



GERNOT HANS ZIEGLER

77 03 20 – 8459

HAR AVLAGT

CIVILINGENJÖRSEXAMEN

DATATEKNIK

DEGREE OF MASTER OF SCIENCE (MSc)
IN COMPUTER SCIENCE AND ENGINEERING

Mille Millnert
Dekanus

Anders Lindman
Utbildningsledare

LINKÖPINGS TEKNISKA HÖGSKOLA
LINKÖPING INSTITUTE OF TECHNOLOGY • SWEDEN

DEGREE CERTIFICATE

This is a translation of the original Swedish document

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has in accordance with the regulations governing Swedish higher education (No.100 of 1993)
fulfilled the requirements for the degree of

MASTER OF SCIENCE in

COMPUTER SCIENCE AND ENGINEERING, 180 points

Branch of studies: Individual Specialization

Thesis in the Subject of Media Technology

Compulsory and Elective Courses

<i>Course</i>	<i>Points</i>	<i>Grade</i>	<i>Examiner</i>
Probability, first course	2.5	Three	Univ adj T Linhardt
Statistics, first course	2.5	Three	Univ adj T Linhardt
Numerical Algorithms	3.5	Four	Univ lekt W Lenferink
Combinatorial Optimization, introductory course	3.5	Four	Prof K Holmberg
Linear Algebra	5.0	Four	Univ lekt T Karlsson
Calculus, one variable	7.0	Three	Univ lekt B Josefson
Calculus, several variables	6.0	Five	Univ lekt P Hackman
Mathematical Analysis	5.0	Five	Univ lekt K Hildén
Discrete Mathematics and Logic	8.0	Three	Univ adj O Axling
Artificial Intelligence	3.5	Four	Univ lekt P Lambrix
Object-Oriented Development of Usable Systems	6.0	Pass 1)	Univ adj J Maleki
Data Structures and Algorithms	4.5	Four	Univ lekt U Nilsson
Software Engineering Project from a Wide Perspective	8.0	Four	Prof U Assmann
Concurrent Programming and Operating Systems	4.0	Four	Univ lekt N Reed


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(signature)

Grades given: Approbatur (Three), Non sine laude approbatur (Four), Cum laude approbatur (Five)

1) The only grade given is Pass

2) D=only attendance required

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<i>Course</i>	<i>Points</i>	<i>Grade</i>	<i>Examiner</i>
Programming	8.0	Five	Univ adj J Wallgren
Modern Physics	2.5	Five	Prof W Chen
Electromagnetism	3.0	Three	Univ lekt M Boman
Engineering Mechanics D	3.0	Four	Univ lekt R Ribberfors
Introduction to Computers and Networks	1.0	Pass 1)	Univ adj K Hartman
Leadership	4.0	Four	Univ lekt J Ljung
Communication	2.0	Pass 1)	Univ adj M Merkel
Sweden and Europe: From the Viking Age to the European Union	5.0	Pass 1)	Univ lekt L Strömbäck
Technical Descriptions	1.0	Pass 1)	Univ lekt K Mårdsjö
English	3.0	Five	Univ lekt H Hollqvist
3-D Computer Graphics and Virtual Reality	6.0	Five	Univ lekt B Gudmundsson
Modelling and Animation	5.0	Four	Univ lekt M Ollila
Virtual Reality Techniques	5.0	Four	Prof A Ynnerman
Scientific Visualization	5.0	Five	Prof A Ynnerman
Image Based Rendering	4.0	Five	Univ lekt M Ollila
Basic Electronics and Measurement Technology	5.0	Four	Univ adj S Söderkvist
Circuit Theory	6.5	Four	Univ adj S Söderkvist
Digital Project Laboratory	4.0	Pass 1)	Univ lekt I Ragnemalm
Switching Theory and Logical Design	4.0	Three	Univ adj L Bengtsson
Computer Hardware and Architecture	5.0	Five	Univ adj L Asperud
Microcomputer Project Laboratory	3.5	Pass 1)	Univ lekt T Svensson
Signal Theory	3.0	Five	Univ prof U Henriksson
Introduction in Matlab	1.0	Pass 1)	Prof F Gustafsson
Automatic Control Y	4.0	Four	Univ adj A Hagenblad



 (signature)

Grades given: Approbatur (Three), Non sine laude approbatur (Four), Cum laude approbatur (Five)

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<i>Course</i>	<i>Points</i>	<i>Grade</i>	<i>Examiner</i>
Thesis	20.0	Pass 1)	Univ lekt S Gustavson
Title of the thesis:	MPEG Z/Alpha and High Resolution MPEG.		

