Turku Centre for Computer Science

Annual Report 2002

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Christel Donner
Monika Eklund
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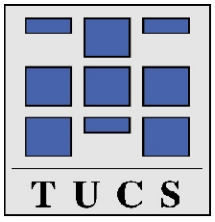
Ulrika Gustafsson
Timo Järvi
Nina Kivinen



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TUCS General Publication

No 28, September 2003

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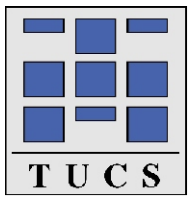

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1 Introduction

This is the annual report 2002 for the Turku Centre for Computer Science (TUCS). TUCS is a joint research and education centre between the University of Turku, Åbo Akademi University, and the Turku School of Economics and Business Administration. Its mission is to coordinate research and education in the field of Information Technology.

The year 2002 was marked by many changes in the personnel of the TUCS office. Professor Ralph Back, the director of TUCS from the very beginning, took a leave of absence to lead the new center of excellence for Formal Methods in Programming. Professor Timo Järvi was named as the acting director. TUCS also got a new coordinator's half time post, for which academy lector Mats Aspnäs was appointed. The holders of the two administrative officers' positions were changed. Further an administrative officer position for information and marketing was re-established. During 2002 the TUCS administration has been working on establishing its administration practice.

In 2002 TUCS started an international Master's School, where the courses in the domestic Master's School were opened for students from abroad. Due to a tight schedule for creating and marketing the Master's School it started small. The research was supported mainly by giving the laboratories of the TUCS support for purchasing equipment etc.

TUCS has published its annual report yearly since 1996. The report for 2000-2001 was printed in June 2003. This report will normalize the situation and in the future we hope to publish the annual reports already in the first quarter of the year. The editorial staff thanks everybody involved in gathering the material for this report.

1.1 Overview

The Turku Centre for Computer Science (TUCS) is a joint research and education centre between the three universities in Turku, Finland: the University of Turku, Åbo Akademi University, and the Turku School of Economics and Business Administration. TUCS coordinates research and education in the field of Information Technology. These activities are carried out in the TUCS Master's and Graduate Schools and in the centre's research laboratories. The main areas of research are Algorithmics, Discrete Mathematics, Electronics and Communication Systems, Embedded Systems, Information Systems, Mathematical Modeling, and Software Engineering.

The following departments participate in TUCS and its Graduate School:

University of Turku
- Department of Information Technology
- Department of Mathematics

Åbo Akademi University
- Department of Computer Science
- Department of Information Systems

Turku School of Economics and Business Administration

- Department of Management
  - Institute of Information Systems Science

TUCS was started in March 1994, in cooperation between the three universities. The purpose was to combine the research, the advanced level teaching and the Ph.D. education of the participating departments into a joint research centre, with a Graduate School as a central component. The first students started at the TUCS Graduate School in September 1994. In the end of 2002, TUCS had 74 full time Ph.D. students.

From the very start, TUCS has had a strong international profile. The working language in many research laboratories is English, and all Graduate School courses are taught in English. TUCS has an extensive international recruitment of Ph.D. students, postdoctoral researchers and senior researchers. As a consequence, most postdoctoral researchers and a large number of the TUCS Ph.D. students come from abroad. During 2002 TUCS has had postdoctoral researchers e.g. from China, The Netherlands, Jugoslavia, Tunisia, Finland, Czech Republic, Portugal and Romania.

TUCS has presently 16 research laboratories, with research spanning from theoretical basic research in Computer Science and Discrete Mathematics to computer applications in industrial and business information systems. The research laboratories are involved in a number of more specific research projects, mostly with external funding from the Academy of Finland (basic research), TEKES (industrial applied research), or direct funding from the industry. The supervision of Ph.D. students is carried out within the research laboratories.

Besides having a graduate school with common courses and seminars, TUCS also coordinates the research activities at the participating departments. It organizes scientific conferences, workshops and summer schools. It publishes a joint technical report series, Ph.D. theses and conference proceedings, as well as a National Publication Series. The TUCS publications are all available on the World Wide Web for immediate downloading and inspection. The web also provides the most updated and detailed information about TUCS, its daily activities and its accumulated results (the web address is www.tucs.fi).

1.2 The development of TUCS 1994-2001

All three universities in Turku have departments in the areas covered by TUCS, and the need for cooperation was evident for a long time. As a fist step, the departments moved into common localities in DataCity, in 1988. This was the first part of the Turku Technology Centre to be built, and it was followed by four more buildings: BioCity, ElectroCity, EuroCity and PharmaCity.

The next step was the forming of a joint graduate school in Computer Science between the departments that were situated in DataCity. The initiative for forming the graduate school was taken in August 1993, and a small working group was set up to plan the school. The working group made quick progress, and the Turku Graduate School in Computer Science was formed in November 1993. After discussions with the Academy of Finland, it was decided that the scope of activities should be expanded to a full research centre, and that the Graduate School was to be a part of this research centre. The Turku Centre for Computer Science, abbreviated TUCS, was consequently formed in February 1994.

The working language of TUCS was chosen to be English. This was a way of solving the problem of combining research and teaching at three universities with two different teaching languages, Finnish at the University of Turku and at the Turku School of Economics and Business Administration and Swedish at Åbo Akademi University. Even more important however was the desire to make TUCS into a truly international research centre. This has also succeeded, to an extent that was not really even foreseen in the beginning, with all the TUCS courses now being lectured in English, a large part of the Ph.D. students (40%) coming from abroad, and quite a number of foreign postdoctoral researchers and more senior researchers visiting TUCS for longer periods.

TUCS was a pilot project that received special support from the Ministry of Education in its first two years. The TUCS Graduate School was the first graduate school to start in Finland. The graduate school model was considered very successful by the Ministry of Education, and in the next two years altogether 93 graduate schools were formed in Finland, in all areas of science. There are now five other graduate schools in Computer Science besides TUCS: HECSE in Helsinki, TISE in Tampere, COMAS in Jyväskylä, ECSE in Eastern Finland (Joensuu, Lappeenranta, Kuopio), and InfoTech in Oulu. TUCS has acquired its own share of the full-time Ph.D. student positions that were allocated to the new graduate schools. In 1995, 10 Ph.D. student positions were allocated to TUCS. In 1998, TUCS got 10 additional positions, and from January 1999 TUCS has had 29 Ph.D. student positions financed by the Ministry of Education. In addition to these, there are also Ph.D. student positions financed by the expansion program in Computer Science and Electronics education, by the departments and by externally financed research projects.

In 1995, TUCS was selected as a Centre of Excellence in research by the Academy of Finland. This was a recognition of the strong research carried out by the research groups at TUCS. The research group of Prof. Arto Salomaa in formal languages and cryptology at the University of Turku and the research group of Prof. Ralph-Johan Back in programming methodology at the Åbo Akademi University were especially mentioned. The combined research strength of TUCS gave it the Centre of Excellence status also in the following years (1996-1999).

In 1998, the Finnish Ministry of Education decided to start a national program in order to expand the education in Computer Science and in Engineering and Electronics. Alltogether, 1000 new students within this area are admitted annually to the Finnish universities. Of this increase, the universities participating in TUCS get 120 new student positions annually. The annual student intake to Computer Science and related areas within the three universities thus increased from 180 in 1997 to over 300 in the year 2000 and after. The main part of the expansion is directed to the program in Computer Science and Engineering, leading to a Master's of Science in Technology. As a part of the expansion, a four-year program for professional upgrading was also started in 1999, with a student intake of over 200 per year. TUCS assumed the role of the coordinating organ for the education programs among the three universities. This resulted in a considerable change in the organisation of TUCS, since its responsibilities was extended also to cover basic education.

In March 2000, the program in Electronics and Telecommunications technology at the University of Turku, Department of Applied Physics joined TUCS. Electronics and Tele-communication is actively involved in the education program in Computer Science and Engineering, which is carried out in cooperation between Åbo Akademi University and the University of Turku. At the same time, Electronics and Telecommunication was accepted as a new research area within TUCS.

The Software Development Centre, OK, was started as a cooperation between TUCS and the Turku Polytechnic in the autumn 2000. Its mission is to bridge the requirements of IT-companies' product development with the applied and scientific know-how of the universities and polytechnics in the area. The OK carries out software development projects together with the industry, and employs students doing their thesis (both from TUCS and the polytechnic) as project workers. The main competence areas of the OK are embedded systems, broadband and computer networks, user interfaces and databases, as well as the quality and methods for practical software production process management.

Until the beginning of 2001, the research at TUCS was organized in a number of research groups. In the beginning of 2001 it was decided to reorganize the research into 16 research laboratories. A research laboratory consists of a group of researchers, typically between 10 and 30, within a well focused topic of research. A laboratory may be shared between two universities or more. Doctoral students within the TUCS Graduate School all belong to a laboratory. The laboratories are also responsible for the advanced level education within their own field of research. The laboratories should try to find external funding for their research projects.

1.3 Year 2002

This section gives a short overview of the more important changes and events at TUCS in the year 2002.

1.3.1 Department of Information Technology

In january 2002 the Faculty of Mathematics and Natural Sciences at the University of Turku carried out a reorganization of the study programs and the departments. The Department of Information Technology at the University of Turku was formed, by combining the program in Computer Sciences, which formerly belonged to the Department of Mathematical Sciences, and the program in Electronics and Telecommunication Technology, which formerly was part of the Department of Applied Physics. The program in mathematics formed an own department, the Department of Mathematics.

1.3.2 TUCS Master's School

In the autumn 2002, the TUCS Master's school was started with a first intake of students. The TUCS Master's school coordinates four Master's programs: "Information Technology" at the University of Turku, "Software Engineering" and "Electronic and Mobile Commerce" at Åbo Akademi University, and "Global IT Management" at the Turku School of Economics and Business Administration. The Master's programs accept students with a B.Sc.-level education and leads to a Finnish Master's degree after about two years of study.

1.3.3 CREST

In 2002 the Centre for Reliable Software Technology, CREST, was formed. CREST is a research center within Åbo Akademi University and TUCS and it consists of four research groups: Distributed Systems, Embedded Systems, Mechanised Reasoning and Software

Construction. CREST is a Centre of Excellence for Formal Methods in Programming, appointed by the Academy of Finland.

1.3.4 New premises

In the autumn 2002, TUCS moved from the fourth floor in DataCity to the fifth floor. The new premises are about 750 m^2. The Department of Information Technology (University of Turku) aquired about 1220 m^2 also on the fifth floor. A unit of the IT-department of about 400 m^2, which previously was located on the sixth floor, was moved to the new premises, so the net increase was about 800 m^2. The Department of Computer Science at Åbo Akademi University expanded to TUCS' former premises on the fourth floor, and also aquired about 800 m^2 additional office space on the fourth floor. The net increase thus was about 1200 m^2.

1.3.5 Theses awards

In May 2002 the Finnish Information Processing Association's awarded the prize for the best Ph.D thesis in information technology in Finland 2001 to Mauno Rönkkö from the Department of Computer Science at Åbo Akademi University for his dissertation "Stepwise Development of Hybrid Systems".

In November 2002, the Research Foundation of the Rolf Nevanlinna Institute awarded the prize for the best doctoral thesis in mathematics in Finland in 2001 to Tero Aittokallio from the Department of Mathematics at the University of Turku. The title of the thesis is "Characterization and Modelling of the Cardiorespiratory System in Sleep-disordered Breathing".

The Finnish Association for Mathematicians, Physicists and Computer Scientists awarded the prize for the best Master's thesis in information technology in Finland 2001 to Jukka Arvo from the Department of Information Technology at the University of Turku. The title of the thesis is "Real-time Shadow Algorithms for Dynamic Environments".

1.4 Organization

The education and research activities at TUCS are carried out within the Master's and Graduate Schools and the Research Laboratories. Decisions are primarily made in the TUCS board. Planning and execution is carried out in the workgroups, Graduate School Committee and the Advisory Committee. By the end of 2002 there were about 30 professors, 50 Ph.D. level researchers and 79 doctoral students (74 full time and 5 part time students) at TUCS.

