Graduation Guide 2017-2018
MSc program Systems and Control

September 2017

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
- Planning of colloquia: Heleen Sakkee
- Head of educational committee: Bart De Schutter
- DCSC member of board of examiners: Tamas Keviczky
- DCSC management: Hans Hellendoorn

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 http://studenten.tudelft.nl/informatie/faculteits specifiek/3me/onderwijsinformatie-3me/organisatie/regelingen-reglementen/
1 Introduction

The MSc program in Systems and Control consists of two years. While the first year of the MSc program consists primarily of course work, the second year mainly consists of the Literature survey and the MSc thesis project. The literature study and MSc thesis project together are your graduation project. (Students who started before August 31, 2017 can also perform an internship in the second year. For more information, see Section 3 and the the study guide).

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 your 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 MSc coordinator.

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.

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 supervisor. 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

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.

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).
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". 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 supervisor, 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.

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 environment, you should be prepared to handle a different set of challenges. The formal requirements are found in the appendix.
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

Starting from September 1, 2017 DCSC will handle a new procedure to spread the students among the different sections. This procedure consists of the following steps:

a) In order to inform the students about possible topics the DCSC final thesis market will be organised in the White Week (lecture-free week) at the end of October. During this market the staff-members present their projects.

b) In the first quarter of the academic year students will receive a form by e-mail, on which they fill out a top three (or more) with their favourite staff-members before December 1, 2017.

c) A division will be organised based on the top three (or more) of the students. The students will be informed to which staff-member they are assigned before December 10. 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 December 20.

e) In the third quarter students can submit a change request for an alternative supervisor/section if necessary. Switching supervisor/section can only be done if the required staff-member/section has capacity for new students.

f) For students with a Double Degree there will be a separate division.

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 Graduation agreement which comprises details concerning the following issues:

- Full (working) title of MSc project.

http://www.dcsc.tudelft.nl/education/links_forms_guides.html
• Names of MSc student and of the members of a supervisory committee, consisting of the daily supervisor and possible other supervisors.

• 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.

• Arrangements about the project work (MSc colloquia and/or Workshops) if the MSc project is conducted outside the university (abroad or in industry).

The agreement has to be signed by the MSc thesis supervisor 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 time-frame 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 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

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.

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 website\(^7\) to learn more about the details about how to organize your presentations. You will receive a grade for each colloquium. It is advisable

\(^7\)See [http://www.dcsc.tudelft.nl/education/msc_program/systems_and_control/colloquia_workshops.html](http://www.dcsc.tudelft.nl/education/msc_program/systems_and_control/colloquia_workshops.html)
to download the corresponding evaluation form from the DCSC website\textsuperscript{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 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. However, you should avoid to anticipate the final presentation in presenting definitive results already 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 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.

\textsuperscript{8}See http://www.dcsc.tudelft.nl/education/links_forms_guides.html
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.

2.8.1 Referencing and source quotation

Do not run the risk of being accused of plagiarism!

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/

2.9 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 you 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

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9 The text in this section is based on the website: http://studenten.tudelft.nl/index.php?id=69444&L=1
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. Students who started before September 2017 can still combine the graduation project with a 15 EC internship (SC52005). They will have to finish their internship before the September 1, 2018. Students who started in September 2017 or later can do a 6 EC internship (SC42115). This course counts as a free technical elective course in the first year.
Course code: SC52005  Internship Systems and Control (old style)  15 EC
An internship old style 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 supervisor.
In most of the cases, the students approach companies on their own (ONLY after gaining permission from your MSc thesis supervisor). Always ask if your MSc thesis supervisor has assignments available. The MSc thesis supervisor 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.

Course code: SC42115  Internship Systems and Control (new style)  6 EC
An internship new style (starting September 2017) 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 responsible teacher.

Procedure:

a) Students find an interesting internship proposal.

b) Intake form to be filled out by the company with
   1. Project description
   2. Learning goals
   3. Academic challenge

c) Responsible teacher 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 (responsibilities/motivation/creativity).

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 teacher 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.

Remarks:

• 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)
• Students who already started before September 1, 2017 can still do the old style internship (SC52005, 15 ECTS) until August 31, 2018. Students starting after September 1, 2017 can only do the new style internship.
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 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](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/.
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.

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.

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

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

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.)