Voluntary Courses

<i>Course</i>	<i>Points</i>	<i>Grade</i>	<i>Examiner</i>
Visits to Industry	1.0	D 2)	Prof S Gunnarsson
Work Experience, 12 weeks			

The education was completed on 21 May 2003.

On behalf of the Board, Faculty of Technology


Ulrika Söderberg
Examenshandläggare

The Degree Certificate issued on 16 June 2003

Grades given: Approbatur (Three), Non sine laude approbatur (Four), Cum laude approbatur (Five)

1) The only grade given is Pass

2) D=only attendance required



INSTITUTE OF TECHNOLOGY
LINKÖPING UNIVERSITY

DIPLOMA SUPPLEMENT

Gernot Hans Ziegler

770320-8459

This Diploma Supplement follows the model developed by the European Commission, Council of Europe and UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international "transparency" and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended.

1. Information identifying the holder of the qualification

- | | |
|--|---------------|
| 1.1 <i>Family name:</i> | Ziegler |
| 1.2 <i>Given name:</i> | Gernot Hans |
| 1.3 <i>Date of birth (day/month/year):</i> | 20 March 1977 |
| 1.4 <i>Civic registration number:</i> | 770320-8459 |

2. Information identifying the qualification

- 2.1 *Date of issue:* 21 May 2003
- 2.2 *Name of qualification and (if applicable) title conferred (in original language):*
Civilingenjörsexamen i Datateknik
- 2.3 *Name of qualification and (if applicable) title conferred in official translation to English:*
Master of Science in Computer Science and Engineering
- 2.4 *Main field(s) of study for the qualification:* Individual Specialization
- 2.5 *Name (in original language) and status of awarding institution:*
Linköpings universitet (State)
- 2.6 *Name (in original language) and status of institution (if different from 2.5) administering studies:*
Not applicable.
- 2.7 *Language(s) of instruction:* Mainly Swedish

3. Information on the level of the qualification

- 3.1 *Level of qualification:* Undergraduate education according to the Swedish higher educational system, 4.5 years. This translation of level does not correspond to the British and American systems. For more information on higher education in Sweden, please see point 8, appendix 2.
- 3.2 *Official length of programme:* 180 credit points (270 ECTS-credits). The scope of undergraduate education shall be stated in accordance with a credit system, where each credit point corresponds to one week of full-time studies.

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- 3.3 Access requirement(s):** General eligibility is attained by completing an upper secondary school programme and obtaining a pass grade or better in courses comprising at least 90 per cent of the upper secondary credits required in the programme, or by providing proof of an equivalent level of knowledge.

The specific requirements vary according to the field of higher education and are expressed in terms of subjects in the upper secondary school.

4. Information on the contents and results gained

- 4.1 Mode of study:** Full-time equivalent.

- 4.2 Degree requirements:**

Scope

A Master of Science in Engineering shall be awarded after completion of course requirements of 180 credit points in total.

Objectives (in addition to the general objectives set out in chapter 1, section 9 of the Higher Education Act).

In order to obtain a Master of Science in Engineering, the student shall have

- acquired knowledge of mathematics and natural science subjects to the extent required to understand and be able to apply the fundamental aspects of mathematics and natural sciences in the chosen area of technology,
- acquired knowledge of and skills in the design of products, processes and working environments, taking into account the abilities and needs of human beings as well as society's objectives as regards social conditions, economy of resources, environment and economy,
- acquired the knowledge enabling him or her, after a few years' work experience within his or her field, to take independent responsibility for development or utilisation of new technology at an internationally competitive level.

