



# The Master's Thesis Manual

## 1. Background

All students at engineering programs of the University of Gävle have to write a thesis before getting a degree. Depending on the level of ambition of the student and the degree in mind, there are thesis assignments on different levels to be chosen.

One requisite for a *Teknologie masterexamen* (officially translated to M.Sc. degree) is the accomplishment of a thesis assignment on the advanced level in the major subject, further on referred to as Master's thesis or just thesis. The Master's thesis in an engineering subject is normally a 20-week assignment, i.e. 30 ECTS, being recognized as a scientific project of a specific academic discipline, i.e. a major subject such as Electronics. Needless to say, the university presumes that the student possesses enough theoretical knowledge in this subject before starting the thesis assignment.

## 2. What is a Master's thesis?

The aim of the Master's thesis is stated in the corresponding syllabus, which is obtained at the department office. In general, the thesis shall reveal that the student:

- has gained insight into the methodology for planning and performance of a scientific project,
- has the qualification of using knowledge on such a level to carry out a given, scientifically interesting task,
- is able of communicating well in both writing and speech,
- is able to profit by advanced literature in the major subject and to apply results thereof in the thesis work,
- has the skills of documenting the work in a scientifically conventional way.

In order to achieve these goals, scientifically experienced people are assigned to help. Both the examiner and the supervisor are scientifically experienced. In addition, you may have other supervisors. However, it is the scientifically experienced supervisor who will vouch for the fulfillment of the first and the last goals in the list above. Hence, the thesis assignment is

aiming to show that you possess enough proficiency to independently attack an engineering problem of scientific nature in your major subject and to present the results professionally.

### 3. Prerequisites

Before starting the thesis assignment an Application for Master's Thesis must be filled out. The application form is obtained at the program Blackboard site or the faculty office. In the application, the title of the thesis has to be stated; a short description of the task is presented of length equal to a standard-sized page; the supervisor, examiner etc. are named.

The **supervisor** is usually an employee of the company (or university institution) where the assignment is performed. The role of the supervisor is to guide the student as regards the description of the task, the planning of the work, and the choice of the most suitable method for the work, bearing in mind the demands of both the company and ATM/Electronics. It is not at all unusual that the supervisor also is responsible for the original idea of the assignment. The supervisor has to be supportive keeping the student in pace with the time plans of the work.

The **examiner** is appointed by the Head of Research at ATM/Electronics. As a rule, the examiner for a specific thesis usually is the lecturer who is closest related to the topic chosen. The role of the examiner is to guarantee that the thesis meets the quality requirements put up by the university. Thus, approval of the thesis is decided by the examiner only.

Prerequisites of theoretical knowledge have to be fulfilled. The reason for this is self-evident, especially since the thesis assignment is associated with certain degree proficiency. The academic records achieved at the University of Gävle can be ordered from the faculty office, and must be attached to the thesis application.

To be allowed to start a thesis assignment, certain prerequisites have to be fulfilled. One of the alternative rules listed below should apply in all cases.

a) Prerequisites for a thesis assignment for Swedish students following a full program at the University of Gävle leading to a M.Sc. degree (minimum 300 ECTS):

- approved results of at least 120 ECTS in mathematics and major subject,
- approved results of such courses which are of importance for the success of the specific thesis assignment, i.e. advanced-level courses in the major subject.

b) Prerequisites for international students or Swedish students holding a B.Sc. degree in a relevant major subject:

- approved results of program courses of at least 60 ECTS
- approved results of such courses on the Master's program which are of importance for the success of the specific thesis assignment, i.e. advanced-level courses in the major subject.

## 4. Formalities associated with the presentation of the thesis

The thesis is presented in a seminar at the University of Gävle. For further information, see “Guide for presentation of thesis work in Electronics” found at the program Blackboard site.

In order to get the thesis assignment approved by the examiner and marked with Grade A - E, the following things have to be accomplished:

- satisfactory oral presentation
- approved thesis
- approved opposition of a fellow student's thesis in public
- participation in at least two other thesis presentations.