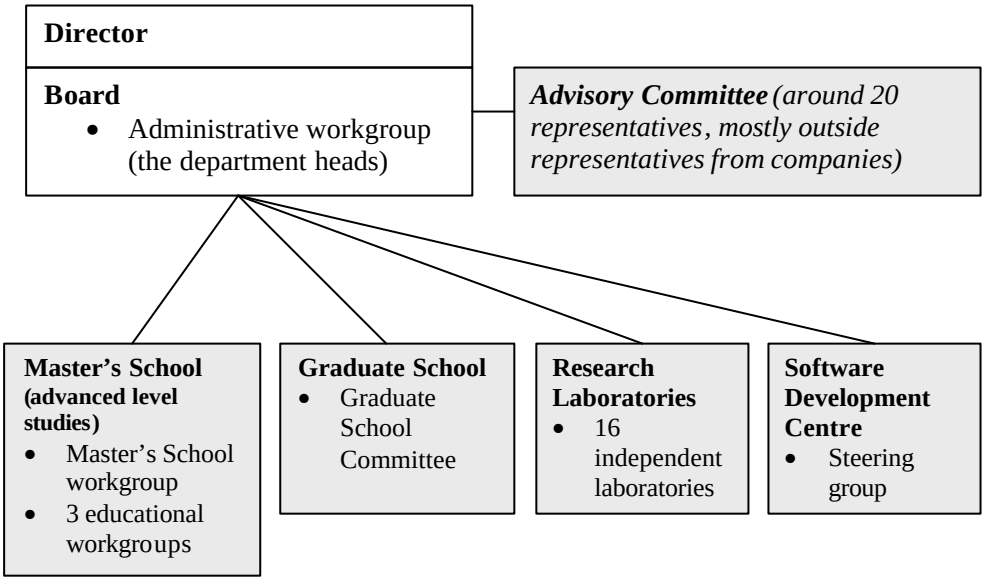

Figure 1. TUCS organization

1.4.1 The Director, the Vice-director, and the TUCS Board

The board is the organ with the highest authority in TUCS. The board is led by the chairman (and the vice-chairman). The director of TUCS (and the vice-director) are responsible to the board, and are responsible for the activities of TUCS. Board meetings are held once each month on an average.

- Director: Prof. Timo Järvi, University of Turku, Dept. of Information Technology
- Vice-director: Prof. Kaisa Sere, Åbo Akademi University, Dept. of Computer Science

The board of the Turku Centre for Computer Science consists of professors from the participating departments, students and a representative from the local IT enterprises. During the year 2002 the board has had the following members:

- Chairman: Prof. Ralph-Johan Back, Åbo Akademi University, Dept. of Computer Science (deputy member Prof. Joakim von Wright)

- Vice-chairman: Prof. Reima Suomi, Turku School of Economics and Business Administration, Inst. of Information Systems Science (deputy member Prof. Hannu Salmela)
- Prof. Christer Carlsson, Åbo Akademi University, Inst. for Advanced Management Systems Research (deputy member Prof. Barbro Back)
- Ph.D. student Cristina Cerschi, Åbo Akademi University (deputy member Ph.D. student Sébastien Lafond)
- Managing director Tarmo Hahto (deputy member Director Teemu Hovi)
- Prof. Jouni Isoaho, University of Turku, Dept. of Information Technology (deputy member Prof. Risto Punkkinen)
- Prof. Juhani Karhumäki, University of Turku, Dept. of Mathematics (deputy member Prof. Mats Gyllenberg)
- Until October 10th 2002: M.Sc. student Jani Kupila, University of Turku (deputy member M.Sc. student Markus Turunen) followed by M.Sc. student Aija Hakala (deputy member M.Sc. student Aki Halonen)
- M.Sc. student Henri Latvanen, Turku School of Economics and Business Administration (deputy member M.Sc. student Julius Manni)
- Prof. Tapio Salakoski, University of Turku, Dept. of Information Technology (deputy member Prof. Markku Nurminen)
- Prof. Kaisa Sere, Åbo Akademi University, Dept. of Computer Science (deputy member Prof. Johan Lilius)

1.4.2 Advisory Committee

The TUCS Advisory Committee (TUCS AC) is an expert body consisting of representatives from the industrial and economic sectors within the field of Information Technology, the public sector and the universities. The Advisory Committee arranges four meetings per year, and its main task is to increase cooperation between TUCS and its external partners. During 2002 the Advisory Committee had 20 members and Managing Director Tarmo Hahto acted as the Chairman of the Committee. The members of the Advisory Committee are listed below:

- Hahto Tarmo, Business to Business Mediat Oy (chairman)
- Hovi Teemu, Sonera Oyj (vice chairman)

- Astola Jaakko, Tampere University of Technology, Signal Prosessing
- Broo Roger, Åbo Akademi University
- Bäckman Kari, B&B Solutions Oy
- Eerola Osmo, Telelogic Finland Oy
- Hyvönen Raimo, Turku Polytechnic
- Häyrynen Jouko, Nokia Mobile Phones
- Immonen Juha, Siemens Osakeyhtiö
- Kurki-Suonio Reino, Tampere University of Technology, Software Systems
- Lahesmaa Riitta, Centre of Biotechnology
- Lahoniitty Armas, The City of Turku
- Lehtinen Hannu, Ericsson
- Lönnberg Harri, the University of Turku, Organic Chemistry
- Nieminen Jorma, Benefon Oyj
- Olin Tim, Kuulalaakeri Ltd
- Rasila Matti, The City of Salo

- Ritakallio Ilkka, Teleste Corporation
- Salomaa Arto, TUCS
- Savo Juho, Regional Council of Southwest Finland (Varsinais-Suomen Liitto)

1.4.3 Master's School Workgroup

The Master's School workgroup handles most of the questions related to the Master's School. The main responsibilities are the coordination and planning of the project and the application procedure. The Master's School workgroup consists of representatives from the departments, faculties and other units involved with the Master's School project. The workgroup is headed by Prof. Jan Westerholm.

The members of the Master's School workgroup:

- Jan Westerholm, ÅA (Chairman)
- Gurli-Maria Gardberg, ÅA
- Markus Granlund, TuKKK
- Tua Henriksson, ÅA
- Pia-Maria Kallio, ÅA
- Jarkko Kari, TY
- Pia Le Grand, TUCS (Secretary)
- Tia Loukkola, TY
- Juha Plosila, TY
- Tapio Salakoski, TY
- Patrick Sibelius, ÅA
- Veronika Ståhlberg, TuKKK
- Franck Tétard, ÅA
- Jukka Teuhola, TY
- Heli Vilhonen, TY
- Britt-Marie Villstrand, ÅA

1.4.4 Educational Workgroups

The administrative work at TUCS is partly organized through workgroups. There are three educational workgroups whose preliminary task is to coordinate the education in their field: the Computer Engineering workgroup, the Computer Science workgroup and the Information Systems workgroup. The educational workgroups consist of teachers and professors from the participating departments, student representatives and administrative staff. The workgroups each arrange about four meetings per year. Minutes from the meetings can be found on the TUCS web pages at http://www.tucs.fi/About/Organization/Workgrp.php.

1.4.5 Graduate School Committee

The Graduate School committee handles most of the questions regarding the GS. The main responsibilities are the handling of study reports, the evaluation of Ph.D. applicants and deciding about principles concerning the supervision of students. The members of the Graduate School committee are professors (and supervisors) from the participating departments. The Committee is headed by Prof. Juhani Karhumäki.

The members of the Graduate School committee:

- Prof. Juhani Karhumäki, University of Turku, Dept. of Mathematics (Chairman)
- Prof. Barbro Back, Åbo Akademi University, Inst. for Advanced Management Systems Research
- Prof. Jouni Isoaho, University of Turku, Dept. of Information Technology
- Prof. Olli Nevalainen, University of Turku, Dept. of Information Technology
- Prof. Hannu Salmela, Turku School of Economics and Business Administration, Inst. of Information Systems Science
- Prof. Joakim von Wright, Åbo Akademi University, Dept. of Computer Science. Replaced by Prof. Kaisa Sere, Åbo Akademi University, Dept. of Computer Science

1.4.6 Research Laboratories

Until the beginning of 2001, the research at TUCS was organized in a number of research groups. As a result of the rapid expansion and the changes in the TUCS' role as a centre for research and education, it gradually became evident that the organization of the research needed to be restructured. Some of the research groups were very large and covered several research topics. This made it difficult to describe the research activities and point out the broad field of competence within TUCS. The structure did not encourage cooperation between researchers in the different departments participating in TUCS, and particularly not between researchers at different universities. Likewise, it seemed to be difficult to start up new research directions within the old structure.

To simplify the organization of the research at TUCS, it was in the beginning of 2001 decided to reorganize the research into a number of laboratories. A research laboratory consists of a group of researchers, typically between 10 and 30, within a well focused topic of research. A laboratory may be shared between two or more universities. Doctoral students within the TUCS Graduate School will all belong to a laboratory. The laboratories are also responsible for the advanced level education within their own field of research. The laboratories should try to find external funding for their research projects. TUCS decided also to support the laboratories by reserving 136.000 euros for this purpose for the year 2002.

TUCS Research Laboratories

- Algorithmics Laboratory
- Bioinformatics Laboratory
- Biomathematics Laboratory
- Data Mining and Knowledge Management Laboratory
- Discrete Mathematics for Information Technology Laboratory
- Distributed Systems Design Laboratory
- Embedded Systems Laboratory
- Health and Medical Informatics Institute
- High Performance Computing and Communication Laboratory
- Laboris Information Systems Laboratory
- Learning and Reasoning Laboratory
- Microelectronics Laboratory
- Mobile Commerce Laboratory

- Network Economics Institute
- Software Construction Laboratory
- Telecommunication and Digital Systems Laboratory

1.4.7 Software Development Centre

The Software Development Centre, the OK, was started as a co-operation between TUCS and the Turku polytechnic in the autumn 2000, and it become a part of TUCS on January 1st 2002. Its mission is to bridge the requirements of IT-companies' product development with the applied and scientific know-how of the universities and polytechnics in the area. The OK carries out software development projects together with industry, and employs students doing their thesis (both from TUCS and the polytechnic) as project workers. The main competence areas of the OK are embedded systems, broadband and computer networks, user interfaces and databases, as well as the quality and methods for practical software production process management.

1.5 Financing

The activities of TUCS are funded mainly by the Ministry of Education, the Academy of Finland, the municipalities and the three universities of Turku – the University of Turku, Åbo Akademi University and the Turku School of Economics and Business Administration.

The total funding for 2002 was 2,6 million euros (including the surplus from 2001). The Ministry of Education financed 29 Ph.D. student positions and the Academy of Finland financed three postdoctoral researcher positions. The Academy of Finland also appropriated TUCS 45.000 euros for researcher training courses (TUCS short courses) and for Ph.D. students´ conference trips. The appropriation from the Ministry of Education was 28 % of the total funding and the appropriation from the Academy of Finland was 5 %.

The municipalities' appropriation was 546.000 euros or 21 % of the total funding. The participating municipalities were Turku, Salo, Raisio, Kaarina, Naantali, Lieto and Uusikaupunki. The surplus from 2001 was 27 % of the total funding, which is a substantial amount.

The total expenses for year 2002 were 2,1 million euros. Of the total expences, 71 % were expenses for Salaries and grants (for Ph.D. students, Post Doc researchers, TUCS Staff). During the summer of 2002 TUCS arranged a Summer School on Specification, Verification and Refinement. The event was partly funded by the EU (39 %).

Some projects belonging to the Software Development Centre, which is a joint research unit of TUCS and the Turku Polytechnic, are included in the total expenses. The total expenses of these projects are 5 % of the total expenses.