The objectives set by the institution of higher education concerned shall in addition apply.

- 4.3 Programme details (e.g. modules or units studied), and the individual grades/marks/credits obtained:** See Degree Certificate/Official Transcript.

- 4.4 Grading scheme and, if available, grade distribution guidance:** See Degree Certificate.

- 4.5 Overall classification of the qualification (in original language):** Not applicable for Swedish degrees.

5. Information on the function of the qualification

- 5.1 Access to further study:**

The degree gives access to doctoral studies. For more information on higher education in Sweden, please see point 8, appendix 2.



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5.2 Professional status (if applicable): Regulated education in accordance with the Swedish Degree Ordinance and covered by directive 89/48/EEC or 92/51/EEC amended by 2001/19/EC.

6. Additional information

6.1 Additional information:

The Master of Science in Computer Science and Engineering programme consists for the first five semesters of common compulsory courses. By choosing a combination of courses from the beginning of semester 6 students can concentrate their studies on the application areas Programming and Algorithms/Computer Science, Software Engineering, Computer Systems Architecture, Control and Information Systems, Electronics, Computer Vision and Graphics, Telematics/Communication, Biomedical Engineering, Media and Information Technology, Secure Interactive Computer Systems, Software Integrated Systems for Communication and Media, Bioinformatics, Information technology, Management and Business processes, AI Cognition and Interaction or an individual research area. The special subjects are followed during semesters 6, 7 and 8 parallel to other compulsory and optional courses.

The programme ends with a compulsory thesis/extended essay worth 20 credit points, which will be presented and defended in public.

Examiners according to Degree Certificate:

Prof (Professor)
Bitr prof (Associate Professor)
Adj prof (Visiting Professor)
Univ lekt (Associate Professor)
Univ adj (Lecturer)
Fo asst (Postdoctoral Fellow)
Timplärare (Part-Time Teacher)

6.2 Further information sources:

Linköpings universitet
SE-581 83 LINKÖPING
Sweden
phone: +46 13 281000
www.liu.se

National Agency for Higher Education
The Swedish ENIC/NARIC Office
Box 7851
SE-103 99 STOCKHOLM
Sweden
www.hsv.se

DIPLOMA SUPPLEMENT

Gernot Hans Ziegler

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7. Certification of the supplement

7.1 *Date:* 16 June 2003

7.2 *Signature and official stamp or seal (if used)*



Ulrika Söderberg



7.3 *Capacity:* Officer of Degree Administration

8. Information on the national higher education system

Information on the Swedish higher education system cf enclosure.

Appendix 2

The Swedish Higher Education System

(The following description is approved by the National Agency for Higher Education)

General

Higher education institutions have great autonomy in the organisation of studies, use of resources and general organisation. Diplomas from all higher education institutions recognised by the Government have equal official value. The higher education institutions in Sweden are designated as either "universitet" or "högskola". The status of "universitet" is awarded by the Government to higher education institutions fulfilling certain criteria. The same law governs all higher education institutions. Private providers of higher education may be recognised by the Government, obtain the right to award degrees and receive state subsidies. All recognised higher education is funded by the State. All university programmes and major subjects are to be evaluated by the National Agency for Higher Education every six years, starting in 2001.

Grading

The Higher Education Ordinance states that the following grades can be used: Pass with Distinction ("väl godkänd"), Pass ("godkänd") or Fail ("underkänd") unless the institution decides to grade on some other scale. A number of courses use only two grades: Pass and Fail. Others, like Law and Engineering, traditionally use scales with several levels – expressed as letters or numbers. No overall grade is given for a degree.

Degrees

Higher education is provided in the form of courses. These may be linked to constitute degree programmes with varying levels of individual choice. Students themselves are also able to combine different courses into a degree. A course syllabus is required for each undergraduate course and a curriculum for each degree programme.

Sweden has a system of credit points ("poäng"), one week of successful full-time study is equivalent to 1 credit point. One academic year usually yields 40 credit points.

