Graduation Guide 2015-2016
MSc program Systems and Control
Track Control Engineering in MSc program ME

September 2015

Relevant contacts within DCSC

- MSc coordinator: Ton van den Boom
- DCSC education coordinator: Ton van den Boom
- Assistant education coordinator: Marieke Versloot
- Administrative support: Heleen Sakkee and/or Kitty Dukker
- Planning of colloquia: Heleen Sakkee
- Planning of MSc workshops: Heleen Sakkee
- Head of educational committee: Bart De Schutter
- DCSC member of board of examiners: Tamas Kevicky
- DCSC management: Hans Hellendoorn

Detailed contact information can be found on the DCSC website\textsuperscript{1}.

This document supplements the official study guides\textsuperscript{2} of the MSc program Systems and Control and the track Control Engineering within the MSc Mechanical Engineering and the Teaching and Examination Regulations\textsuperscript{3}.

\textsuperscript{1}See http://www.dcsc.tudelft.nl

\textsuperscript{2}See www.studiegids.tudelft.nl

\textsuperscript{3}See http://studenten.tudelft.nl/informatie/faculteitspecifiek/3me/onderwijsinformatie-3me/organisatie/regelingen-reglementen/
1 Introduction

While the first year of the MSc program consists primarily of course work, the second year mainly consists of project work. There are two options for the second year, either with or without an internship:

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without internship</td>
<td>With internship</td>
</tr>
<tr>
<td>Literature survey</td>
<td>Literature survey</td>
</tr>
<tr>
<td>MSc thesis project</td>
<td>MSc thesis project</td>
</tr>
<tr>
<td></td>
<td>Internship</td>
</tr>
</tbody>
</table>

The literature study and MSc thesis project together are your graduation project. Sometimes an internship is combined with the graduation project, but in most cases the internship is not related to the graduation project.

In the following sections we discuss all important issues with respect to the graduation project (Section 2) and the internship (Section 3). Further we will give some guidelines for conducting a literature search (Section 4).

2 Graduation project

2.1 Choosing a graduation project

You may only start with your graduation project once you have finished all the course work.

Choosing a graduation project is a very important decision to make, and you should begin thinking about it at least two months before finishing the last courses. Please note that the initiative for finding a suitable project rests with you.

It is recommended to closely coordinate the choice of elective courses with the subject of the intended MSc project direction, with the support of the MSc coordinator. You have three options for your choice:

a) MSc projects within ongoing research activities of DCSC. Any scientific staff member of DCSC can formulate and supervise specific MSc projects and will then act as the MSc thesis advisor. A list of possible MSc project descriptions is advertised on the internet, but it is as well possible to formulate individual projects that are not publicly announced.

b) MSc projects in collaboration with any of the groups at Delft University of Technology that are affiliated with the MSc program of DCSC.  

---

4 Affiliated groups: Biomechanical Engineering (3mE), Precision and Microsystems Engineering (3mE), Mathematische Fysica (EWI), Control & Simulation/Control & Operations (AE), Product and Process Engineering (AS), Bioprocess Engineering (AS), Transport & Planning (CiTG).
c) MSc projects that are completed under the supervision of DCSC either at national or international universities, research institutions, or research departments of industry.

Projects in b) or c) can either be chosen within existing activities or they can be formulated on an individual basis. The scope is in no way restricted as long as there is a strong component related to theoretical or practical aspects of systems and control. At least one member of DCSC’s scientific staff has to act as a supervisor such that the course of the project complies with the scientific standards of DCSC.

In order to make up your mind, the most important advice is to talk to the scientific staff of DCSC about the different variants and possibilities. You might follow the subsequent procedure:

- In order to learn about possible directions, consult the list of currently offered DCSC "thesis subjects"\(^5\). However, please note that projects can as well be formulated on an individual basis, as long as there is a strong component related to theoretical or practical aspects of systems and control. The formal requirements are found in the appendix.

- Make an appointment with one of the scientific staff members with activities of your interest for a concrete discussion and evaluation of the various possibilities for graduation within DCSC.

- Talk to current PhD students who are doing research on topics that you find interesting, and explicitly inquire about concrete projects that are suitable for graduation. Even if there is no match with your concrete interests, it is useful for you to orient yourself in a somewhat broader perspective, and PhD students are happy to refer you to their colleagues.

- If you are interested in completing your project with any of the affiliated groups at Delft University of Technology, or with any other research department of national or international universities or industry, it is as well advisable to consult with any of the staff members of DCSC for further information on existing contacts. Again there is typically quite some flexibility in formulating a project, with formal requirements to be found in the appendix.