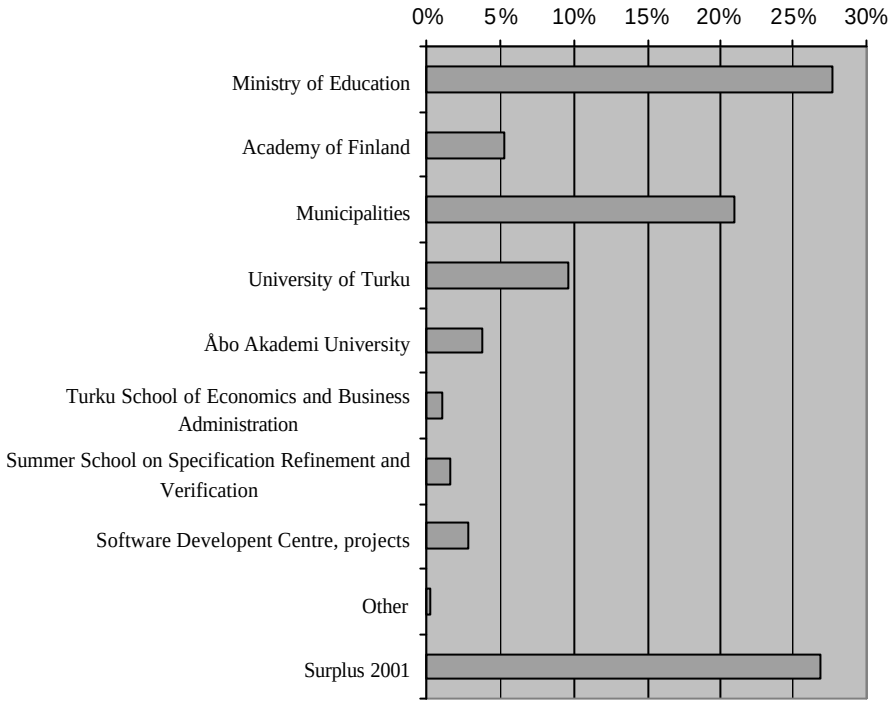

Figure 2. Incomes 2002, total 2,62 million €

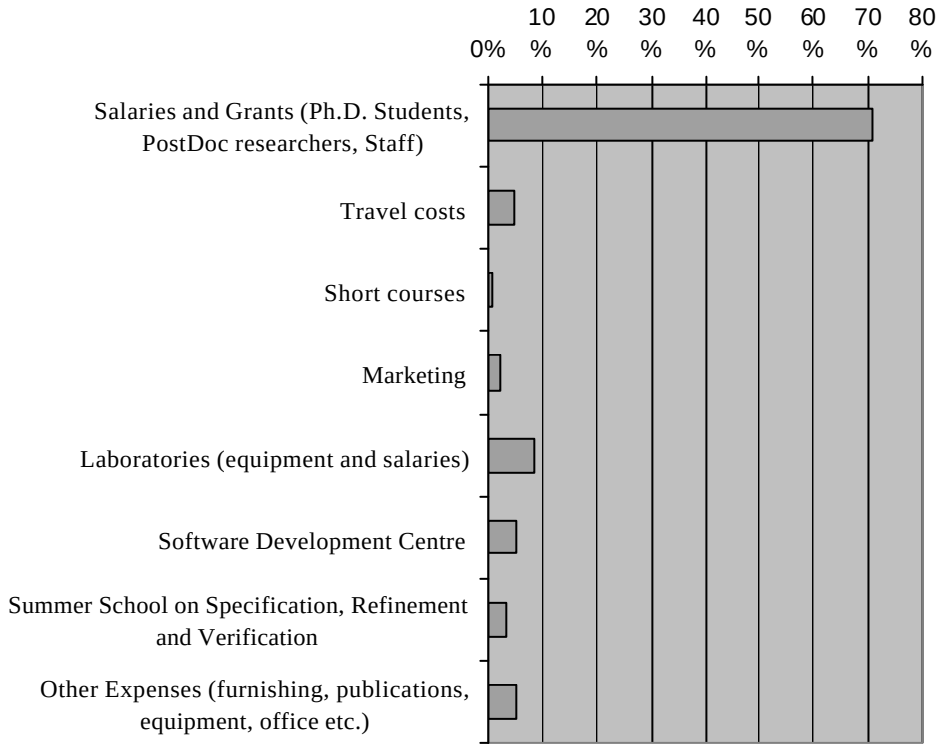

Figure 3. Expences 2002, total 2,11 million €

1.6 Facilities

TUCS and its Graduate School are situated in DataCity in the Turku Technology Centre, together with a number of other university departments and companies in computer and communication technology, electronics, biotechnology and material sciences.

Most of the participating departments are located in the same building: the Department of Information Technology at the University of Turku on the second and fifth floor, the Department of Computer Science at Åbo Akademi University on the third and fourth floor, the Institute of Information Systems Science at the Turku School of Economics and Business Administration on the third floor, the Department of Information Systems and the IAMSR at Åbo Akademi University on the sixth floor, and TUCS and its graduate school on the fifth floor. Only the Department of Mathematics at the University of Turku is located on the University hill, on about 10 minutes walking distance. The fact that all researchers and students at TUCS are located so close to each other has turned out to be a great asset, and helps to achieve cooperation and communication between the different units.

1.7 International Cooperation

TUCS is a founding member of the European Educational Forum (EEF), a joint initiative of European inter-universitary research schools in computer science. Since the beginning in 1997, the EEF has grown from originally three research organizations (BRICS, IPA and TUCS) to seven research schools involving 41 universities in Denmark, Finland, France, Germany, Italy, the Netherlands and the United Kingdom. The aim of the EEF is to organize training activities directed at Ph.D. students and young researchers from all over Europe. The research promoted by all research schools concerns basic research in Computer Science and its applications. The EEF is funded by the European Union. The EEF has so far organized 19 summer schools or workshops in computer science, of which four have been organized by TUCS.

In May 2002 the Department of Mathematics at the University of Turku arranged a workshop on Automata, Words and Logic and the Institute for Advanced Management Systems Research at Åbo Akademi University arranged a workshop on Real Options.

The third International Conference on Integrated Formal Methods (IFM 2002) was arranged in May by the Department of Computer Science at Åbo Akademi. 49 researchers attended the conference.

In July 2002 the Department of Information Technology at the University of Turku arranged the eighth Scandinavian Workshop on Algorithm Theory (SWAT 2002) with 87 participants. The web pages for the conference were awarded a shared second prize in a competition among web sites for conferences held in Finland during 2002.

In August 2002, the EEF Foundations School on Specification, Refinement and Verification was arranged in Turku for the second time. An EEF Summer School with the same theme was also arranged in Turku in 1998. The summer school gathered 59 participants (and 13 lecturers).

2 TUCS Master's School

The TUCS Master's School was established in the autumn of 2002 and presently consists of four master's programs. These two-year master's programs, which are taught in English, are awarded by a Finnish Master's degree from one of the participating universities. Prerequisites are a Bachelor's degree equivalent to a Finnish university Bachelor's degree in a relevant field and a certificate of knowledge of English. There are no tuition fees for the Master's School, but the Student Union membership is compulsory for Master's degree students.

TUCS main role within the Master's School project is to coordinate the planning of the Master's School project, provide for information about the Master's School - mainly on the Internet and through e-mail - as well as to coordinate the application procedure. All applications to the master's programs arrive at the TUCS office, from where they are distributed to the universities after the deadline.

The master's programs within the Master's School are:

- Master's Program in Information Technology (University of Turku, Faculty of Mathematics and Natural Sciences, Dept. of Information Technology and Dept. of Mathematics)
    - Computing
    - Electronics and Communication Systems
    - Mathematics
- Master's Program in Software Engineering (Åbo Akademi University, Faculty of Mathematics and Natural Sciences, Dept. of Computer Science)
- Master's Program in Electronic and Mobile Commerce (Åbo Akademi University, Faculty of Economics and Social Sciences, Dept. of Information Systems)
- Master's Program in Global IT Management (Turku School of Economics and Business Administration, Dept. of Management, Inst. of Information Systems Science)

The academic year begins on the 1st of August and ends on the 31st of July. Lectures are given from the beginning of September to the end of May. Course examinations are usually concentrated to the end of the terms

3 TUCS Graduate School

The Graduate School of the Turku Centre for Computer Science (TUCS) offers a framework for studying for the Doctoral (Ph.D.) degree in Computer Science, Mathematics, Information Systems, Computer Engineering, Communication Systems, and Microelectronics. It is open for students from everywhere. Prerequisites are either a Master's or a Bachelor's degree in a relevant field. Study time is expected to be four years.

The Graduate School offers supervision of students within existing research projects: each student is assigned a personal supervisor from one of the five departments participating in TUCS. The students can attend all advanced level courses within the field of Information Technology offered by the participating departments. The language of instruction of these advanced level courses is English.

3.1 Curriculum Requirements

The curriculum for the Master's degrees and the Doctor's degrees follow the Finnish standard requirements. The Ph.D. degree normally requires a Master's degree.

The Master's degree requires 40 credits in addition to the Bachelor's exam. A part of these credits are obtained by taking courses and part by writing a Master's thesis. For the Ph.D. degree, in addition to the Master's degree, the student must take 40 credits of courses and carry out research leading up to a Ph.D. thesis.

The students within the TUCS Graduate School are expected to take courses from at least two of the research areas represented in TUCS.

3.2 Application Procedure

The deadline for applications is twice a year: May 15th for studies starting in September, and September 30th for studies starting in January. Students applying to the TUCS Graduate School can apply for a student position within the Graduate School with or without financing from TUCS.

The applications are first examined by the Graduate School Committee, on whose recommendations the TUCS board makes the decisions on which applicants can get funding from the Graduate School or from a department's research project, and which ones can accepted to the Graduate School without funding (these get the "TUCS status"). The decisions about admittance for Ph.D. studies are made by the Faculties.

Prerequisites for the Graduate School are a Master's or a Bachelor's degree in a relevant field (Computer Science, Mathematics, Information Systems, Computer Engineering, Communication Systems, or Microelectronics). A certificate of knowledge of English is required for applicants outside Finland.

3.3 Financing the Studies

Students can be accepted to the TUCS Graduate School with or without financing.

The Graduate School offers a number of grants for students from abroad. The grant is sufficient to cover housing and basic living expenses. Doctoral students from Finland or the European Union and are paid a salary, which after taxes is equivalent to the grant.

Maximum time for funding is four years. The funding is conditional: it is given for one year at a time and it is based on the progress made by the student. Each year the students submit a Study Report, which measures their study progress during the past year. The Study Report also includes a statement from the supervisor about the student's work.

There are no tuition fees for the Graduate School.

3.4 New Students 2002

The following 24 new Ph.D. students began their studies at the TUCS Graduate School in 2002:

- *Arvo, Jukka,* M.Sc. (Computer Science) from Univ. of Turku, Finland.
- *Bergroth, Lasse,* M.Sc. (Computer Science) from Univ. of Turku, Finland.
- *Collan, Mikael,* Master of Social Sciences (Economics) from Åbo Akademi Univ., Finland.
- *Eklund, Tomas,* Master of Economic Sciences (Information Systems) from Åbo Akademi Univ., Finland.
- *Enqvist, Henrik*. M.Sc. in Technology (Computer Engineering) from Åbo Akademi Univ., Finland.
- *Isaksson, Joakim,* M.Sc. in Technology (Computer Engineering) from Åbo Akademi Univ., Finland.
- *Kadyté, Vaida*, M.Sc. in Management from Kaunas Univ. of Technology, Lithuania.
- *Marghescu, Dorina,* M.Sc. in Economics from Academy of Economic Studies, Romania.
- *Nikkanen, Anu*, M.Sc (Mathematics) from Univ. of Turku, Finland.
- *Okunoye, Adekunle*, M.Sc. (Computer Science) from Univ. of Jyväskylä, Finland.
- *Ping, Yan*, M.Sc (Mathematics) from Su Zhou Univ., China.
- *Sell, Anna*, Master of Economic Sciences (Information Systems) from Åbo Akademi Univ., Finland.
- *Steinby, Paula*, M.Sc (Mathematics) from Univ. of Turku, Finland.
- *Auranen, Esa*, M.Sc (Mathematics) from Univ. of Turku, Finland.
- *Czeizer, Eugen*, B.Sc. (Computer Science) from Univ. of Bucharest, Romania.
- *Kärki, Tomi*, M.Sc (Mathematics) from Univ. of Turku, Finland.
- *Petre, Elena*, B.Sc. (Computer Science) from Univ. of Bucharest, Romania.
- *Hakkarainen, Tuomas*, M.Sc. (Mathematics) from Univ. of Turku, Finland.
- *Hirkman, Piia*, Master of Economic Sciences (Information Systems) from Åbo Akademi Univ., Finland.
- *Virkki, Arho,* M.Sc. in Engineering (Technical mathematics), Tampere Univ. of Technology, Finland.

- *Piirainen, Ville*, M.Sc (Mathematics) from Univ. of Turku, Finland.
- *Shestakov, Denis*, B.Sc. (Computer Science) from Moscow Institute of Physics and Technology

In addition to the above-mentioned students, the 3 following Ph.D. students were granted a student status (without financing) within the TUCS Graduate School:

- *Gyllenberg, Robert.* M.Sc. in Technology (Computer Engineering) from Åbo Akademi Univ., Finland.
- *Vilola, Matti*. M.Sc. in Engineering (Business Economics), Tampere Univ. of Technology, Finland.
- *Olofsson, Svante.* M.Sc. (Computer Science) from Åbo Akademi Univ., Finland.

4 Research

The TUCS researchers come from the areas of Computer Science, Mathematics, Information Systems, and Electronics and Telecommunication. The focus of research is on Information Technology. The main areas of research at TUCS are:

- Algorithmics (A)
- Discrete Mathematics (DM)
- Electronics and Telecommunication (ETC)
- Embedded Systems (ES)
- Information Systems (IS)
- Mathematical Modeling (MM)
- Software Engineering (SE)

The research at TUCS is organized in sixteen research laboratories. The laboratories are independent and choose their own research topics. The research laboratories are organized around one to three professors and in addition to that consist of senior researchers, postdoctoral researchers, Ph.D. students and M.Sc. students. Many of the research groups get external funding from the Academy of Finland (basic research), TEKES (industrial applied research) or directly from the industry. A principle of matching external funding is followed in allocating TUCS funding to the research laboratories, in particular what comes to Ph.D. students and postdoctoral positions. The TUCS internal funding thus favors those research laboratories that are successful in competing for external funding. The laboratories provide supervision both for Ph.D. and M.Sc. students, and are also responsible for teaching advanced level courses within their own specific research area.