Opportunities for thesis seminars are given at certain dates several times each year. These occasions are announced by the faculty office. The choice of seminar date should be given to the faculty office at least two weeks in advance. Furthermore, the final thesis must be available to the examiner and opponent at least two weeks before the seminar.

## 5. Opposition

Acting as opponent, it is your task to scrutinize a fellow student's thesis. Hence, it is important to be well prepared, to request elucidation on obscurities in the thesis, and to bring forward the advantages and drawbacks of the work. Avoid an obviously friendly opposition. But, on the other hand, do not be vicious. Just act professionally!

Below some advice is given on what to focus when debating a thesis:

- Is the aim of the thesis in good agreement with what is performed?
- Do you find the main thread throughout the work?
- Is the scientific approach obvious?
- Is the chosen method the best alternative in this context?
- Is the argumentation well supported by theory, references, or the author's own logical reasoning?
- Is the Abstract really a summary of the entire work, or is it limping? Is the Abstract a reader friendly section of stand-alone character, or is it more like an alienated compilation of cut-outs from the thesis?
- Is it likely that the author has read and understood all the references used?
- Is the author showing creativity in the conclusions?
- Is the thesis written according to the conventions pointed out in this document?

## 6. Secrecy

The thesis may be treated confidentially in exceptional cases. In such case, a special application has to be filled out. The application form is obtained at the department office. If the Head of Education of the University of Gävle is approving the application of secrecy, the thesis has to be written in two editions. One edition is containing all material including the confidential parts. This edition will be used by the examiner, if nothing else is agreed on.

Another edition is reduced in contents to fit the requirements of secrecy. Nonetheless, the reduced edition should be readable as a stand-alone piece of literature.

## **7. Examination book – The Green Book**

The examination book, so called Green Book for traditional reasons, is a form obtained at the program Blackboard site or the faculty office. In the Green Book dates of approved thesis, opposition, and visits to other thesis seminars are stated. The Green Book has to be signed by the examiner in duty for each occasion. Hence, it is obvious that the Green Book is a valuable document which cannot be restored if lost.

## **8. Approved thesis**

The examiner receives the final thesis when revised and marks the thesis assignment according to given instructions with a grade A-E by means of signing the original application form as well as the Ladok record form kept at the ATM faculty office. The final degree will be a weighted grade from three individually graded parts: *process*, *content*, and *presentation*.

When a thesis is approved, a “publish - ready” digital version of the thesis has to be delivered by the student, cf. Section 9. At this moment the thesis is public. If any restrictions in publicity are agreed on according to secrecy (cf. Section 6), the reduced version of the thesis will be considered as the public version.

## **9. Publishing of the thesis**

After the examiner approval of the final thesis, it is the job of the student to upload and register the thesis in the e-publishing tool *DiVA* (The Digital Scientific Archive). The routines involved when publishing the thesis in DiVA is described below (also available at <http://www.hig.se/Biblioteket/University-Library---Learning-Center/Write-and-Publish.html>).

When this process is done, the faculty office gets an automatic prompt by email from DiVA, and paper-based archive copies are produced by the faculty office.

DiVA is a public archive where all scientific papers, thesis assignments, and other similar reports produced at University of Gävle are registered. A Master's thesis published in DiVA may also be available through other search engines, e.g., Google, Google Scholar, Scirus, OAIster, Uppsök, and Uppsatser.se.

Below is given a short description of how a Master's thesis is published. A complete description is given at <http://www.hig.se/Biblioteket/University-Library---Learning-Center/Write-and-Publish/Publish-your-thesis-in-DiVA.html>.

- I. Login to DiVA using your personal UG computer user name and password. This can also be done home or elsewhere.
- II. In the upper right corner click Language and choose English.
- III. Click Add publication / Upload files »

- IV. Select Student thesis, and press Continue.
- V. Fill the web form with information about the thesis.
- VI. Upload the thesis in pdf format. No other document formats are accepted.
- VII. Check the information given, and, if necessary, go back and make corrections.
- VIII. Submit the information to the DiVA buffer when you think that everything is OK. After this stage you cannot make any changes.
- IX. The faculty office gets information and makes a check that the given information is adequate. If so, the thesis is published by the faculty office.
- X. The student is informed by email when the thesis is formally published.