- After having gathered sufficient information you need to choose a specific graduation project. You take the full responsibility for this choice, and no one can and will make the decision for you. After you have arrived at a concrete decision, you need to follow the procedure as described in the appendix in order to formally initialize the project. It is particularly important to carefully discuss the assignment with your MSc thesis advisor, and to make a global planning for the final graduation year.

Please note that there are some differences between performing a graduation project at the university or at a company.

\(^5\)See [http://www.dcsc.tudelft.nl/education/msc_program/systems_and_control/msc_thesis_topics.html](http://www.dcsc.tudelft.nl/education/msc_program/systems_and_control/msc_thesis_topics.html)
At the university, the emphasis is on research in a particular theoretical theme and on trying to validate theory on experimental setups. The main challenges are to develop your theoretical knowledge of a research area, and to perform your own experiments. The open academic environment of a university offers the unique opportunity to request the help of PhD students and staff members with very diverse backgrounds.

In industry, the emphasis is often laid on making current theoretical knowledge work on concrete (experimental) applications. As the main challenge, one has to convince partners in an industrial environment about the advantages of using advanced control concepts. Although completing a project with a company might offer the chance to work in a unique high-tech environment, it could come at the expense of encountering less support and of having to fight for achieving the necessary theoretical depth.

**Remark:** Note that the project description of an MSc thesis in industry must always be approved by one of the staff members of DCSC, who will act as a contact person with the industrial partner. If you want to do your final MSc project in industry there are two options:

a) You find your project via one of the staff members.

b) If you already have contact with industry and you have a possible project, it is necessary to find an staff member who approves the project description and wants to act as a contact person.

### 2.2 Initializing an MSc Project

The management of DCSC takes the responsibility that every MSc project fits both in view of quality and contents with the overall scientific mission of DCSC. The MSc thesis advisor is accountable for managing the process of the MSc project. In order to fix the rights and duties of MSc thesis advisor and MSc student, any MSc project has to be initialized by a written Graduation agreement which comprises details concerning the following issues:

- Full (working) title of MSc project.
- Names of MSc student and of the members of a supervisory committee, consisting of the MSc thesis advisor and the staff member who will act as the chairman of the examining committee.
- Listing of required facilities (workplace, computer infrastructure, laboratory equipment) to conclude the MSc project. Explicit budgeting is mandatory if supporting personnel, new equipment, or extra material is required.
- Agreement on distribution of output points in case of involvement of affiliated partners within Delft University of Technology.

---

6[http://www.dcsc.tudelft.nl/education/links_forms_guides.html](http://www.dcsc.tudelft.nl/education/links_forms_guides.html)
• Arrangements about the project work if the MSc project is conducted outside the university (abroad or in industry).

The agreement has to be signed by the MSc thesis advisor and by the MSc student.

2.3 Planning

Ideally, you should spend about three months on the literature survey and about eight months on the subsequent thesis work. It is your own responsibility to keep this timeframe in mind - no one will do it for you! You are allowed to spend more time on your graduation project, but only do so if there is a real must. It is hence important to finish your research, and here in particular experiments, in due time in order to leave sufficient time for writing an adequate MSc thesis.

The time spent on the project will be taken into account in the final grading process.

2.4 Preparation of MSc Thesis Project

Typically, in the initial phase the MSc project involves a literature assignment whose purpose is to get acquainted with the scientific publications within the realm of the MSc thesis project, and to prepare for the specific topics to be investigated.

You will need to search for recent publications (i.e. articles, theses, books) that are relevant for your particular thesis project. It is important to be very careful in judging the literature, since not everything written even in high-standard journals is useful - or even correct. In other words, you should be very critical and selective of which publications you use, and you should try to fully understand those that are relevant. See also Section 4 for guidelines to perform literature searches.

Moreover, you need to identify the current issues in your research area in order to avoid that you perform research on questions that have already been resolved in the literature. Once you have made some well-motivated choices as to what you plan to investigate, you summarize them in a report. This will then form the basis for your subsequent MSc project work.

Once finished, the literature assignment should be handed in to your MSc thesis advisor. At the end of the literature assignment period you have to orally report on the findings of the assignment. Once you have submitted the final copy of your literature assignment, you give a formal 20-25 minutes MSc literature colloquium as further explained in the section “Project work” (see Section 2.6).

