan within his/her research group.

4.5. Follow up Meetings (during thesis work)

During the thesis work the master student holds regular contacts with his advisor at the department. The master student should provide a written progress report at least once a month (email) even when the thesis work is progressing normally. One or more follow up meetings can be held, and if needed (in the case of big changes in the direction of the thesis, time plan, etc.), even the examiner can take part in the meeting. In these meetings, discussions should focus on the progress of the thesis work and the structure of the report. The master student should inform his department advisor of any delays that may affect the completion date of the thesis work. If the completion date needs to be moved forward by more than 2 weeks, the time plan has to be modified accordingly and updated in the master thesis proposal.

4.6. Preliminary Report (2-3 weeks from end)

The master student submits a preliminary version (should contain all essential parts including conclusions) of the final report to his department advisor. The advisor reviews the report and makes a decision on whether the report is suitable for oral presentation. The advisor can ask for changes and revisions in the report (many times) before approving an oral presentation.

4.7. Oral Presentation (1-2 weeks from end)

When the preliminary report is judged by the Examiner/advisor suitable for public presentation, the thesis work will be presented in a public seminar at the department. The aim of this seminar is, apart from practicing oral presentation, to obtain external viewpoints and comments on the thesis content and results. These comments can then be used in revising and improving the written report.

The examiner or the department advisor assesses the thesis work, in terms of level and suitability for oral presentation, and gives his recommendations. Once approved, a time for the final seminar is fixed and the call for seminar can be sent out. The candidate contacts the opponent (proposed by the student, approved by the examiner) and provides him/her with a copy of the preliminary report **at latest one week** before the time of the seminar.

The seminar is performed according to the following template:

- The Examiner (or the one replacing him) takes the role of the chair of the seminar.
- The candidate presents the master thesis work. During the presentation the chair can allow short questions of clarification type but has to keep all detailed discussions until after the presentation.
- After the presentation the chair gives the word to the opponent to give his/her oral review of the thesis. The opponent should discuss the report (structure and technical content) and the oral presentation.
- The chair gives the word to the audience for questions and comments.
- The chair closes the seminar.

The seminar should not be longer than 30 minutes. The examiner assesses (and grades) the oral presentation. The grade given to the presentation is a grade of pass or fail. In the case of a grade of fail, the candidate should prepare for a new oral presentation that should be held after all corrections have been provided.

4.8. Opposition

The opponent should familiarize him/her-self with the material and participates in the oral presentation (seminar). The opposition consists of two parts:

1. Opposition report(review): should cover at least the following points:
 - Organization and structure of the report (aim, goal, models, methods, results, conclusions, etc...)
 - Consideration of previous work in the report (literature review).
 - Used methods.
 - Relevance and importance of conclusions drawn in the report.

- The language and graphical presentation of the results.

The opposition report should not exceed more than 2 A4-pages. Detailed linguistic, simple formula errors or typos should not be included in the report but can be appended separately in a form of "List of Typos". The opposition report has to be handed to the examiner at least one day before the seminar.

2. Oral opposition at the seminar After the oral presentation of the candidate the opponent makes a short oral presentation summarizing his/her review. The opponent then asks questions and leads a constructive technical discussion with the candidate around the methods used, the purpose, results, and conclusions in the presented thesis work.

It has to be clear from the review and the discussion that the opponent has understood the thesis work, its goal and results. An opposition based only on identifying "typos", errors in mathematical expressions, or viewpoints on the shape of graphical presentations is not considered satisfactory. The examiner assesses (and grades) the opposition effort. The opposition is given a grade of pass or fail.

In the case of fail, the opponent either submits a revised version of the opposition report or, if the opposition was very weak, submits a new opposition report on another master thesis work. In the latter, the report should be submitted before the oral presentation of the other master thesis has taken place. It is the duty of the opponent to suggest the new master thesis for the new opposition.

The opposition can even be done in another department. In that case, it is the duty of the master student to bring a written certificate, from the examiner of the reviewed master thesis work, indicating the approval of the opposition.

4.9. The Final Report

The master student takes the opponent comments and all other comments (from examiner, advisor, audience of the presentation) and makes the necessary corrections in the report. He/she then submits a final version of the report for approval together with a point-by-point reply to all the comments raised by the opponent during the seminar. Once approved, the thesis report is filed in the examination part of the research group.

4.10. The Final Grade

The final grade is reported when the seminar, the opposition, the final report, and attending of other seminars have been approved by the examiner.