If there are any problems with this procedure, the faculty office will happily answer any questions.

## 10. At last

Some students think of university regulations as something to avoid or even obstruct. This peculiarity may be more or less understandable, but as regards thesis assignments the bureaucratic procedure is purely emerging from the needs of the student alone.

The application form needed to fill out before starting the thesis assignment is an outstanding example of this fact. This form is forcing the supervisor or his/her superiors to:

- elaborate thoroughly on the idea
- allocate resources for e.g. supervision of the work
- formally sign an agreement on the sincere intention of supporting the student to successful results.

An impeccably filled out form, along with an enclosure describing the project and the conditions for success, is your insurance if the assigned supervisor comes up with exclamations like "I don't have time for that!". In such cases, you always have the signed form telling the opposite, viz. an agreement between three parties: yourself, the employer, and the University of Gävle. Neither official of the university - the examiner, the Head of Research at ATM/Electronics, the Program Director, the Head of Education, the President of the University, or anybody else - will be able to help at all if the form is not properly filled out.

Moreover, you should never reflect upon a thesis proposal which you suspect might be too difficult even for the employer. It sometimes happens that an employer is considering the student as being God Almighty, i.e., the revelation solving the unsolvable problem. Such a project is obviously too difficult even for you (unless you really consider yourself to be the very God Almighty), and a meaningful supervision of the work will of course never be provided by the employer whatsoever. The driving force for the employer should rather be: "This is a very interesting project for us, however of less priority for the moment. The company/university cannot put any effort to it right now, except for supervision of the thesis assignment."

In large companies thesis proposals are of common occurrence. So are scientists at a university. However, mostly none of these are used to the academic leveling of thesis assignments. It is probably not leading anywhere to discuss differences between academic

levels in principle. It is more feasible to discuss aim, scientific approach, and methodology, along with the commitments of the employer, and also to point out the needs in this respect for a Master's degree.

It is not unusual for a research group at a university to formulate a task useful for the research as a thesis assignment. If so, you will probably be part of that particular research group during the assignment. Such a procedure may well act as a stimulating factor for Ph.D. studies on top of your looming Master's degree.

Good Luck !

A handwritten signature in blue ink, appearing to read 'E. Nordlander', with a stylized, cursive script.

Prof. E. Nordlander

## **APPENDIX 1: Formalities for thesis writing**

Student theses from ATM/Electronics are uniform. Use the cover page available at the program Blackboard site or the faculty office, and also respect the format given.

The division of the thesis in chapters is a business of the author in agreement with the supervisor. However, the layout shown here in Appendix 1 is quite common and may thus be used to structure the thesis.

It might well be the case, that the thesis will be part of a scientific paper published in an international journal or conference. Such papers are often written in a special way, and for this reason the supervisor may present special demands on the thesis layout and to give references according to guidelines put up by the journal or the conference committee.

### **Figures and tables**

In the report, legibility is improved by referencing numbered figures and tables in the text. This goes for equations/mathematical expressions as well.

For example: ".....equipment which is shown in Fig. 3.", ".....equipment, see Fig. 2.", ".....equipment, cf. Fig. 8.", ".....measurements which are presented in Table 1.", ".....measurements, see Table 3.", ".....measurements, cf. Table 9."

Figures and tables are numbered in separate sets, implying that Table 1 very well may occur after e.g. Fig. 8.

To figures and tables unique captions (figure captions, table captions) are attached. These captions should be possible to read without reading the running text of the report, but nevertheless be recognized in the running text where it is referenced. For example, a figure caption may say: "Fig. 7. Flow chart of the control principle for the production unit RUFUS." In the running text the figure is given like: "The control principle for the production unit AF3893/7 from Lifsta Mechanical Inc., in-house commonly called RUFUS, is described by the flow chart in Fig. 7."

### **Latin terms**

Latin terms, especially in abbreviated form, are frequently used in reports in English. In the table below some of the most commonly used terms are listed.