2.5 Carrying out the MSc project

The MSc thesis work is the final assignment in the MSc program, during which you either further develop the theoretical knowledge gained in your literature assignment, or you apply it in the form of computer simulations or in the form of experiments (depending on
the chosen project). The thesis work differs from the rest of your study in that you are expected to already be able to perform research at the level of an engineer with an MSc degree. It is therefore important not to require too much assistance - after all, you should be able to work on your own!

In completing your project, it is relevant to achieve both a certain theoretical depth as well as some originality. As mentioned in the section on the literature study, you should not duplicate research that has already been done.

In this phase you also have to orally report on the progress of your project. During the monthly “MSc workshop” (werkbespreking) you have the opportunity to report on sub-topics of your project in informal ten minutes presentations, in particular in order to receive feedback on your work from colleagues. You will as well need to give a formal MSc colloquium presentation at the end of the eight months thesis-work period, as further detailed in Section 2.6.

The results of your research should be reported in a MSc thesis. This report forms the basis for the final examination during which you must defend your work in front of the examining committee - see the Section 2.8 on the final examination for more details.

2.6 Project work

The project work of the graduation project consists of two informal ten-minutes presentations during the monthly “MSc workshop” (werkbesprekingen) and two formal MSc colloquium presentations (literature and final colloquium), and are coordinated by Heleen Sakkee. Please consult the information on the DCSC website\(^7\) to learn more about the details about how to organize your presentations. You will receive a grade for each MSc colloquium. It is advisable to download the corresponding evaluation form from the DCSC website\(^8\) in order to get an idea about how your talk is judged. Moreover, it is as well recommended to first practice each colloquium with your supervisors and/or fellow students.

The goal of an MSc colloquium is to present your research topic, goals and progress in about 20-25 minutes. You should always clearly state what your research problem is, why it is relevant, what your research strategy is, and what your (current) conclusions are. Your target audience includes fellow MSc and PhD students. In other words, your presentation should be at the level of an engineer with an MSc degree. Even though your family and friends are welcome at any colloquium, the presentations should be aimed solely at your colleagues.

The literature colloquium should be held shortly after finishing your literature assignment. You present the current issues of your research area as you have explored them in the literature. You are strongly encouraged to make critical selections since the scientific literature is, in many cases, not only debatable but might even contain inconsistencies or plain mistakes.

The final colloquium will be held just before your final examination, during which you

\(^7\)See http://www.dcsc.tudelft.nl/education/msc_program/systems_and_control/colloquia_workshops.html
\(^8\)See http://www.dcsc.tudelft.nl/education/links_forms_guides.html
will present the main results of your work. Again, in particular for this presentation you should bear in mind that your target audience consists of your colleagues and the examining committee!

A “MSc workshop” (werkbespreking) is a DCSC meeting of MSc students, PhD students and staff members, typically held every last Friday of the month. During such a meeting, about number of students each give a small presentation about their graduation project, followed by an extensive discussion. These presentations have an informal character, and are aimed at sharing your current research problems so that you can subsequently discuss them with your colleagues. Look at them as an exercise to adequately disclose the latest developments, with only little preparation. Moreover, you might provide a good opportunity to receive useful feedback from your fellow students, PhD students or from staff members. During your final year, you are obliged to attend at least seven of these meetings, and to give presentations during two of them (typically one in the preparation phase and one in the thesis work period). The workshop coordinator Heleen Sakkee schedules the dates of the meetings.

It is compulsory for you to attend at least 15 colloquia (literature or final colloquia) and 7 MSc workshops. If a student will carry out the final MSc thesis project outside Delft (in industry, research institute, or abroad) and it is not possible to attend a sufficient number of colloquia or MSc workshops, the Msc advisor at DCSC will decide how the project work can be carried out at the MSc working place.

2.7 Reports

At the beginning of your final year you are expected to be able to write a decent report. Both your literature assignment and your final MSc thesis are completed under your full responsibility. However, it is strongly advisable to discuss a draft copy with your MSc thesis advisor in order to receive feedback for improvements, and to take the corresponding comments seriously. It is required to hand in the final version of your literature study at an early stage such that you can benefit from possible critical comments for the preparation of the final MSc thesis.

Although the size of your report (number of pages) is not really rigidly fixed, it should be as concise as possible, without risking any danger of leaving out essentials or becoming unclear. Confine the main text of the report to the really relevant aspects of your research, and put possible side aspects in appendices.

In the final stage the MSc student has to write an MSc thesis that provides a concise description of the MSc project and the achieved results. The main text should comprise not more than approximately 60-80 pages, and it should comply with usual scientific standards concerning correctness, accuracy, readability, and literature referencing.