The research laboratories at TUCS are listed below. More detailed information about the laboratories is provided by the leaders of the groups, and can be found at the TUCS home pages.

4.1 Algorithmics Laboratory

The research of the Algorithmics laboratory is centered around techniques and methods for algorithm design and analysis, with the emphasis on both theory and applications. The foundation of the research is discrete mathematics and theoretical computer science. In particular, research of combinatorial algorithms, parallel algorithms, algorithms for computer games, graphics and compression methods have been pursued. The laboratory is based on the long tradition of active co-operation with Finnish companies and research institutes on solving real-life problems by the use of combinatorial optimization and latest techniques on software development. The following 11 key areas are covered:

- Combinatorial algorithms and applications
- Text, dictionary and image compression
- String algorithms
- Database structures and search methods for databases
- Industrial algorithms
- Constraint programming

- Parallel machines and algorithms
- Clustering Methods
- Analysis of biomedical signals
- Data Mining
- Computer games
- Embedded algorithms

Laboratory Leaders
Prof. Olli Nevalainen
Prof. Risto Lahdelma

Professors
Timo Knuutila
Risto Lahdelma
Ville Leppänen
Olli Nevalainen
Jukka Teuhola

Researchers
Tero Aittokallio
Esa Alhoniemi
Jouni Smed

Ph.D. Students
Jukka Arvo
Lasse Bergroth
Marius Codrea
Attila Gyenesei
Harri Hakonen
Mika Hirvikorpi
Antero Järvi
Jarno Kansanaho
Mika Keränen
Juha Kivijärvi
Markus Kurki
Joonas Lehtinen
Jussi Salmi
Kari Salonen
Teemu Tasanto

4.2 Bioinformatics Laboratory

The laboratory's purpose is to practice algorithmic and software-oriented bioinformatics research, and, in collaboration with the bioinformatics group at the Turku Centre for Biotechnology, to develop and maintain key bioinformatics and functional genomics methods and tools. The laboratory encourages collaboration between bioscientific and IT research at the University of Turku and Åbo Akademi University, and contributes to the development and implementation of the bioinformatics curricula at TUCS and the participating faculties, in collaboration with the Institute of Medical Technology, University of Tampere.

Research topics

- Analysis of functional genomics and related data
- Data mining and knowledge discovery from biological text
- Development of biological databases and analysis tools
- Mobile bioinformatics: wireless access to biological databases and bioinformatics services

Laboratory Leader
Prof. Tapio Salakoski

Researchers
Esa Alhoniemi
Jorma Boberg
Jouni Järvinen
Chang-Sik Kim
Alexandr Mylläri

Ph.D. Students
Esa Auranen
Filip Ginter
Markus Kurki
Mika Laaksonen
Eija Nordlund
Tapio Pahikkala
Pentti Riikonen
Denis Shestakov
Timo Viljanen

4.3 Biomathematics Laboratory

The group has done research in many diverse areas of biomathematics. Here we mention only (1) the mathematical theory of population dynamics (especially structured populations and metapopulations) with applications to ecology with special attention to conservation biology; (2) adaptive dynamics, i.e., the interaction between population dynamics, evolutionary dynamics and the physical environment; (3) the mathematical foundations of taxonomy and the development of classification algorithms; (4) modelling and analysis of physiological phenomena with applications to treatment of heart rate variability and sleep apnea.

Here are a few research problems (related to (3) above) that will be addressed in the near future:

1. To develop probabilistic models for classification and analysis of information and to detect hidden structures in large data sets.
2. To perform rigorous mathematical analysis of Bayesian Models and Hidden Markov Models.
3. To derive asymptotic properties of taxonomies. This means that we analyse the structure of the resulting taxonomy when either the training set or the material to be classified (or both !) becomes large.

4. To develop machine learning techniques and programs for taxonomical purposes.
5. To apply the mathematical classification methods and results to real microbiological data and thereby
   a. improve the definition of bacterial species, based on different fingerprinting techniques and computational methods, with a view to understanding biodiversity and devising a universal species concept,
   b. detect significant structures, like families or tree structure, in the data.

Laboratory Leader
Prof. Mats Gyllenberg

Senior researchers
Timo Leipälä
Heikki Ruskeepää
Stefan Geritz
Eva Kisdi

Post doc researchers
Tero Aittokallio
Kalle Parvinen

Ph.D. Students
Jarmo Hemminki
Diana Ion
Jorma Jaakkola
Nelly Noikova
Ville-Veikko Rantanen
Ping Yan

4.4 Data Mining and Knowledge Management Laboratory

The focus of research is on developing, implementing and evaluating new methods for data mining and knowledge management. We also conduct practical implementation studies in organizations.

Research topics
- Data mining
- Knowledge management
- Self-organizing maps
- Financial benchmarking
- Text mining
- Text retrieval
- Contents-based search

Laboratory Leader
Prof. Barbro Back

Professors
Inger Eriksson

Eija Karsten
Kaisa Sere

Researchers
Iulian Nastac

Ph.D. Students
Adrian Costea
Tomas Eklund
Piia Hirkman
Erkki Innola
Minna Kallio
Jonas Karlsson
Antonina Kloptchenko
Eija Koskivaara
Dorina Marghescu
Adekunle Okunoye

4.5 Discrete Mathematics for Information Technology Laboratory

The two major research areas are automata theory (in a broad sense) and coding theory. More concrete topics are:

- Decidability questions
- Automata theory and term rewriting
- Combinatoric on Words
- Cellular automata with applications
- Cryptography, in particular protocols and applications to industry
- Coding theory with applications
- Graph theory
- Quantum computing

Laboratory Leader
Prof. Juhani Karhumäki

Professors
Arto Salomaa (emeritus)
Magnus Steinby
Jarkko Kari

Senior Researchers
Jyrki Lahtonen
Iiro Honkala
Tero Harju
Juha Honkala

Junior researchers
Ari Renvall
Eija Jurvanen

Tero Laihonen
J. Järvinen
Tatjana Petkovic

Ph.D. Students
Arto Lepistö
Mika Hirvensalo
Vesa Halava
Ion Petre
Jan Manuch
Tommi Meskanen
Matti Rönkä
Paula Steinby
Saeed Salehi
Dirk Nowotka
Gordon Alford
Kalle Ranto
Sanna Ranto
Petri Rosendahl
Jarkko Hiltunen

4.6 Distributed Systems design Laboratory

In many distributed systems, especially different types of control and embedded systems, both the hardware and the software are important to ensure reliability. Since the software runs in constant interaction with the hardware their interactions are also an intrinsic part of the software behavior. The division line between what will be implemented on hardware and what will be implemented on software is less clear at the early stages of the design. Moreover, systems get more integrated. Reliability of such computer-based systems can be achieved only if rigorous methods are used already at the system level. Within the laboratory we study and propose methods, techniques, and tools for building correct and reliable distributed systems and software to support the design of both hardware and software (using software methods).

Research topics

- Design methodology for distributed systems
- Component-based design approaches
- Distributed systems with mobile components
- Design and analysis of hybrid systems
- Design methodology for asynchronous and synchronous as well as mixed asynchronous/synchronous circuits
- Methodology for SoC design
- Integration of informal or semi formal notations and methods like UML and VHDL with formal notations within different phases of system design
- Coordination paradigm in the overall software architecture and its use in formal systems engineering
- Safety analysis techniques and their role as an integral part of formal systems engineering

- Asynchronous communication paradigm for components in general and for embedded systems in particular

Laboratory Leader
Prof. Kaisa Sere

Researchers
Zheng Liang
Juha Plosila
Tiberiu Seceleanu
Elena Troubitsyna
Marina Walden

Ph.D. Students
Pasi Liljeberg
Luigia Petre
Rimvydas Ruksenas
Johanna Tuominen
Maryam Varfan
Tomi Westerlund
Lu Yan

4.7 Embedded Systems Laboratory

The main research areas of the laboratory are:
- Methods for co-design of systems with heterogenous models of computation
- Object-oriented methods for designing embedded systems
- Java for embedded systems
- Networked embedded devices

Laboratory Leader
Prof. Johan Lilius

Professors
Risto Lahdelma
Johan Lilius

Ph.D. Students
Jukka Arvo
Dag Björklund
Henrik Enqvist
Robert Gyllenberg
Juha Kivijärvi
Sébastien Lafond
Jonas Munsin
Dragos Truscan
Seppo Virtanen

4.8 Health and Medical Informatics Laboratory

Main areas of activity are currently:

Medical informatics

TY

- Computer assisted medical diagnosis
- Recognition, analysis and compression of imaging or signal data
- Computer-assisted diagnosis of medical images
- Data mining in medical data

Health informatics

TY

- Evaluation of health information systems
- Organisational implementation of health information systems
- IT support for the care chain
- IT in evolving work practices in health care
- Mobile IT in home care
- IT in working life health care

TuKKK

- Usability of health care information systems
- Evaluation of health care information systems
- Providing service and activities through internet and e-commerce
- Strategic information systems planning and assessment for health care organisations

Laboratory Leader
Prof. Timo Järvi

Professors
Timo Järvi
Eija Karsten
Olli Nevalainen
Markku Nurminen
Reima Suomi

Senior researchers
Mehran Gomari
Jarmo Tähkäpää

Junior researchers
Aija Laine
Sami Laine
Thomas Hughes

4.9 High Performance Computing and Communication Laboratory

Research description
The laboratory does research in both software and hardware related issues in high performance computing. Traditionally this has been the study of parallel systems, but here the concept of high performance computing has been enlarged to contain any computationally intensive system where due to hardware or software limitations the cost of computation in time, memory, power, etc., becomes unacceptably high. The focus of our studies is on the performance of computer systems.

Research topics
- parallel computing clusters, cluster performance
- computer graphics: algorithms, hardware performance

Laboratory Leader
Prof. Jan Westerholm

Researchers
Mats Aspnäs
Xinrong Zhou

Ph.D. Students
Jukka Arvo (University of Turku)

4.10 LABORIS Information Systems Laboratory

Research description
The mission of LABORIS is to find and spread new ways of improving the usability of Information Systems (IS) in organisational business context. This is accomplished by developing methodologies and by marketing services for evaluating the usability of information systems in different organisational settings and from different perspectives.

Laboratory Leader
Prof. Markku Nurminen

Professors
Inger Eriksson
Eija Karsten

Researchers
Satu Aaltonen
Pekka Reijonen

4.11 Learning and Reasoning Laboratory

Main activities:

- Research in Computer Science Education
- Research in building and applying Educational Technology
- Coordinating the Computer Science Teacher specialisations (TY, ÅA)
- Development of distance education within the Professional Upgrading programmes and Open University (ÅA, TY)
- Development of a virtual undergraduate Computer Science curriculum
- Development of learning environments for use in education, industry and business
- Methodological and technological support for course development within TUCS, for selected courses especially in new field

Laboratory Leader
Prof. Joakim von Wright

Professors
Tapio Salakoski

Researchers
Åke Gustavson
Jorma Boberg

4.12 Microelectronics Laboratory

The focus is on system on package design and manufacturing technology. Packaging technology and design is an emerging area in the laboratory. Physical architecture of interconnects and integrated circuits is rapidly gaining significance such that greater attention has to be directed to signal path optimization crosstalk and interconnect design.

One of main interests is production of special silicon structures for light production by electroluminescence to produce light emitting structures in normal IC-(cmos) technology.

Sensor technology: the laboratory has been manufacturing special large area particle detectors in cooperation with HIP (Helsinki Institute of Physics) and MIL (Mircoelectronics Instrumentation laboratory, University of Oulu). Our laboratory is one of the few laboratories in Finland where real silicon processing can be carried out.

Laboratory Leader
Lect. Risto Punkkinen

Senior researchers
Lauri Heikkilä
Tom Kuusela
Juhani Peltonen
Hannu Tenhunen
Esa Tjukanoff

Junior researchers
Hannu-Pekka Hedman
Mika Hirvonen
Miika Meretoja
Mikko Mäkelä
Tero Nurmi
Teemu Peltonen
Teppo Stenholm
Tommi Torikka

4.13 Mobile Commerce Laboratory

The research of the laboratory is focusing on finding new, effective products and services, which will both offer significant value added substance to the customers and means for companies to build a growing profitable business.