<u>Term</u>	<u>Origin</u>	<u>Translation</u>	<u>Function</u>
i.e.	id est	it is	explanation
e.g.	exempli gratia	for example	exemplification
cf.	confer	compare with	reference
viz.	videlicet	namely	elucidation
Q. E. D.	quod erat demonstrandum	which should be proven	ending of a proof
ibid.	ibidem	at the same location	in reference lists

## **Structure of thesis**

### **Cover Page** (no pagination)

The cover page is of special format, printed on special paper.

### **Preface** (no pagination)

The preface is a product of the student. In the preface it is customary to thank those which considerably have contributed to the thesis. Notice, however, everybody does not wish to be recognized.

### **Abstract** (no pagination)

The Abstract is a summary of the diploma work, and should contain all major parts of the work. Nothing which is not found in the report may be presented in the Abstract. However, in the Abstract brief information is presented on e.g. aim, method, results, conclusions.

### **Table of contents** (no pagination)

Reference to pages where chapters and subsections may be found.

### **1. Introduction**

Should give the reader an introduction to the thesis work, the background, and the aim.

### **2. Theory**

Presentation of theories used in the work.

### **3. Process and results**

The theory is applied on the subject. Results are presented.

### **4. Discussion**

Discuss the results and the method chosen, the strengths and weaknesses of the work.

### **5. Conclusions**

Here the work should be concluded and the major results presented. Suggestions of continuation and spin-off projects may be brought forward.

### **References**

See Appendix 2 in this document - the conventions pointed out must be followed unless your supervisor and/or examiner is recommending otherwise.

### **Appendices**

In the appendices, material is placed which is not needed for the immediate comprehension of the work. For example, extensive calculations, computer programs and data listing, and peripheral information may be placed in the appendix section. Appendices are treated as documents of their own, which implies that figures and tables are numbered independently of those in the main report.



## **APPENDIX 2:            Referencing**

Reference lists should be produced according to the following standard, i.e. the IEEE standard for scientific publications. The list is arranged after first appearance in the text. Within the text, the reference is marked in the end of the sentence with a number in square brackets, e.g. The first fundamental patent on UWB communications systems simply referred to the technology as “base-band pulse” [5].

### **Book with one author, see e.g. [14]**

The title of the book is printed in italics. The place/city given is the location of the publishing house, not the location of the printing house.

### **Book with two authors, see e.g. [13]**

**Anthology where several authors made contributions, and some of them are editors, see e.g. [30]**

### **Article from a journal with one author, see example [9]**

Give the name of the journal (*italics*), volume number, corresponding pages, month and year.

### **Article from a journal with two authors, see example [1]**

### **Article from a journal with more than two authors, see example [41]**

### **Conference or symposium contribution, see e.g. [21], [27], [33]-[36]**

### **Report from the department which does not belong to a series, see e.g. [7]**

### **Application notes, see e.g. [15]**

### **Patents, see e.g. [5]**

### **Reports of various kinds, see e.g. [3], [25]**

### **Information gained without documentation**

C. Anderson, Private communication, 2003.

The credibility of such a reference is increased if the affiliation of Mr. Anderson is given, as well as the occasion the discussion took place.

### **Web sites on the Internet, see e.g. [2], [40], [44]**

If reference is a web site, then give the date indicating when you last actually read the reference with a web browser. It may well happen that the web site is removed or changed after this date. For scientific reports, this kind of reference should be avoided or be used only scarcely.