The MSc thesis should be fully completed at least two weeks before the final examination takes place. Hard-copies of the main text have to be made available to the examining committee.

For archival purposes within DCSC, an electronic version (pdf) of the main text and relevant appendices (in particular software that has been developed within the project) should be collected onto one well-documented CD-Rom or DVD.
2.7.1 Referencing and source quotation

Do not run the risk of being accused of plagiarism!\(^9\)

Using extracts from others texts without correctly quoting the source in texts and bibliographies is plagiarism. Plagiarism is a form of cheating and is not tolerated in an academic environment. Anything which applies to written text also applies to ideas, diagrams, figures and other data. It is irrelevant whether their incorrect use is due to negligence or a deliberate attempt to cheat: negligence conflicts with the expectations of an academic course to the extent that the question of whether the plagiarism is deliberate or accidental is not really an issue.

Also if you refer to extracts from text you have written yourself, for example in a paper for another course or project, you have to quote the source correctly.

See also:

- http://www.plagiarism.org/

2.8 Final examination

Once you have handed in the final version of your thesis, you can start up the administrative procedure for the final examinations (see Section 2.9). This includes choosing a date for the final exam, which happens of course in close consultation with your MSc thesis advisor and the members of the examining committee. Note that there has to be at least a period of two weeks between the submission of the report and the date of the final exam.

The final examination consists of a one hour interrogation of the MSc student by the examining committee. During this examination, your graduation work and your personal qualities as an engineer will be scrutinized. The oral examination lasts one hour and is taken by the examining committee. The examining committee is chaired by a DCSC staff member. Once you have completed the exam, you will receive grades for your theoretical skills, for your practical competence, for the quality of your MSc thesis, for how you managed to defend yourself during the examination, and for your final MSc colloquium. You will receive a final final grade, which is not necessarily an average of the individual marks.

Once you have passed the examination, both you and your examining committee will sign your MSc diploma. With the signature of the degree certificate by all members of the examining committee and by the MSc student the MSc degree is formally awarded. The MSc diploma can be taken home immediately!

Many students like to invite their family and friends for their final MSc colloquium, even though they will probably not understand the topics very well. Still it is essential to

\(^9\)The text in this section is based on the website: http://studenten.tudelft.nl/index.php?id=69444&L=1
remember that the colloquium should be aimed at fellow MSc students. Moreover you should stay concentrated for the final examination right after your presentation. Although the final examination is not public, it is possible to let family and friends be present after the examination when the signatures are put on the diploma.

**Cum Laude**

If approved by the board of examiners, the examining committee votes about the designation “cum laude” which is granted in case of unanimous consent.

Marks and designations “cum laude” will be registered within DCSC in order to monitor excessive evaluations and to enable comparison with other MSc programs. DCSC strives for awarding the distinction “cum laude” to about 5% of the MSc student population.

2.9 **Administration**

For administrative support, such as concerning your registration at DCSC or the procedure around completing your MSc project, please consult Heleen Sakkee and/or Kitty Dukker. For your convenience you will receive a checklist which comprises all relevant procedural steps that need to be followed.
3 Internship

An internship is a structured academic opportunity that allows students to apply academic skills and knowledge in the work place. Experiential education that is based on a set of learning objectives helps students to prepare to meet career responsibilities after graduation. An internship is performed in industry or at a research institute for a period of 2.5 - 3 months, either inside or outside the Netherlands.

This internship is optional and has to be chosen with the approval of your MSc thesis advisor.

Course codes:

SCP4520-11 Internship Systems and Control  15 EC
ME2200-15 Internship Control Engineering  15 EC

In most of the cases, the students approach companies on their own (ONLY after gaining permission from your MSc thesis advisor). Always ask if your MSc thesis advisor has assignments available. The MSc thesis advisor has to give prior approval for the working period, on basis of a written assignment, which has been communicated with the company. In many cases, students take the opportunity to carry out the assignment in foreign companies or institutes abroad.

Study goals of the internship

- The student has demonstrated his capability, independently and in consultation with specialists, to define, limit, solve and discuss systems and control problems as defined in the internship project description.
- The student has proven to be capable of communicating about his internship research project both through an oral presentation and a report.
- The student has demonstrated his capability to consider and discuss the technological, ethical, and societal impact of his internship work.
- The student has shown his life-long learning competence by investigating the scientific publications related to the problems investigated in his internship thesis and processing this information in his thesis.