In the Degree Ordinance, the Government has laid down which degrees may be awarded and the objectives for these degrees. In the Swedish higher education system there are generally no intermediate qualifications. All degrees are regarded as final qualifications, even if there is a possibility to continue studying. Degrees are divided into general degrees and professional degrees.

General degrees:

1. "högskoleexamen" requiring a minimum of 80 credit points
2. "kandidatexamen" requiring a minimum of 120 credit points with 60 credit points in the major subject including a thesis/degree project of 10 credit points
3. "magisterexamen med ämnesdjup" requiring a minimum of 160 credit points with 80 credit points in the major subject including one thesis of 20 or two theses/ degree projects of 10 credit points each
4. "magisterexamen med ämnesbredd" requiring a minimum of 40 credit points with specialisation including a thesis/ degree project of at least 10 credit points. A prerequisite for "magisterexamen med ämnesbredd" is a general or professional degree of at least 120 credit points or a comparable foreign degree.

"Kandidatexamen" and "magisterexamen med ämnesdjup" may indicate the major subject or faculty, e.g. "ekonomie magisterexamen". The most advanced courses (60-80 credits level) at "magisterexamen" can be accepted as partial fulfilment of the requirements of doctoral programme. Institutions entitled to describe themselves as "universitet" have the right to award the degrees of "magisterexamen med ämnesdjup" and "magisterexamen med ämnesbredd". Institutions designated as "högskola" have a general entitlement to award the degree of "magisterexamen med ämnesbredd" but need to apply for the right to award the degree of "magisterexamen med ämnesdjup".

Professional degrees

Professional degrees are awarded in the fields of engineering, health care, agriculture, law, education, fine arts etc. Programmes leading to professional degrees vary in length depending on their character. There are around 50 professional degrees. Professional qualification also includes degrees in fine arts. Some of the professional degrees demand a previous undergraduate qualification as a prerequisite, especially within the field of health care. Institutions have to apply for the right to award professional degrees.

Access and admission to higher education

Higher education in Sweden has two strata of eligibility: general/basic and (additional) specific requirements. The general eligibility is the same for all higher education. General eligibility is attained by completing an upper secondary school programme and obtaining a pass grade or better in courses comprising at least 90 per cent of the credits required for the programme, or by providing proof of an equivalent level of knowledge. People who are at least 25 years old, who have been employed for four years and who have a command of English and Swedish corresponding to that obtained by completing a national upper secondary programme are also considered to have general eligibility. The specific requirements vary according to the field of higher education and are expressed in terms of subjects in the upper secondary school. Numerus clausus is used for all study programmes and courses.

Postgraduate training

Institutions entitled to describe themselves as "universitet" have permanent allocations of funds for research and postgraduate education and can award doctoral degrees, whereas for institutions designated as "högskola" these rights may be restricted to specific research areas only or they may have research links with a "universitet".

Postgraduate training is based on undergraduate education of at least 120 credit points. Furthermore, the faculty board in question may stipulate additional requirements for admission. Postgraduate programmes nominally comprise 160 credit points (four years) and lead to a "doktorsexamen" (PhD). A PhD student must complete a number of taught courses and write a doctoral dissertation. The dissertation must be defended at a public oral examination. A "licentiatexamen" (licentiate degree) can be obtained after a minimum of 2 years, 80 credit points, including course work and a thesis. Normally students aim directly for a "doktorsexamen" but it is also possible to take a "licentiatexamen" as an intermediate degree. All faculties can award a "licentiat"- or "doktorsexamen", in which the discipline is named, e.g. "teknologie licentiatexamen" (Licentiate in Technology). However a faculty of engineering, like any other, may also award a "filosofie doktorsexamen" (Ph.D).



LINKÖPINGS UNIVERSITET

GENERAL INFORMATION

- University Degrees

The 1993 Higher Education Reform

INFORMATION

The latest reform of higher education in Sweden took effect in July 1993. The universities were granted more freedom and independence to decide which programmes and courses to offer.