- [1] C. L. Bennett and G. F. Ross, "Time-domain electromagnetics and its applications," *Proc. IEEE*, vol. 66, pp. 299–318, Mar. 1978.
- [2] Revision of part 15 of the commission's rules regarding ultra-wideband transmission systems [Online]. Notice of inquiry, adopted August 20, 1998, released September 1, 1998. Available: <http://www.fcc.gov/oet/dockets/et98-153>
- [3] "Revision of part 15 of the commission's rules regarding ultra-wideband transmission systems," Report and order, adopted February 14, 2002, released July 15, 2002.
- [4] "Assessment of ultra wideband (UWB) technology," Ultra-Wideband Radar Rev. Panel, R 6280, Office of the OSD/DARPA, Washington, DC, July 13, 1990.
- [5] G. F. Ross, "Transmission and reception system for generating and receiving base-band duration pulse signals without distortion for short base-band pulse communication system," U.S. Patent 3 728 632, Apr. 17, 1973.
- [6] I. I. Immoreev and D. V. Fedotov, "Ultra wideband radar systems: Advantages and disadvantages," in *Proc. IEEE Ultra Wideband Systems and Technologies Conf.*, Baltimore, MD, May 2002, pp. 201–205.
- [7] G. F. Ross, "The transient analysis of multiple beam feed networks for array systems," Ph.D. dissertation, Dept. Elect. Eng., Polytech. Inst. Brooklyn, Brooklyn, NY, 1963.
- [8] F. Davis and H. W. Loeb, "Time-domain measurements for transistor and network characterization up to 1 GHz," *Proc. IEEE*, vol. 53, pp. 1649–1650, Oct. 1965.
- [9] G. F. Ross, "The transient analysis of certain TEM mode four-port networks," *IEEE Trans. Microwave Theory Tech.*, vol. MTT-14, pp. 528–547, Nov. 1966.
- [10] J. D. DeLorenzo, "A range for measuring the impulse response of scattering objects," in *Northeast Electronics and Engineering Meeting Rec.*, vol. 9, Nov. 1967, pp. 80–81.
- [11] A. Nicolson, "Broadband microwave transmission characteristics from a single measurement of the transient response," *IEEE Trans. Instrum. Meas.*, vol. IM-17, pp. 395–402, Dec. 1968.
- [12] C. L. Bennett, "A technique for computing approximate electromagnetic impulse response of conducting bodies," Ph.D. dissertation, School Eng., Purdue Univ., West Lafayette, IN, 1968.
- [13] C. E. Cook and M. Bernfeld, *Radar Signals: An Introduction to Theory & Application*. New York: Academic, 1967.
- [14] A. Papoulis, *The Fourier Integral and Its Applications*. New York: McGraw-Hill, 1962, ch. 5.
- [15] "Time domain reflectometry," Hewlett-Packard, Palo Alto, CA, Applicat. Note #62, 1964.
- [16] G. F. Ross, "A time domain criterion for the design of wideband radiating elements," *IEEE Trans. Antennas Propagat.*, vol. AP-16, p. 355, Mar. 1968.
- [17] K. W. Robbins, "Short baseband pulse receiver," U.S. Patent 3 662 316, May 9, 1972.
- [18] A. M. Nicolson and R. Mara, "Detector having a constant false alarm rate," U.S. Patent 3 983 422, Sept. 28, 1976.
- [19] R. J. Fontana and J. F. Larrick, "Ultra wideband receiver with high speed noise and interference tracking threshold," U.S. Patent 5 904 172, May 4, 1999.
- [20] R. J. Fontana, "UWB dual tunnel diode detector for object detection, measurement, or avoidance," U.S. Patent 6 239 741, May 29, 2001.
- [21] G. F. Ross, "A historic review of UWB radar and communications and future directions," presented at the IEEE Radio and Wireless Conf., Boston, MA, Oct. 12, 2003.
- [22] "Reexamination certificate (4084th)," U.S. Patent B1 5 361 070, May 16, 2000. [Online] Available: [http://www.multispectral.com/pdf/Reexam\\_Certificate.pdf](http://www.multispectral.com/pdf/Reexam_Certificate.pdf)
- [23] R. J. Baker and B. P. Johnson, "Applying the Marx bank circuit configuration to power MOSFETs," *Electron. Lett.*, vol. 29, no. 1, pp. 56–57, 1993.