Assessment

The internship will be assessed on the report you hand in after returning. The internship will be graded with a pass/fail decision (no grade). Contact your MSc thesis advisor for requirements on the report.
4 Conducting a Literature Search

When you start researching a topic, the first thing you want to know is the state-of-the-art of the topic. So you want to find relevant articles/papers concerning that subject. To be able to find the relevant ones out of the big pile of all existing articles known to mankind, all articles are stored in databases, that can be searched using: keywords, topic, author, etc. Widely–used search databases are: Web of Science [1], and INSPEC [2]. Here, a strategy is explained on how to perform a literature search.

1) The first thing to do is to determine a set of basic keywords related to your topic. Good sources for this are the project description and your supervisor. Asking your supervisor for keywords saves a lot of time and guarantees the input is correct.

Using your keywords, search the database for a review or survey paper that covers your topic. Just enter “review” or “survey” as one of the keywords. A paper like that usually spans a much broader subject than your topic alone. It gives a good insight of how your topic has evolved and how it fits in with others. Furthermore, the paper provides a starting point for a more elaborate search into literature. When you find more than one survey paper, read their abstracts and then decide which one to read carefully.

2) When reading a paper you encounter references. Check/mark the references when they seem interesting or related to your topic. This way the paper guides you to the literature relevant to you. Collect the referenced papers after you are done reading. Be careful, resist the temptation to start reading referenced papers before finishing the section of the paper you were initially reading or you will end up reading an endless number of papers.

Also, search the database for newer articles that refer to the article you are reading. This is called a cited search. Simply click view citations. From the publications you find, determine whether they are relevant by reading the title and the abstract. If it seems relevant, collect it.

When reading papers, try to get as many new keywords concerning your topic and also search the databases using those.

3) From the pile of collected papers, read their abstract and conclusions. The conclusion is usually the last paragraph of the paper and summarizes the published achievements. If these are of interest to you and you want to know more about how it is done, then read the paper carefully and apply step 2 on it to dig deeper.

When you ask your supervisor for keywords, he/she will probably give you a few names of authors that are specialists also. Because the publications of these authors are a valuable source of knowledge, also search the database for their publications.
Hints & Tips:

Journal papers are usually much better written/detailed/thought over than conference papers. So, given the choice, opt for a journal paper describing the same topic as a conference one. Some search engines will allow you to force showing only results from journals.

Always try to organize your reading by relevance. You will never have the time to read all papers that seem interesting on a particular topic. A good search result on a particular research topic is between 10 and 50 papers. This is of course just a rule of thumb, if the topic is highly popular you might get a lot of good results, if unpopular, very few. Of course, if you are looking for a particular paper, a single result is perfectly OK.

You do not need to read all the papers page-by-page. A high-level scan is recommended as a first step, to determine the relevance of the paper. For instance you can read the abstract, intro and conclusions, and scan the technical contents. If the paper is deemed not interesting at this point, just file it somewhere and do not give it more time. You will get better and faster at this as you read more. If you have many search results (say more than 20), it will not be feasible to even do that. What one can do in that case is to open all the PDFs on-screen, scan the abstracts, and do not even save things that do not appear relevant.

Paper search engines:

1) http://ieeexplore.ieee.org/search/advsearch.jsp
2) http://scholar.google.nl/
3) http://link.springer.com/ (computer science papers).
4) http://www.sciencedirect.com/ (this one is very general).
5) http://www.library.tudelft.nl - webspirs multi-database search covers a broad range of publications, yielding books too.
6) http://ovidsp.ovid.com/autologin

Note that you must be connected to a TU Delft network in order to get access to most of these search engines, through the TU Delft license.

More:

For more information on searching literature, see http://www.library.tudelft.nl/en/support/students/teach-yourself/. 
[1] To get to the Web of Science database: Go to a computer that is attached to the TU Delft network. (This is important because a subscription is required). Go to http://www.library.tudelft.nl, under the tab search click on databases, then in the Databases Alphabetical list click on W, from the list click Web of Science.

[2] To get to the INSPEC database: Go to a computer that is attached to the TU Delft network. (This is important because a subscription is required). Go to http://www.library.tudelft.nl, under the tab search click on databases, then in the Databases Alphabetical list click on I, from the list click INSPEC.

[3] See the table of field tags on the webpage for other types and how to use them.

[4] To perform the search, the keywords have to be connected by Booleans (AND, OR, NOT, SAME). This way you can include or exclude certain keywords on order to regulate the number of hits.

[5] Try to google it up (or via Google Scholar) using the provided “Find related information in” a Web Search Engine link. If that is unfruitful, try to locate the personal website of the author at the university where he is active, (Get info from the published record at the database) in most cases it is published there also. (This can be quite a task.)