The following research objectives have been specified:

- Find, identify potential customer groups for fast-growing value added mobile e-commerce
- Design, develop and implement mobile e-commerce solutions for selected customer groups
- Test and evaluate systems solutions for integrated production and distribution of m-commerce products and services. Find bottlenecks and modify and enhance service capacity with intelligent information systems and agent technology
- Design and test value added user interfaces and user support systems for mobile e-commerce customers
- Find value added services for customer groups and evaluate them; test the service concepts in different potential markets; revise or design services

The laboratory is working on both (i) theory-oriented research in user interfaces, software agents technology and support systems, and (ii) applied research, which is focused on planning and problem solving with corporate partners.

Laboratory Leader
Prof. Pirkko Walden

Professors
Christer Carlsson

Researchers
Bill Anckar
Shuhua Liu

Ph.D. Students
Chihab Benmoussa
Shenghan Han
Ville Harkke
Vaida Kadyte

Pär Landor
Anas Lanedri
Svante Olofsson
Ruggero Rossi de Mio
Anna Sell

4.14 Network Economics Laboratory

Information systems science is a field of science that studies utilisation of information and communication technology (ICT) in enterprises and other organisations. In the Turku School of Economics and Business Administration information systems research has been conducted in the following areas:

- Strategic planning of information systems
- Network economics
- Health-care information systems
- Decision and learning support systems
- IT-management
- IS self use management

Typical research method is action research, in which the researchers participate in the development of information systems in enterprises or organizations. The researchers bring their outsider's perspective and theoretical knowledge to facilitate the development systems and user processes. At the same time they aim to create publicly usable methods to plan, develop and use information systems.

Laboratory Leader
Prof. Hannu Salmela

Professors
Reima Suomi
Jussi Puhakainen
Timo Leino

Ph.D. Students
Jonna Järveläinen
Olli Järvinen
Eija Koskivaara
Juha Kontio
Tuomas Laiho
Timo Lainema
Jussi Nissilä
Lauri Salmivalli
Victor Tsygankov
Jarmo Tähkäpää

4.15 Software Construction Laboratory

The research of the laboratory centers around techniques and methods for software construction. This includes software analysis and design methods, programming methods, languages and environments and the software construction process at large. Particular emphasis is put on the construction of highly reliable and functionally correct software systems.

- Software processes and methods
- The use of UML in software analysis and design
- Software construction tools
- Object-oriented programming (methods, theory, semantics, correctness)
- Programming logics (program correctness, semantics, program refinement)
- Different kinds of programming paradigms (concurrent systems, hybrid systems, interactive systems, etc.)

Laboratory Leaders
- Ralph-Johan Back and Ivan Porres

Professor
- Ralph-Johan Back

Acting Professor
- Ivan Porres

Researchers
- Victor Bos

Ph.D. Students
- Cristina Cershi
- Joakim Isaksson
- Luka Milovanov
- Luigia Petre
- Viorel Preoteasa
- Marcus Alanen

Undergraduate Students
- Miika Hakala
- Petri Mannila
- Sergio Palomo
- Linus Bernas
- Peter Eriksson

4.16 Telecommunication and Digital Systems Laboratory

The focus of the laboratory is to develop key enabling technology needed for designing and implementing future communication and computation systems. This includes integration of wireless and wired communication infrastructures with dynamic system implementation techniques and platforms. System design methodologies cover both functional and physical design and modelling issues. The laboratory cooperates actively with Tampere University of Technology and the Royal Institute of Technology (Stockholm, Sweden).

Research topics

- Advanced radio systems design and implementation
- Future communication and computing methods and platforms
- Formal system modelling and refinement
- SoC communication platforms
- Asynchronous, self-timed circuit techniques
- System design methodologies for nano-scale systems
- Dynamic reconfigurable systems
- Physical performance modelling and noise analysis

Laboratory Leader
Prof. Jouni Isoaho

Professors
Valery Ipatov
Hannu Tenhunen

Researchers
Harri Arvela
Imed Ben Dhaou
Afshin David
Juhani Peltonen
Juha Plosila
Tiberiu Seceleanu

Ph.D. Students
Petri Isomäki
Tommi Laine
Pasi Liljeberg
Tero Nurmi
Sami Nuuttila
Jarkko Paavola
Tero Säntti
Sampo Tuuna
Tuomas Valtonen
Seppo Virtanen
Tomi Westerlund

5 Personnel

In the following section, the personnel of the departments participating in TUCS, is presented. In addition to the personnel at the departments, TUCS also has its own administrative staff (presented in the end of this section),

5.1 Faculty

The faculty of TUCS consists of professors, lecturers and assistant professors working at the departments participating in TUCS. The present faculty is listed below, with their affiliation, e-mail address and research interests.

Afshin David, Assistant Professor at the University of Turku, Electronics and Information Technology. E-mail: afshin.david@utu.fi. Research interests: DSP algorithms.

Bill Anckar, Researcher at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: banckar@abo.fi. Research interests: electronic commerce, marketing in travel & tourism.

Harri Arvela, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: harri.arvela@utu.fi. Research interests: digital signal processing, thin film and sensor technology.

Mats Aspnäs, Acting Professor at Åbo Akademi University, Department of Computer Science. E-mail: mats@abo.fi. Research interests: parallel programming, programming tools and environments for parallel systems, applications of parallel programming.

Barbro Back, Professor at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: bback@abo.fi. Research interests: accounting information systems, neural networks, genetic algorithms, electronic commerce.

Ralph-Johan Back, Professor at Åbo Akademi University, Department of Computer Science. E-mail: backrj@abo.fi. Research interests: programming methodology, formal methods, parallel and distributed programming. On leave of absence 1.8.02-31.7.07.

Lasse Bergroth, Lecturer at the University of Turku, Computer Science. E-mail: bergroth@cs.utu.fi.

Jerker Björkqvist, Assistant Professor at Åbo Akademi University, Department of Computer Science. E-mail: jerker.bjorkqvist@abo.fi.

Jorma Boberg, Lecturer at the University of Turku, Computer Science. E-mail: jorma.boberg@cs.utu.fi. Research interests: bioinformatics, clustering algorithms and analysis, classification and prediction of protein structures.

Christer Carlsson, Professor at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: ccarlsso@abo.fi. Research interests: knowledge-based systems, fuzzy logic and multi criteria decision making.

Patrik Eklund, Professor at the Umeå University, Department of Computing Science, Sweden. Professor at Åbo Akademi University, Department of Computer Science, 1.8.02-31.7.03. E-mail: peklund@cs.umu.se. Research interests: fuzzy systems, information system application, neural networks.

Inger Eriksson, Professor at the University of Turku, Computer Science. Research interests: information systems. Retired 1.7.2002.

Markus Granlund, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: markus.granlund@tukkk.fi. Research interests: management accounting, accounting information systems, ERP-systems.

Mats Gyllenberg, Professor at the University of Turku, Department of Mathematics. E-mail: mats.gyllenberg@utu.fi. Research interests: mathematical biology in particular population dynamics, ecology, taxonomy and molecular biology.

Erkki Innola, Lecturer at the University of Turku, Computer Science. E-mail: erkki.innola@it.utu.fi.

Jouni Isoaho, Professor at the University of Turku, Electronics and Information Technology. E-mail: jouni.isoaho@utu.fi.

Timo Järvi, Professor at the University of Turku, Computer Science. E-mail: jarvi@it.utu.fi. Research interests: computer architecture, medical informatics.

Jouni Järvinen, Lecturer at the University of Turku, Computer Science. E-mail: jouni.jarvinen@cs.utu.fi. Research interests: mathematic logic, bioinformatics.

Juhani Karhumäki, Professor at the University of Turku, Department of Mathematics. E-mail: karhumak@cs.utu.fi. Research interests: formal languages and automata, cryptography, combinatorics in words, decidebility questions.

Eija Karsten, Professor at the University of Turku, Computer Science. E-mail: eija.karsten@cs.utu.fi. Research interests: information systems, IT and work.

Kai Kimppa, Senior Assistant at the University of Turku, Computer Science. E-mail: kai.kimppa@utu.fi.

Vladimir Kvassov, Assistant Professor at Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: vkvassov@abo.fi. Research interests: knowledge management, IT and productivity, IT to support decision-making, information system personalization.

Timo Knuutila, Professor at the University of Turku, Computer Science. E-mail: timo.knuutila@it.utu.fi. Research interests: logic programming, automata, machine learning.

Risto Lahdelma, Professor at the University of Turku, Computer Science. E-mail: risto.lahdelma@it.utu.fi. Research interests: embedded optimization systems, large-scale software engineering tools, decision support.

Ville Leppänen, Professor at the University of Turku, Computer Science. E-mail: ville.leppanen@it.utu.fi. Research interests: parallelism, routing and embedding problems, object-oriented programming languages.

Johan Lilius, Professor at Åbo Akademi University, Department of Computer Science. E-mail: johan.lilius@abo.fi. Research interests: model checking, hardware/software co-design, theory of distributed systems, petri nets, foundations of concurrent object oriented programming, formal methods.

Ilpo Lindfors, Lecturer at the University of Turku, Computer Science. E-mail: ilpo.lindfors@it.utu.fi.

Shuhua Liu, Assistant professor at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: sliu@abo.fi. Research interests: business applications of intelligent agents, information extraction, text understanding, intelligent data analysis, applications of fuzzy logic, mobile services for working parents.

Olli Nevalainen, Professor at the University of Turku, Computer Science. E-mail: olli.nevalainen@it.utu.fi. Research interests: algorithmics.

Markku Nurminen, Professor at the University of Turku, Computer Science. E-mail: markku.nurminen@it.utu.fi. Research interests: information systems.

Tomi Pasanen, Lecturer at the University of Turku, Computer Science. E-mail: tomi.pasanen@cs.utu.fi. Research interests: algorithmics, bioinformatics.

Juhani Peltonen, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: juhani.peltonen@utu.fi. Research interests: Processor systems, neural networks.

Aulis Pirinen, Research Director at Åbo Akademi University, Department of Computer Science. E-mail: aulis.pirinen@abo.fi.

Juha Plosila, Assistant professor at the University of Turku, Electronics and Information Technology. E-mail: juha.plosila@utu.fi. Research interests: ULSI design and formal methods.

Risto Punkkinen, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: risto.punkkinen@utu.fi. Research interests: Semiconductor technology, particle/radiation detectors.

Timo Raita, Professor at the University of Turku, Computer Science. Deceased. Research interests: data compression methods.

Tapio Reponen, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science (on leave for rectorship). E-mail: tapio.reponen@tukkk.fi. Research interests: information systems strategies, management of IS function.

Mauno Rönkkö, Lecturer at the University of Turku, Computer Science.

Tapio Salakoski, Professor at the University of Turku, Computer Science. E-mail: tapio.salakoski@it.utu.fi. Research interests: bioinformatics, computer science education, object oriented programming.

Hannu Salmela, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: hannu.salmela@tukkk.fi.

Jussi Salmi, Lecturer at the University of Turku, Computer Science. E-mail: jussi.salmi@cs.utu.fi. Research interests: algorithmics, medical data analysis, artificial intelligence, neural networks.

Arto Salomaa, Academician (Professor emeritus) at the University of Turku, Department of Mathematics. E-mail: asalomaa@utu.fi. Research interests: formal languages, automata, cryptography.

Tiberiu Seceleanu, Assistant professor at the University of Turku, Electronics and Information Technology. E-mail: tiberiu.seceleanu@utu.fi. Research interests: Formal methods and SoC design.

Kaisa Sere, Professor in Computer Science and Engineering at Åbo Akademi University, Department of Computer Science. E-mail: kaisa.sere@abo.fi. Research interests: formal methods, parallel and distributed systems.

Magnus Steinby, Professor at the University of Turku, Department of Mathematics. E-mail: steinby@utu.fi. Research interests: automata, universal algebra, mathematical logic.

Reima Suomi, Professor at the Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: reima.suomi@tukkk.fi. Research interests: inter-organizational information systems, telecommunications management.

Aimo Tietäväinen, Professor emeritus at the University of Turku, Department of Mathematics. E-mail: tietavai@cs.utu.fi. Research interests: coding theory.

Jukka Teuhola, Professor at the University of Turku, Computer Science. E-mail: jukka.teuhola@it.utu.fi. Research interests: databases, algorithmics.

Esa Tjukanoff, Lecturer at the University of Turku, Electronics and Information Technology. E-mail: esa.tjukanoff@utu.fi. Research interests: SoP technology and modelling.

Elena Troubitsyna, Assistant Professor at Åbo Akademi University, Department of Computer Science. E-mail: elena.troubitsyna@abo.fi.

Antti Tuomisto, Lecturer at the University of Turku, Computer Science. E-mail: antti.tuomisto@cs.utu.fi. Research interests: information systems.