- [24] M. J. Lesha and F. J. Paoloni, "Generation of balanced subnanosecond pulses using step-recovery diodes," *Electron. Lett.*, vol. 31, no. 7, pp. 510–511, 1995.
- [25] "Response to FCC notice of proposed rule making ET Docket 98-153, 'Revision of part 15 of the commission's rules regarding ultra-wideband transmission systems,'" Multispectral Solutions Inc., Germantown, MD, Sept. 12, 2000.
- [26] R. J. Fontana and J. F. Larrick, "Waveform adaptive ultra-wideband transmitter," U.S. Patent 6 026 125, Feb. 15, 2000.
- [27] R. J. Fontana, E. A. Richley, L. C. Beard, and J. Barney, "A programmable ultra wideband signal generator for electromagnetic susceptibility testing," in *Proc. IEEE Ultra Wideband Systems and Technologies Conf.*, Reston, VA, Nov. 2003 [CD-ROM], Session A1—NETEX.
- [28] M. Z. Win and R. A. Scholtz, "Impulse radio: How it works," *IEEE Commun. Lett.*, vol. 2, pp. 10–12, Jan. 1998.
- [29] H. L. Van Trees, *Detection, Estimation, and Modulation Theory*. New York: Wiley, 2001, pt. 1, ch. 4.4.1.
- [30] J. Taylor, Ed., *Introduction to Ultra-Wideband Radar Systems*. Boca Raton, FL: CRC, 1995.
- [31] *Ultra-Wideband, Short-Pulse Electromagnetics 1, 2, 3 and 4*. New York: Plenum, 1993, 1994, 1997, and 1999.
- [32] R. J. Fontana, J. C. Koppier, and R. W. T. Mulloy, "A low cost ultra wideband (UWB) radar altimeter," in *Proc. AUVSI '96*, Orlando, FL, July 15–19, 1996, pp. 297–301.
- [33] R. J. Fontana, J. F. Larrick, and J. E. Cade, "A low cost ultra wideband system for UAV communications and high resolution radar applications," in *Precision Strike Technology Symp.*, Baltimore, MD, Oct. 8–9, 1997.
- [34] R. J. Fontana, J. F. Larrick, J. E. Cade, and E. Rivers, "An ultra wideband synthetic vision sensor for airborne wire detection," presented at the Enhanced and Synthetic Vision, Orlando, FL, Apr. 1998.
- [35] M. D. Gallagher, F. R. Wentland, E. Drocella, P. Roosa, and D. Anderson, "Comments of the National Telecommunications and Information Administration, in the matter of revision of part 15 of the commission's rules ET docket no. 98-153," NTIA, Washington, DC, Jan. 15, 2004.
- [36] R. J. Fontana, "Experimental results from an ultra wideband precision geolocation system," presented at the EuroEM 2000, Edinburgh, Scotland, May 30, 2000.
- [37] S. Bancroft, "An algebraic solution of the GPS equations," *IEEE Trans. Aerosp. Electron. Syst.*, vol. AES-21, pp. 56–59, Jan. 1985.
- [38] R. J. Fontana and S. J. Gunderson, "Ultra wideband precision asset location system," in *Proc. IEEE Ultra Wideband Systems and Technologies Conf.*, Baltimore, MD, May 2002, pp. 147–150.
- [39] R. J. Fontana, E. Richley, and J. Barney, "Commercialization of an ultra wideband precision asset location system," in *Proc. IEEE Ultra Wideband Systems and Technologies Conf.*, Reston, VA, Nov. 2003, Session D4—Radar and Position Location Applications.
- [40] V. Lipset, (2002, Dec.) Cellonics: Home networking UWB's killer app?, *Ultrawidebandplanet.com* [Online]. Available: [http://www.ultra-widebandplanet.com/technology/article/0,10850\\_1557911,00.html](http://www.ultra-widebandplanet.com/technology/article/0,10850_1557911,00.html)
- [41] I. Gresham *et al.*, "Ultrawide-band radar sensors for short-range vehicular applications," *IEEE Trans. Microwave Theory Tech.*, vol. 52, pp. 2105–2122, Sept. 2004.
- [42] "Compatibility between ultra wide band services—Aviation systems and provisional limits," NATO NATMC, Brussels, Belgium, Information Doc. CEPT SE24, ver. 3.0, Mar. 2002.
- [43] T. G. Leng, "An update on UWB activities and developments in Singapore," presented at the 10th Infocomm Horizons Seminar, Singapore, Sept. 18, 2003 [Online]. Available: <http://www.i2r.a-star.edu.sg/events/horizons.htm>