A system of credit points is employed for measuring quantity in higher education. One point corresponds to one week of full-time study. One semester corresponds to 20 points. One academic year consists of two semesters.

UNDERGRADUATE EDUCATION

Degrees

A student who has passed all courses within a programme, is awarded a degree (kandidatexamen*, magisterexamen**). There are official English translations of all general degrees. The following general principles apply to the English translation:

- 1 "The Degree of Bachelor of Arts/Social Science/ Science / Education/Fine Arts/Theology" is awarded if the student has successfully passed at least 120 points with at least 60 points including a final thesis of at least 10 points in the major subject. The major subject must be stated in the diploma.
- 2 The degree of "Master of Arts/Social Science /Science/ Fine Arts" is used for degree programmes including 80 points in the major subject and a total of not less than 160 points.
The student must have completed a final thesis of at least 20 points in the major subject or two theses of 10 points each.
Part of the Master's Degree course (usually 20 points) is given credit within the postgraduate programmes.
- 3 "University Diploma" is a professional degree. The length can vary from 40 to 220 points. The student is normally required to complete a final thesis of 10 points in the major subject.
- 4 A student who has studied less than 120 points is awarded a "University Diploma". The basic requirement is courses of a total of 80 points with focus on a major subject. The major subject, 40 points, must be stated in the diploma.

* The degree of Kandidatexamen is translated into English as Bachelor of...

Programmes

There is a variety of programmes. A full-time study programme is 40 to 220 points of length. Most programmes cover 120 points or more.

Single Subject Courses

A student can also obtain a degree by studying single subject courses. Each single subject course normally requires 10 to 20 points of full-time study.

Examination

Examination procedures vary between departments and courses. Examinations can be written or oral. Other forms of examination are project work and/or individual paper.

Grades

The grading system: Pass or Pass and PD (Pass with distinction) or Three (Approbatur), Four (Non sine laude approbatur) and Five (Cum laude approbatur).

D = only attendance required.

ECTS grading system is used parallel to the Swedish grades for international students.

POSTGRADUATE EDUCATION

Anyone who has completed a degree covering at least 120 points meets the general requirements for admission to postgraduate studies. In addition to that, the student must meet special requirements pertaining to his/her major subject. Sometimes there are also minor subject requirements.

Licentiate degree programmes (Sw. *licentiatexamen*) comprise 80 points and include a degree thesis of at least 20 points.

Studies for the doctor's degree comprise 160 points. Postgraduate studies normally take four years. For the doctor's degree the student must complete graduate courses usually 80 points - and write a doctoral thesis which is to be defended in public. Postgraduate studies are judged on a pass/fail basis only.

** The degree of Magisterexamen is translated into English as Master of ...



LINKÖPINGS UNIVERSITET

The Faculty of Arts and Science

Approximately 10000 of the 21500 students at the university are enrolled in the Faculty of Arts and Sciences. The faculty comprises a wide range of departments that offer education at all levels of study. A variety of subjects are incorporated in each department, thus facilitating cooperation between subjects by the creation of study programmes and single-subject courses. At the faculty, students can choose from 20 study programmes, six of which are teacher-training programmes. There is a rich array of some 200 single-subject courses in about 40 fields of study.

Research and postgraduate studies are carried out within disciplines and also across disciplinary boundaries. The interdisciplinary approach is the main idea and basis of the Tema Institute, an interdisciplinary research institute that is unique in Sweden. Study programmes are also offered in, for example, statistics, economics, business administration, education, psychology and information systems development.

Degrees awarded by the Faculty:
Kandidatexamen*, magisterexamen**

- Bachelor/Master of Arts
- Bachelor/Master of Science within Business Administration/Economics
- Bachelor/Master of Science within Business Administration/Economics, International Programme
- Master of Science within Commercial and Business Law
- Bachelor/Master of Science within Political Science and Economics
- Bachelor/Master of Science in Psychology
- Bachelor/Master of Science in Systems Analysis
- Master of Science within Social and Cultural Analysis Programme
- Master of Science within Culture, Society, Mediaproductioin Programme
- Bachelor/Master of Science within Environmental Science Programme
- Master of Science... (Special Education, Pedagogical Work)
- University Diploma in User-Oriented Systems Development
- Bachelor/Master of Science in Statistics
- Bachelor/Master of Science in Human Resource Management and Work Sciences

* The degree of Kandidatexamen is translated into English as Bachelor of...