Aimo Törn, Professor emeritus at Åbo Akademi University, Department of Computer Science. E-mail: atorn@abo.fi. Research interests: simulation methodology, global optimization, software quality.

Joakim von Wright, Professor at Åbo Akademi University, Department of Computer Science. E-mail: jwright@abo.fi. Research interests: programming methodology, mechanical verification. On leave of absence 1.8.02-31.7.03.

Marina Waldén, Assistant Professor at Åbo Akademi University, Department of Computer Science. E-mail: marina.walden@abo.fi.

Pirkko Walden, Professor at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: pwalden@abo.fi. Research interests: strategic management, knowledge-based systems, electronic commerce.

Xinrong Zhou, PhD, Assistant Professor at Åbo Akademi University, Department of Computer Science. E-mail: xinrong.zhou@abo.fi.

5.2 Collaboration Partners

The adjunct faculty of TUCS consists of researchers (doctors) who are actively involved in the research and teaching at TUCS but which do not directly belong to any of the research groups of TUCS.

Malin Brännback, Research Director, D.Sc (Econ. & Bus. Adm.) and B.Sc. (Pharm.) at the Turku School of Economics and Business Administration / Innomarket Unit. E-mail: malin.brannback@tukkk.fi.

Jyrki Katajainen, Docent at the University of Turku, Computer Science, from University of Copenhagen (Professor). E-mail: jyrki@diku.dk. Research interests: algorithmics.

Timo Koski, Professor at the University of Linköping, Sweden. E-mail: tikosk@mai.liu.se Research interests: classification algorithms, probability.

5.3 Researchers

The following researchers (doctors) are actively involved in TUCS and its Graduate School, as members of research teams and as supervisors of M. Sc. and Ph. D. studies.

Luis Alvarez, Professor at the Turku School of Economics and Business Adminitration. E-mail: alvarez@tukkk.fi. Research interests: diffusion processes, stochastic calculus, mathematical finance, comparative static properties of population densities, optimal harvesting, stochastic epidemics.

Robert Fullér, research fellow at Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR), from Eotvos Loránd University, Department of Computer Science, Budapest, Hungary. E-mail: rfuller@abo.fi. Research interests: approximate reasoning, soft decision analysis, neural fuzzy systems for decision support, computational intelligence in finance.

Stefan Geritz, Senior Assistant at the University of Turku, Department of Mathematics. E-mail: sgeritz@utu.fi. Research interests: adaptive dynamics, speciation, evolution of migration in metapopulation.

Marko Grönroos, Researcher at Åbo Akademi University, Department of Computer Science. E-mail: magi@utu.fi.

Vesa Halava, Senior Assistant at the University of Turku, Department of Mathematics. E-mail: vehalava@utu.fi. Research interests: automata and formal languages, computability, combinatorics on words.

Tero Harju, Academy Research Fellow at the University of Turku, Department of Mathematics. E-mail: harju@utu.fi. Research interests: automata theory, combinatorics of words, graph theory.

Jukka Heikkilä, Professor at the University of Jyväskylä. Docent at the University of Turku, Computer Science. E-mail: jups@cc.jyu.fi. Research interests: information systems.

Jarmo Hemminki, Assistant at the University of Turku, Department of Mathematics. E-mail: jhemmin@utu.fi. Research interests: structured population models.

Iiro Honkala, Academy Research Fellow at the University of Turku, Department of Mathematics. E-mail: honkala@cs.utu.fi. Research interests: coding theory.

Juha Honkala, Senior assistant at the University of Turku, Department of Mathematics. E-mail: jhonkala@utu.fi. Research interests: L systems, formal power series, number systems.

Eija Jurvanen, Lecturer at the University of Turku, Department of Mathematics. E-mail: jurvanen@utu.fi. Research interests: tree automata.

Jaakko Järvi, Postdoctoral Researcher at the Indiana University, Bloomington, Computer Science. E-mail: jajarvi@cs.indiana.edu. Research interests: open source software.

Jouni Järvinen, Lecturer at the University of Turku, Department of Information Technology. E-mail: Jouni.Jarvinen@it.utu.fi. Research interests: ordered sets and lattices, rough sets, knowledge representation systems.

Timo Kaukoranta, Researcher at the University of Turku, Computer Science. Deceased. Research interests: image compression (block truncation coding, vector quantization, image quality) and image processing.

Eva Kisdi, Researcher at the University of Turku, Department of Mathematics. E-mail: evakis@utu.fi. Research interests: evolutionary ecological models concerning adaptive dynamics and life history evolution.

Tom Kuusela, Researcher at the University of Turku, Electronics and Information Technology. E-mail: kuusela@utu.fi. Research interests: solitons, solitary waves, toda lattice, non-linear electrical transmission lines, chaotic electrical systems, modelling cardiovascular system.

Jyrki Lahtonen, Senior Assistant/Professor at the University of Turku, Department of Mathematics. E-mail: lahtonen@utu.fi. Research interests: coding theory.

Linas Laibinis, Researcher and Assistant Professor, 1.8.02-31.7.03, at Åbo Akademi University, Department of Computer Science. E-mail: llaibini@abo.fi. Research interests: mechanisation of the refinement calculus, interactive environments for proof and/or program construction.

Tero Laihonen, Postdoctoral researcher at the University of Turku, Department of Mathematics. E-mail: terolai@utu.fi. Research interests: coding theory.

Arto Lepistö, Researcher at the University of Turku, Department of Mathematics. E-mail: alepisto@utu.fi. Research interests: combinatorics of words.

Jan Manuch, PhD., the University of Turku, Department of Mathematics. E-mail: manuch@cs.utu.fi. Research interests: combinatorics of words, formal languages and automata, discrete mathematics, communication complexity.

Kalle Ranto, Assistant at the University of Turku, Department of Mathematics. E-mail: kalle.ranto@utu.fi. Research interests: algebraic coding theory.

Pekka Reijonen, Researcher at the University of Turku, Computer Science. E-mail: pekka.reijonen@cs.utu.fi.

Ari Renvall, Senior Assistant at the University of Turku, Department of Mathematics. E-mail: ariren@utu.fi. Research interests: cryptography.

Pentti Riikonen, Researcher at the University of Turku, Computer Science. E-mail: pentti.riikonen@cs.utu.fi. Research interests: information systems.

Karl Rönnholm, Assistant at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: karronnh@abo.fi.

Ulla Solin, Lecturer at the Åbo Akademi University, Department of Computer Science. E-mail: ulla@abo.fi. Research interests: parallel programming, real time systems.

Frank Tétard, researcher at Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: frank.tetard@abo.fi.

Reino Vainio, Docent at Applied Mathematics, Åbo Akademi University, Department of Mathematics. E-mail: reino.vainio@abo.fi. Research interests: connectivity concepts, order completions, ordered function.

5.4 Visiting Researchers and Postdoctoral Researchers

The following researchers (doctors) have been active at TUCS either as long term visiting researchers or employed as postdoctoral researchers during 2002.

Tero Aittokallio, Postdoctoral Researcher/TUCS, the University of Turku, Department of Mathematics. E-mail: tero.aittokallio@utu.fi. Research interests: analysis of biomedical signals, pattern recognition.

C. Choffrut, Paris, France. Researcher at the University of Turku, Department of Mathematics.

Valery Ipatov, Visiting Professor at the University of Turku, Electronics and Information Technology. E-mail: valery.ipatov@utu.fi. Research interests: spread spectrum radio systems.

Mika Johnsson, Postdoctoral Researcher at the University of Turku, Computer Science. E-mail: johnsson@cs.utu.fi. Research interests: combinatorial optimisation, TSP, production planning in electronic industry, scheduling algorithms, machine optimisation.

L. Lisovik, Researcher at the University of Turku, Department of Mathematics. Professor at the State University of Ukraine.

Iulian Nastac, Postdoctoral Researcher at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: iulian.nastac@abo.fi.

Ari Paasio, Postdoctoral Researcher at the University of Turku, Electronics and Information Technology. E-mail: ari.paasio@utu.fi. Research interests: cellular neural/nonlinear networks.

Tomi Pasanen, Postdoctoral Researcher at the University of Turku, Computer Science. E-mail: tomi.pasanen@cs.utu.fi. Research interests: algorithms and data structures.

Tatjana Petkovic, Postdoctoral Researcher at the University of Turku, Department of Mathematics. E-mail: tatpet@utu.fi. Research interests: automata theory, algebraic theory of semigroups, formal languages, theory of rings.

Hannu Tenhunen, Visiting Professor at the University of Turku, Electronics and Information Technology. E-mail: hannu@imit.kth.se. Research interests: ULSI design.

Xiaocong Fan, Postdoctoral Researcher at Åbo Akademi University, Department of Computer Science. E-mail: fan.xc@abo.fi.

Haiyi Zhang, Postdoctoral Researcher at Åbo Akademi University, Department of Information Systems, Institute for Advanced Management Systems Research (IAMSR). E-mail: zhaiyi@abo.fi

5.5 Ph.D. Students

The following Ph.D. students have been enrolled for studies with the TUCS Graduate School during 2002:

Francisco Alcaraz Carcia, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: falcaraz@abo.fi. Research interests: analysis of biomedical signals, pattern recognition.

Gordon Alford, M.Sc., University of Turku, Department of Mathematics. E-mail: gordon@cs.utu.fi. Research interests: formal language theory, specifically DNA computing.

Chihab BenMoussa, MBA, Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: cbenmous@abo.fi.

Dag Björklund, DI, Åbo Akademi University, Department of Computer Science. E-mail: dbjorklu@abo.fi.

Orieta Celiku, B.A., Åbo Akademi University, Department of Computer Science. E-mail: orieta.celiku@abo.fi.

Adrian Costea, B.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: acostea@abo.fi.

Eugen Czeizler, M.Sc., University of Turku, Department of Mathematics. E-mail: eugenc@cs.utu.fi.

Marius-Cosmin Codrea, B.Sc., University of Turku, Computer Science. E-mail: codrea@cs.utu.fi.

Tomas Eklund, M.Sc. (Econ.), Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: toeklund@abo.fi.

Henrik Enqvist, DI, Åbo Akademi University, Department of Computer Science. E-mail: henqvist@abo.fi.

Irina Georgescu, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: igeorges@abo.fi.

Mehran Gomari, Researcher at the University of Turku, Computer Science. E-mail: gomari@cs.utu.fi. Research interests: applying artificial neural networks for solving medical problems.

Åke Gustavsson, TUCS/AA data-technology, works as a Lecturer at Åbo Akademi University, Department of Computer Science. E-mail: agustavs@abo.fi. Research interests: petri nets, hardware/software co-design, simulation, graphs, AI, programming interface.

Attila Gyenesei, M.Sc., University of Turku, Computer Science. E-mail: gyenesei@cs.utu.fi.

Tuomas Hakkarainen, M.Sc., University of Turku, Department of Mathematics. E-mail: tuheha@utu.fi.

Harri Hakonen, M.Sc., University of Turku, Computer Science. E-mail: hat@cs.utu.fi. Research interests: string algorithms, software construction.

Shengnan Han, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: shan@abo.fi.

Ville Harkke, M.Sc.(Econ.), Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: vharkke@abo.fi.

Eric Hedman, Ph.D. student at Åbo Akademi University. E-mail: ehedman@abo.fi.

Jeanette Heidenberg, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: jeanette@infa.abo.fi. Research interests: mechanical verification.

Jarkko Hiltunen, M.Sc., University of Turku, Department of Mathematics. E-mail: jakahi@utu.fi. Research interests: coding theory.

Piia Hirkman, M.Sc. (Econ.), Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: phirkman@abo.fi.

Mika Hirvensalo, Ph.Lic., University of Turku, Department of Mathematics. E-mail: mikhirve@utu.fi. Research interests: quantum computing.

Johanna Holm, M.Sc. (Econ.), Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: johanna.holm@tukkk.fi.

Samuel Holmström, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: sholmstr@abo.fi. Research interests: hardware/software codesign, hardware description languages, reconfigurable computing systems.

Davide D'Incau, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: davide.dincau@abo.fi.

Jorma Jaakkola, M.Sc., University of Turku, Department of Mathematics. E-mail: joeija@utu.fi. Research interests: Markov operators.

Jonna Järveläinen, M.Sc. (Econ.), Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: jonna.jarvelainen@tukkk.fi. Research interests: electronic commerce in tourism industry and grocery shopping.

Antero Järvi, M.Sc., University of Turku, Computer Science. E-mail: ajarvi@cs.utu.fi. Research interests: medical image analysis and compression.

Vaida Kadyte, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: vkadyte@abo.fi.

Juha Kivijärvi, M.Sc., University of Turku, Computer Science. E-mail: juhkivij@utu.fi. Research interests: image compression.

Antonina Kloptchenko, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: akloptch@abo.fi

Eija Koskivaara, Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: eija.koskivaara@tukkk.fi. Research interests: information systems, neural networks and auditing.

Tomi Kärki, M.Sc., University of Turku, Department of Mathematics. E-mail: topeka@utu.fi.

Sébastien Lafond, Ingénieur en génie électrique, Åbo Akademi University, Department of Computer Science. E-mail: slafond@abo.fi.

Tommi Laine, M.Sc., University of Turku, Electronics and Information Technology. E-mail: tomila@utu.fi. Research interests: digital audio.

Timo Lainema, M.Sc., Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: timo.lainema@tukkk.fi. Research interests: The Pros and Cons of Business Gaming: How to Enhance Employee Business Perception with Game-Playing.

Anas Lanedri, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: alanedri@abo.fi.

Joonas Lehtinen, M.Sc., University of Turku, Computer Science. E-mail: joonas.lehtinen@cs.utu.fi. Research interests: image compression (TUCS WWW-server).

Péter Majlender, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: pmajlend@abo.fi.

Dorina Marghescu, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: dmarghes@abo.fi.

Tommi Meskanen, Ph.Lic., University of Turku, Department of Mathematics. E-mail: tommes@utu.fi. Research interests: cryptography, automata and formal language theory, computability.

Luka Milovanov, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: lmilovan@abo.fi.

Ruggero Rossi de Mio, M.Sc., Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: rrossi@abo.fi.

Lars Nielsen, Post-graduate student at Åbo Akademi University. E-mail: lnielsen@abo.fi.

Anu Nikkanen, M.Sc., University of Turku, Department of Mathematics. E-mail: anikka@utu.fi.

Dirk Nowotka, M.Sc., Åbo Akademi University, Department of Mathematics. E-mail: dnowotka@abo.fi.

Elena Petre, M.Sc., University of Turku, Department of Mathematics. E-mail: epetre@cs.utu.fi.

Ion Petre, Ph.D., University of Turku, Department of Mathematics. E-mail: ipetre@cs.utu.fi. Research interests: combinatorics on words.

Luigia Petre, M.Sc. and Assistant Professor, 1.8.02, at Åbo Akademi University, Department of Computer Science. E-mail: lpetre@abo.fi. Research interests: distributed systems focusing on mobility aspects, UML semantics and formalisation, hybrid and control systems, object and component-oriented programming.

Ville Piirainen, M.Sc., University of Turku, Department of Mathematics. E-mail: visapi@utu.fi.

Viorel Preoteasa, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: viorel.preoteasa@abo.fi. Research interests: mathematical logic, theoretical computer science, programming languages, data structures.

Sanna Ranto, M.Sc., University of Turku, Department of Mathematics. E-mail: sanna.ranto@utu.fi. Research interests: coding theory.

Petri Rosendahl, Ph.Lic., University of Turku, Department of Mathematics. E-mail: perosen@utu.fi.

Rimvydas Rukvsenas, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: rruksena@abo.fi. Research interests: formal methods in the design of the asynchronous delay-insensitive VLSI circuits, mechanisation of the refinement calculus, interactive environments for proof and/or program construction.

Matti Rönkä, M.Sc., University of Turku, Department of Mathematics. E-mail: matronka@utu.fi. Research interests: tree languages and term rewriting systems, automata and formal language theory.

Saeed P. Salehi, M.Sc., University of Turku, Department of Mathematics. E-mail: saeed@cs.utu.fi.

Cristina Seceleanu, M.Sc., Åbo Akademi University, Department of Computer Science. E-mail: ccerschi@abo.fi.

Gustav Selén, FL, Åbo Akademi University, Department of Computer Science. E-mail: gselen@abo.fi. Research interests: medical informatics.

Anna Sell, M.Sc. (Econ.), Åbo Akademi University, Institute for Advanced Management Systems Research (IAMSR). E-mail: asell@abo.fi.

Jouni Smed, M.Sc. University of Turku, Computer Science. E-mail: jouni.smed@cs.utu.fi.

Paula Steinby, M.Sc., University of Turku, Department of Mathematics. E-mail: pauste@utu.fi.

Elina Syrjänen, M.Sc., Turku School of Economics and Business Administration, Institute of Information Systems Science. E-mail: elina.syrjanen@tukkk.fi. Research interests: medical informatics, business process reengineering.

Dragos Truscan, M.Sc, Åbo Akademi University, Department of Computer Science. E-mail: dtruscan@abo.fi.

Victor Tsygankov, TuKKK Master's student, Turku School of Economics and Business Administration. E-mail: Victor.Tsygankov@tukkk.fi.

Tuomas Valtonen, M.Sc., University of Turku, Electronics and Information Technology. E-mail: tuomas.valtonen@utu.fi. Research interests: future communication systems.

Arho Virkki, M.Sc., University of Turku, Department of Mathematics. E-mail:arho.virkki@utu.fi.

Pentti Virtanen, M.Sc. University of Turku, Computer Science. E-mail: pentti.virtanen@sci.fi. Research interests: measuring the software development process.

Seppo Virtanen, M.Sc., University of Turku, Electronics and Information Technology. E-mail: seppo.virtanen@it.utu.fi. Research interests: embedded systems, communication protocols.

Tuure Välimaa, M.Sc., University of Turku, Department of Mathematics. E-mail: ttvali@utu.fi.

Tomi Westerlund, M.Sc., University of Turku, Electronics and Information Technology. E-mail: tomi.westerlund@utu.fi.

Lu Yan, PM, Åbo Akademi University, Department of Computer Science. E-mail: lyan@abo.fi.

Ping Yan, M.Sc., University of Turku, Department of Mathematics. E-mail: pinyan@utu.fi.

5.6 TUCS Office

The following administrative staff has been employed by the TUCS Office during the year:

Mats Aspnäs, Coordinator (since February 1st 2002). E-mail: mats@abo.fi.

Christel Donner, Administrative Officer, financing. (on maternity leave until September 2nd 2002). E-mail: cdonner@abo.fi.

Ulrika Gustafsson, Administrative Officer, financing (maternity leave substitute until September 5th 2002). Administrative Officer, information and marketing (since September 6th 2002). E-mail: ugustafs@abo.fi.

Tomas Junnonen, Laboratory Engineer (until May 31st 2002). E-mail: tjunnone@abo.fi.

Timo Järvi, Director. E-mail: jarvi@it.utu.fi.

Nina Kivinen, Secretary. E-mail: nikivine@abo.fi.

Pia Le Grand, Administrative Officer, educational affairs (since May 1st 2002). E-mail: plegrand@abo.fi.

Leena Palmulaakso-Nylund, Office Secrerary. E-mail: lpalmula@abo.fi.

Teemu Peltola, Laboratory Engineer. E-mail: tesape@utu.fi.

Tapio Salakoski, Vice-director (until January 31st 2002). E-mail: tapio.salakoski@it.utu.fi.

Kaisa Sere, Vice-director (since February 1st 2002). E-mail: kaisa.sere@abo.fi.

Thomas Sund, Administrative Officer, educational affairs (until April 12th 2002). E-mail: tsund@abo.fi.

6 Accepted Theses

In 2002 TUCS produced 10 Ph.D. theses and 1 Ph.Lic. thesis:

6.1 Doctoral Theses

In 2002 TUCS produced 10 Ph.D. theses:

Vesa Halava. *The Post Correspondence Problem for Marked Morphisms*. PhD thesis, University of Turku, Apr 2002.

Lauri Heikkilä. *Electroluminescence in Si-SiO2 layer structures*. PhD thesis, University of Turku, 2002.

Vladimir Kvassov. *Information Technology and the Productivity of Managerial Work*. PhD thesis, Åbo Akademi University, Jun 2002.

Arto Lepistö. *On Relations Between Local and Global Periodicity*. PhD thesis, University of Turku, Dec 2002.

Jan Manuch. *Defect Theorems and Infinite Words*. PhD thesis, University of Turku, Jun 2002.

Nelly Noykova. *Modelling and identification of microbial population dynamics in wastewater treatment.* PhD thesis, Institute for Applied Mathematics, University of Turku, Institute for Applied Mathematics, FIN-20014 Turku, Finland, Mar 2002.

Ion Petre. *Commutation Problems on Sets of Words and Formal Power Series.* PhD thesis, University of Turku, May 2002.

Kalle Ranto. *Z4-Goethals Codes, Decoding and Designs*. PhD thesis, University of Turku, Oct 2002.

Jouni Smed. *Production Planning in Printed Circuit Board Assembly*. PhD thesis, University of Turku, Turku, Finland, Jan 2002.

Franck Tétard. *Managers, Fragmentation of Working Time, and Information System.* PhD thesis, Åbo Akademi University, Jun 2002.

6.2 Licentiate Theses

During 2002 TUCS produced 1 Ph.Lic. thesis:

Jarkko Hiltunen. Algebraic Methods in the Design of Space-Time Codes. Ph.lic. thesis, University of Turku, Nov 2002.

7 Publications 2002

7.1 TUCS Publication Series

TUCS has four publication series:

- TUCS Dissertation series (ISSN 1239-1883) contains dOctoral dissertations by researchers affiliated with TUCS.
- TUCS Technical Report series (ISSN 1239-1891) contains technical reports from TUCS. This series is part of NCSTRL, the Networked Computer Science Technical Reports Library, administered by the Computer Science Department at the Cornell University.
- TUCS General Publication series (ISSN 1239-1905) contains all other publications from TUCS, like proceedings from conferences organized by TUCS, annual reports, etc.
- TUCS National Publication series (ISSN 1457-8301) is intended for similar types of publications as the general publication series, but the publication language is either Finnish or Swedish.

During 2002, TUCS has published 7 dOctoral dissertations, 60 technical reports and two other publications. Most of the TUCS publications are available online in electronic format from the TUCS World Wide Web pages .

7.1.1 TUCS Dissertations

The following dOctoral dissertations have been published in the TUCS Dissertation series during 2002. The number refers to the publication number in the series.

36. Jouni Smed. Production Planning in Printed Circuit Board Assembly. PhD thesis, University of Turku, Turku, Finland, Jan 2002.
37. Vesa Halava. The Post Correspondence Problem for Marked Morphisms. PhD thesis, University of Turku, Apr 2002.
38. Ion Petre. Commutation Problems on Sets of Words and Formal Power Series. PhD thesis, University of Turku, May 2002.
39. Vladimir Kvassov. Information Technology and the Productivity of Managerial Work. PhD thesis, Åbo Akademi University, June 2002.
40. Franck Tétard, Managers, Fragmentation of Working Time, and Information Systems, PhD thesis, Åbo Akademi University, June 2002.
41. Jan Manuch. Defect Theorems and Infinite Words. PhD thesis, University of Turku, June 2002.
42. Kalle Ranto. Z4-Goethals Codes, Decoding and Designs. PhD thesis, University of Turku, Oct 2002.

7.1.2 TUCS Technical Reports

The following reports have been published in the TUCS Technical Report series during 2002. The number refers to the publication number in the series.

439. Salomaa, Arto and Sosik, Petr, Watson-Crick D0L Systems: the Power of One Transition
440. Karhumäki, Juhani and Lisovik, Leonid, A Surprising UnDecidability Result: The Equivalence Problem for Finite Subsitutions on ab*c
441. Porres, Ivan, A Toolkit for Manipulating UML Models
442. Mateescu, Alexandru and Salomaa, Arto and Yu, Sheng, Subword Histories and Parikh Matrices
443. Ranto, Sanna, Optimal Linear Identifying Codes
444. Kvassov, Vladimir, Linking Personalization of Information System to Managerial Productivity
445. Gyllenberg, Mats and Osipov, Andrej and Päivärinta, Lassi, On Determining Individual Behaviour from Population Data
446. Hirvensalo, Mika and Karhumäki, Juhani, Computing partial information out of uncomputable one - The first digit of 2^n at base 3 as an example
447. Järvinen, Jouni, On the Structure of Rough Approximations
448. Ying, Mingsheng, Reasoning about Probabilistic Sequential Programs in a Probabilistic Logic
449. Celiku, Orieta and von Wright, Joakim Theorem Prover Support for Precondition and Correctness Calculation
450. von Wright, Joakim, From Kleene Algebra to Refinement Algebra
451. Back, R.-J. and MilovaNov, L. and Porres, I. and Preoteasa, V, An Experiment on Extreme Programming and Stepwise Feature Introduction
452. Collan, Mikael and Majlender, Péter, Fuzzy Multiplicator in Including Trend Information in Fuzzy Capital Budgeting: Problems and Conclusions
453. Collan, Mikael and Långström, Stefan, Flexibility in Investments: Exploratory Survey on How Finnish Companies Deal with Flexibility in Capital Budgeting
454. Smed, Jouni and Kaukoranta, Timo and Hakonen, Harri, A Review on Networking and Multiplayer Computer Games
455. Codrea, Marius and Tyystjärvi, Esa and vandeVen, Martin and Valcke, Roland and Nevalainen, Olli, Classifying Apples by the Means of Fluorescence Imaging
456. Georgescu, Irina, Fuzzy Structural Distance
457. Salomaa, Arto, DNA Complementarity and Paradigms of Computing
458. Karhumäki, Juhani and Latteux, Michel and Petre, Ion, The Commutation with Codes and Ternary Sets of Words
459. Lahdelma, R. and Miettinen, K. and Salminen, P., Stochastic Multicriteria Acceptability Analysis Using Achievement Functions
460. Knuutila, Timo and Hirvikorpi, Mika and Johnsson, Mika and Nevalainen, Olli, Grouping PCB Assembly Jobs with Typed Component Feeder Units
461. Plosila, Juha and Seceleanu, Tiberiu, Specification of an Asynchronous On-Chip Bus
462. Seceleanu, Tiberiu and Plosila, Juha and Liljeberg, Pasi, On-Chip Segmented Bus: A Self Timed Approach
463. Halava, Vesa and Harju, Tero and Hirvensalo, Mika and Karhumäki, Juhani, (G)PCP for Words of Length at Most Two
464. Back, R.J.R. and von Wright, J., Compositional Action System Refinement
465. Kloptchenko, Antonina and Back, Barbro and Visa, Ari and Toivonen, Jarmo and Vanharanta, Hannu, A Prototype-matching System for Scientific Abstract Collection Semantic Clustering
466. Fullér, Robert and Majlender, Péter, On Weighted Possibilistic Mean and Variance of Fuzzy Numbers
467. Alcaraz Garcia, Francisco Augusto and Heikkilä, Markku, Improving Investment Decision-Making by Expanding Key Knowledge with Real Option Tools

468. Georgescu, Irina, Rational and Congruous Fuzzy Consumers
469. Kivijärvi, Juha and Lehtinen, Joonas and Nevalainen, Olli, A Parallel Genetic Algorithm for Clustering
470. Kaitovaara, Petteri and Hyötyläinen, Mika, Towards Packaged IT Consulting Services: An Illustrative Case from IT Business
471. Lahdelma, Risto and Salminen, Pekka, Modelling Dependent Uncertainties by Multivariate Gaussian Distributions in SMAA
472. Lahdelma, Risto and Salminen, Pekka, Classifying Alternatives in SMAA Using Cross Confidence Factors
473. Petre, Luigia, Control Systems Development - A Case Study –
474. Kaitovaara, Petteri and Nurminen, Markku, Information Technology Artefacts and Services They Provide
475. Petre, Elena, Watson Crick omega-automata
476. Carlsson, Christer and Fullér, Robert and Majlender, Péter, On Possibilistic Cauchy-Schwarz Inequality
477. Fullér, Robert and Majlender, Péter, On Possibilistic Dependencies
478. Carlsson, Christer and Fullér, Robert and Majlender, Péter, On Constrained OWA Aggregations
479. Harju, Tero and Nowotka, Dirk, Duval's Conjecture and Lyndon Words
480. Alcaraz Garcia, Francisco Augusto, Possibilistic Hedging
481. Mateescu, Alexandru and Salomaa, Arto and Yu, Sheng, An Inequality for Occurrences of Subwords
482. Salomaa, Arto, Developmental Languages versus DNA Computing
483. Czeizler, Eugen, Self-activating P Systems
484. Salonen, Kari and Smed, Jouni and Johnsson, Mika and Nevalainen, Olli, Grouping and Sequencing PCB Assembly Jobs with Minimum Feeder Setups
485. Halava, Vesa and Harju, Tero and Karhumäki, Juhani, Decidability of Binary Infinite Post Correspondence Problem
486. Porres, Ivan and Alanen, Marcus, A Generic Deep Copy Algorithm for MOF-Based Models
487. Codrea, Marius and Aittokallio, Tero and Keränen, Mika and Tyystjärvi, Esa and Nevalainen, Olli, Feature Learning with a Genetic Algorithm for Fluorescence Fingerprinting of Plant Species
488. Honkala, Iiro and Laihonen, Tero and Ranto, Sanna, On Locating-Dominating Codes in Binary Hamming Spaces
489. Hiltunen, Jarkko and Lahtonen, Jyrki, Space-Time Lattice Codes From Algebraic Number Fields
490. Hiltunen, Jarkko, Algebraic Methods in the Design of Space-Time Codes
491. Back, Ralph-Johan and Sjöberg, Mats and von Wright, Joakim, Field Tests of the Structured Derivations Method
492. Gyllenberg, Mats and Wang, Yi, Dynamics of the Periodic Type-K Competitive Kolmogorov Systems
493. Baeten, Jos C.M. and Bos, Victor, Formalizing Programming Variables in Process Algebra
494. Alcaraz Garcia, Francisco Augusto, On (fL,fR)-weighted Possibilistic Mean and Variance of Fuzzy Numbers
495. Anttila, Heikki and Back, Ralph-Johan and Ketola, Pekka and Konkka, Katja and Leskelä, Jyrki and Rysä, Erkki, Combining Stepwise Feature Introduction with User-Centric Design
496. Back, Ralph-Johan, Software Construction by Stepwise Feature Introduction
497. Troubitsyna, Elena, Specifying Fault Tolerant Software Using Statecharts and FMEA

498. Troubitsyna, Elena, Integrating Safety Analysis into Formal Specification of Safety-Critical Systems

7.1.3 TUCS General Publications

The following publications have been published in the TUCS General Publications series during 2002. The number refers to the publication number in the series.

21. Johan Lilius, Seppo Virtanen (Eds.), TTA Workshop Notes 2002.
22. Mikael Collan, Investment Planning - An Introduction.

7.2 Publications by TUCS Researchers

This section contains a list of all publications from the researchers within TUCS during the year 2002, organized by research laboratory and type of publication. The information is gathered from the TUCS bibliographical database.

7.2.1 Algorithmics Laboratory

Ph.D. Theses

1. Jouni Smed. *Production Planning in Printed Circuit Board Assembly*. PhD thesis, University of Turku, Turku, Finland, Jan 2002.

Journal Articles

1. Abraham Bookstein, Vladimir A. Kulyukin, and Timo Raita. Generalized hamming distance. *Information Retrieval*, 5(4): 353–375, Oct 2002.

2. Timo Knuutila and Olli Nevalainen. A reduction technique for weighted grouping problems. *European Journal of Operations Research*, (140): 590–605, 2002.

3. Tero Laakso, Mika Johnsson, Tommi Johtela, Jouni Smed, and Olli Nevalainen. Estimating the production times in PCB assembly. *Journal of Electronics Manufacturing*, 11(2): 161–70, 2002.

4. Risto Lahdelma and Pekka Salminen. Pseudo-criteria versus linear utility function in stochastic multicriteria acceptability analysis. *European Journal of Operational Research*, 141(2): 454–469, 2002.

5. Risto Lahdelma, Pekka Salminen, and Joonas Hokkanen. Locating a waste treatment facility by using stochastic multicriteria acceptability analysis with ordinal criteria. *European Journal of Operational Research*, 142(2): 345–356, 2002.

6. A.A. Mylläri, V.V. Orlov, and N.P. Pitjev. Evolution of structure of directions field in rotationally-symmetric potentials. *Vestnik of St. Petersburg St. Univ. Series 1*, pages 105–110, 2002. in Russian.

7. Jussi Salmi, Tero Aittokallio, Jan Westerholm, Matias Griese, Arsi Rosengren, Tuula Nyman, Riitta Lahesmaa, and Olli Nevalainen. Hierarchical grid transformation for image warping in the analysis of two-dimensional electrophoresis gels. *Proteomics*, 2(11): 1504–1515, Nov 2002.

8. Jouni Smed, Timo Kaukoranta, and Harri Hakonen. Aspects of networking in multiplayer computer games. *The Electronic Library*, 20(2): 87–97, 2002.

Articles in Conference Proceedings

1. Marius Codrea, Esa Tyystjärvi, Martin vande Ven, Roland Valcke, and Olli Nevalainen. Using fluorescence images in classification of apples. In *IASTED conference, Spain 2002*, 2002. September 2002.

2. Brian Greer, Henri Hakonen, Risto Lahdelma, and Risto Miikkulainen. Numerical optimization with neuroevolution. In D. Fogel, editor, *Proceedings of the 2002 Congress on Evolutionary Computation (CEC'02)*, pages 361–401, Piscataway, NJ, 2002. IEEE Press.

3. Attila Gyenesei and Jukka Teuhola. Mining fuzzy frequent patterns without repeated candidate generation. In Saman Halgamuge Lipo Wang and Xin Yao, editors, *Proceedings of the 1st International Conference on Fuzzy Systems and Knowledge Discovery*, pages 374–380, Singapore, Nov 2002.

4. Juha Kivijärvi, Joonas Lehtinen, and Olli Nevalainen. Clustering by a parallel self-adaptive genetic algorithm. In *Proceedings of the 4th Asia-Pacific Conference on Simulated Evolution and Learning (SEAL'02)*, pages 66–70, Singapore, Nov 2002.

5. V.V. Orlov and A.A. Mylläri. Moving groups of stars: before and after HIPPARCOS. In T.A. Sasina, editor, *Physics of Cosmos*, pages 67–80. Ural Univ. Press, Ekaterinburg, 2002. in Russian.

Technical Reports

1. Marius Codrea, Tero Aittokallio, Mika Keränen, Esa Tyystjärvi, and Olli Nevalainen. Feature learning with a genetic algorithm for fluorescence fingerprinting of plant species. Technical Report 487, TUCS - Turku Centre for Computer Science, Nov 2002.

2. Marius Codrea, Esa Tyystjärvi, Martin vandeVen, Roland Valcke, and Olli Nevalainen. Classifying apples by the means of fluorescence imaging. Technical Report 455, TUCS - Turku Centre for Computer Science, 2002.

3. Jaakko Järvi, Andrew Lumsdaine, and David Wise (editors). MSPLS 2002: Proceedings of the workshop of the midwest society for programming languages and systems. Technical Report 560, Indiana University Computer Science, Apr 2002.

4. Juha Kivijärvi, Joonas Lehtinen, and Olli Nevalainen. A parallel genetic algorithm for clustering. Technical Report 469, TUCS - Turku Centre for Computer Science, Aug 2002.

5. Timo Knuutila, Mika Hirvikorpi, Mika Johnsson, and Olli Nevalainen. Grouping PCB assembly jobs with typed component feeder units. Technical Report 460, TUCS - Turku Centre for Computer Science, 2002.

6. R. Lahdelma, K. Miettinen, and P. Salminen. Stochastic multicriteria acceptability analysis using achievement functions. Technical Report 459, TUCS - Turku Centre for Computer Science, Apr 2002.

7. Risto Lahdelma and Pekka Salminen. Classifying alternatives in SMAA using cross confidence factors. Technical Report 472, TUCS - Turku Centre for Computer Science, 2002.

8. Risto Lahdelma and Pekka Salminen. Modelling dependent uncertainties by multivariate gaussian distributions in SMAA. Technical Report 471, TUCS - Turku Centre for Computer Science, Aug 2002.

9. Kari Salonen, Jouni Smed, Mika Johnsson, and Olli Nevalainen. Grouping and sequencing PCB assembly jobs with minimum feeder setups. Technical Report 484, TUCS - Turku Centre for Computer Science, Oct 2002.

10. Jouni Smed, Timo Kaukoranta, and Harri Hakonen. A review on networking and multiplayer computer games. Technical Report 454, TUCS - Turku Centre for Computer Science, Apr 2002.

7.2.2 Bioinformatics Laboratory

Journal Articles

1. Pentti Riikonen, Jorma Boberg, Tapio Salakoski, and Mauno Vihinen. Mobile access to biological databases on the internet. *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*, 49(12): 1477–1479, Dec 2002.

7.2.3 Biomathematics Laboratory

Ph.D. Theses

1. Nelly Noykova. *Modelling and identification of microbial population dynamics in wastewater treatment.* PhD thesis, Institute for Applied Mathematics, University of Turku, Institute for Applied Mathematics, FIN-20014 Turku, Finland, Mar 2002.

Journal Articles

1. Tero Aittokallio, Mats Gyllenberg, and Olli Polo. Adjustment of the human respiratory system to increased upper airway resistance during sleep. *Bulletin of Mathematical Biology*, 64(1): 3–28, Jan 2002.

2. S.A.H. Geritz, M. Gyllenberg, F.J.A. Jacobs, and K. Parvinen. