

Graduation Guide 2020-2021

MSc program Systems and Control

September 2020

Relevant contacts within DCSC

- | | |
|--------------------------------------|---------------------------------|
| • MSc coordinator: | Ton van den Boom |
| • Assistant education coordinator | Marieke Versloot |
| • Administrative support: | Heleen Sakkee |
| • Planning of colloquia: | Heleen Sakkee |
| • Internship coordinator: | Manon Kok |
| • DCSC education coordinator: | Ton van den Boom |
| • Head of educational committee: | Jan-Willem van Wingerden |
| • DCSC member of board of examiners: | Riccardo Ferrari |
| • DCSC management: | Bart De Schutter |

Detailed contact information can be found on the DCSC website¹.

This document supplements the official study guide² of the MSc program Systems and Control and the Teaching and Examination Regulations³

¹See <http://www.dcsc.tudelft.nl>

²See www.studiegids.tudelft.nl

³See <https://www.tudelft.nl/en/student/faculties/3me-student-portal/education/related/regulations/>

1 Introduction

The MSc program in Systems and Control consists of two years. The first semester of the first year of the MSc program consists of obligatory courses, the second semester of the first year of the MSc program consists of elective courses. The first quarter of the second year the student will perform the integration project and has the choice between following 10 EC additional elective courses or perform a research project (10 EC). The rest of the second year will consist of the Literature survey (10 EC) and the MSc thesis project (35 EC). The literature study, the optional research project, and the MSc thesis project together are your graduation project. For students who started before August 31, 2020 the second year will consist of the Literature survey (15 EC) and the MSc thesis project(45 EC).

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

You may only start with your graduation project once you have finished all your obligatory courses and most of your elective courses. 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 assigned MSc thesis supervisor.

2.1 Initializing an MSc Project

DCSC handles a procedure to spread the students among the different sections. Starting from September 2019 this procedure consists of the following steps:

- a) In order to inform the students about possible topics the DCSC final thesis market will be organized in the White Week (lecture-free week) at the end of the first quarter. During this market the staff-members present their projects.
- b) In the second quarter of the academic year students will receive a form by e-mail, on which they fill out a top five with their favourite staff-members (of at least two different sections) before the given deadline.
- c) A division will be organised based on the top five of the students. The students will be informed to which staff-member they are assigned within two weeks. With this information they can make a selection of the elective courses. From this time the students are under supervision of a staff-member.
- d) The student have to hand in their course list at the secretariat before the end of quarter three.

Note that students who didn't provided their top five in time will be not be assigned to a supervisor so they may not be able to start with their final thesis.

The MSc thesis supervisor is accountable for managing the process of the MSc project. In order to fix the rights and duties of MSc thesis supervisor and MSc student, any MSc project has to be initialized by a written *Master Thesis application form*⁴ which comprises details concerning the following issues:

- Full (working) title of MSc project.
- Project team: Names of MSc student and of the members of a supervisory committee, consisting of the daily supervisor and possible other supervisors.
- Time planning of project: Starting date, planned date of midterm colloquium, planned month of Final examination. Also special arrangements about colloquia will be discussed here.
- 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.

The application form has to be signed by the MSc thesis supervisor and by the MSc student, and handed in at the secretariat.

2.2 Planning

Ideally, you should spend about 7 weeks on the literature survey and about six months on the subsequent thesis work. It is your own responsibility to keep this time-frame in mind - no one will do it for you! 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.

2.3 Research project or additional elective courses

Students can choose to do a short or a long final thesis project.

For a short master thesis project the second year has the following structure:

- 5 EC Integration project (Q1)
- 10 EC Additional electives (Q1)

⁴<https://www.tudelft.nl/en/3me/about/departments/delft-center-for-systems-and-control/education/links-forms-guides/>

- 10 EC Literature study (Q2)
- 35 EC Master thesis project (Q2/Q3/Q4)

For a long master thesis project the second year has the following structure:

- 5 EC Integration project (Q1)
- 10 EC Research project (Q1)
- 10 EC Literature study (Q2)
- 35 EC Master thesis project (Q2/Q3/Q4)

In case of a long master thesis project the Research project will be related to the final thesis project. In practice there is no problem in swapping the research project and literature study (so literature study in Q1 and research project in Q2). There will be separate grades for the research project and the master thesis project.

2.4 Preparation of MSc Thesis Project

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 supervisor.

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!

Half-way your final thesis project you will have to orally report on the first part of your project during your mid-term colloquium. This colloquium includes the literature study and the first results of your research. see the Section 2.7.

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.

Your daily supervisor may regularly organize “MSc workshops” (werkbespreking) in which you have the opportunity to orally report on sub-topics of your project in informal ten minutes presentations, in particular in order to receive feedback on your work from colleagues.

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 2.9 on the final examination for more details.

2.6 Carrying out the MSc project outside the TU Delft

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

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.

Students who want to do their final thesis work outside the university (in industry, other university, research institute, abroad), can contact their supervisor and discuss with him/her about possible projects. To be allowed to do their final MSc thesis project outside the university they have to satisfy the following condition(s):

- The student must have finished all courses before he/she can start the final MSc thesis project.
- If the student goes to industry he/she needs at least an average grade of 7 for the obligatory courses.

- The student, the company and the Dean of the faculty 3mE sign the *Graduation agreement for thesis project in industry*⁵.

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

- a) You find your project via your assigned DCSC supervisor.
- b) If you already have contact with industry and you have a possible project, it is necessary that your assigned DCSC supervisor approves the project description.

2.7 Colloquia

Students are required to give two formal MSc colloquium presentations, namely a midterm colloquium and a final colloquium, and are coordinated by Heleen Sakkee. Please consult the information on the DCSC website⁶ to learn more about the details about how to organize your presentations. You will receive a grade for each colloquium. It is advisable to download the corresponding evaluation form from the DCSC website⁷ 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 the MSc colloquia 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 midterm colloquium should be held half-way your thesis project. 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. Furthermore, you present your research goals and a plan to achieve them. You could compare it with a presentation for the management of a company, explaining exactly why your research is relevant, and why it should be funded. Particular emphasis should be put on a clear exposition of your research strategy and the possible value of future results. Also elaborate on the chosen research strategy and show the first results of your research at this stage.

The final colloquium will be held just before your final examination, during which you will present the main results of your work. Again, in particular for this presentation

⁵See

<https://www.tudelft.nl/en/3me/about/departments/delft-center-for-systems-and-control/education/links-forms-guides>

⁶See

<https://www.tudelft.nl/en/3me/departments/delft-center-for-systems-and-control/education/colloquia/>

⁷See

<https://www.tudelft.nl/en/3me/departments/delft-center-for-systems-and-control/education/links-forms-guides/>

you should bear in mind that your target audience consists of your colleagues and the examining committee!

It is compulsory for you to attend at least 13 colloquia (midterm or final colloquia). 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, the Msc thesis supervisor at DCSC will decide how the project work can be carried out at the MSc working place.

2.8 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 supervisor 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 handed in.

2.8.1 Referencing and source quotation

Do not run the risk of being accused of plagiarism!¹⁸

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

¹⁸The text in this section is based on the website: <https://www.tudelft.nl/library/actuele-themas/copyright/c/plagiarism/>

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/>

2.9 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 2.10). This includes choosing a date for the final exam, which happens of course in close consultation with your MSc thesis supervisor 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 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.

2.10 Administration

For administrative support, such as concerning your registration at DCSC or the procedure around completing your MSc project, please consult Heleen Sakkee. 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.

SC42115 Internship Systems and Control; 6 EC

An internship is performed in industry or at a research institute for a period of at least one month, either inside or outside the Netherlands. The place in the curriculum is in the first year as a free technical elective course. This internship is optional and has to be chosen with the approval of the internship coordinator (Manon Kok).

Procedure:

- a) Students find an interesting internship proposal.
- b) Intake form to be filled out with the company with
 1. Project description
 2. Proposed approach
 3. Expected outcome
- c) Internship coordinator checks the intake form and, if OK, approves the internship.
- d) At the end of the internship a review form needs to be filled out by the supervisor at the company. The following items have to be addressed:
 1. Did the student meet the learning goals.
 2. Is the supervisor satisfied with the results obtained?
 3. How was the internship process (performance, communication en competence).
- e) If the result is not satisfactory an extra task has to be done. This task decides whether the student will pass or fail.
- f) The Internship coordinator will grade (pass/fail) the internship taking into account
 1. The review form of the supervisor.

2. The quality of the final report.
3. The self-evaluation.

Remark: The 6 ECTS are independent of the duration of the internship, but a minimum duration should be 1 month full time (6 ECTS=168 hours of work)

Study goals of the internship

- The student has demonstrated his/her 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/her internship research project both through an oral presentation and a report.
- The student has demonstrated his/her capability to consider and discuss the technological, ethical, and societal impact of his/her internship work.
- The student has shown his/her life-long learning competence by investigating the scientific publications related to the problems investigated in his/her 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).

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 topic. 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. TU Delft Library has numerous collections of with valuable information for your literature search. If you want to find your way in these collections please use the following link: <https://www.tudelft.nl/en/library/collections/find-your-way-in-our-collections/journal-articles-and-conference-papers/>.

- 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”, “survey”, or “tutorial” 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 ones 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 more recent articles that refer to the article you are reading. This is called a cited search. Simply click "view citations". For the publications you find, determine whether they are relevant by reading the title and the abstract. If it seems relevant, keep it.

When reading papers, try to get a few 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 spend more time on it. You will get better and faster at this as you read more.

More:

For more information how to write a literature review report (or paper), see
<https://repository.tudelft.nl/islandora/object/uuid%3Ab00bf768-26a7-4f7a-8f14-6da7f5ba0691>

Paper search engines:

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

- 1) <https://ieeexplore.ieee.org/search/advanced>
- 2) <https://scholar.google.nl/>
- 3) <https://link.springer.com/> (computer science papers).
- 4) <https://www.sciencedirect.com/> (this one is very general).
- 5) <https://www.tudelft.nl/library/>
- 6) <http://ovidsp.ovid.com/autologin.cgi>

To get to the databases at the TU Delft: Go to a computer that is attached to the TU Delft network. (This is important because a subscription is required). Go to
<https://www.tudelft.nl/en/library/collections/journal-articles-and-conference-papers/>
and choose

- Scopus
- Web of Science
- Google Scholar
- IEEE Explore Digital Library

To perform a search, the keywords can often be connected by Booleans ("AND" if both keywords are necessary, "OR" if only one keyword is necessary, "NOT" if one keyword should not appear). This way you can include or exclude certain keywords on order to regulate the number of hits.