GENERAL INFORMATION

- Linköping University

- Bachelor/Master of Science in Cognitive Science
- Master of Education for the Upper Secondary School
- Bachelor of Education .. (Child and Youth Education, Compulsory School, Crafts)
- Bachelor of Theology
- Diploma of Education for the Folk High School
- University Diploma (+ the major subject)

The Faculty of Health Sciences

The Faculty of Health Sciences is part of Linköping University.

The faculty comprises the training of doctors, biomedical laboratory technologists, managers in social care, midwives, nurses, occupational therapists and physiotherapists. There are also programmes for Bachelor/Master of Science in Medical Biology and Bachelor/Master of Science in Public Health. In the different programmes about 1400 students are enrolled. In addition to the degree programmes there are separate single-subject courses. Postgraduate research and scientific training is conducted within about forty health care disciplines.

The Faculty of Health Sciences awards the following professional degrees:

- Bachelor of Science in Nursing
- Bachelor of Science in Occupational Therapy
- Bachelor of Science in Physiotherapy
- Bachelor of Science in Social Care
- Graduate Diploma in Midwifery
- University Medical Degree

and furthermore the following general degrees:
Kandidatexamen*, magisterexamen**

- Bachelor of Science in Biomedical Laboratory Technology
- Bachelor of Science in Health and Care Development
- Bachelor/Master of Science in Biomedical Laboratory Science
- Bachelor/Master of Science in Medical Biology
- Bachelor/Master of Science in Medical Microbiology
- Bachelor/Master of Science in Medicine
- Bachelor/Master of Science in Nursing
- Bachelor/Master of Science in Occupational Therapy
- Bachelor/Master of Science in Pharmacology
- Bachelor/Master of Science in Physiotherapy
- Bachelor/Master of Science in Public Health
- Bachelor/Master of Science in Social Care Science
- Bachelor/Master of Science in Social Pedagogy
- Master of Science in Health Care Informatics

** The degree of Magisterexamen is translated into English as Master of ...

The Institute of Technology

7 600 enrolments, which annually awards around 500 master of science degrees in ten engineering programmes. A growing number of three-year engineering study programmes are offered as well. The Institute also offers mathematics and natural sciences programmes and courses. Graduate research and scientific training is conducted in fifty fields.

Degrees awarded by the Faculty:
Kandidatexamen*, magisterexamen**

- Master of Science in Mechanical Engineering
- Master of Science in Applied Physics and Electrical Engineering
- Master of Science in Industrial Engineering and Management
- Master of Science in Industrial Engineering and Management - International
- Master of Science in Computer Science and Engineering
- Master of Science in Engineering Biology
- Master of Science in Information Technology
- Master of Science in Industrial Electronics
- Master of Science in Communication and Transportation Systems
- Master of Science in Media Technology
- Master of Science in Computer Science
- Master of Science in Biology
- Master of Science in Physics
- Master of Science in Chemistry
- Master of Science in Mathematics
- Bachelor of Science in Computer and Electrical Engineering
- Bachelor of Science in Electrical Engineering
- Bachelor of Science in Computer Engineering
- Bachelor of Science in Mechanical Engineering
- Bachelor of Science in Chemical Engineering
- Bachelor of Science in Civil Engineering
- Bachelor of Science in Media and Communication Engineering
- University Diploma in Applied Technology (Electrotechnology, Electronic Manufacturing, Industrial Wood Technology)
- University Diploma in (+ the major subject)

* The degree of Kandidatexamen is translated into English as Bachelor of...

** The degree of Magisterexamen is translated into English as Master of ...

Key Figures

Departments	19
Students	21000
Staff & Faculty	3000

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Linköpings universitet
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+ 46 13281000 + 46 13285810

www.liu.se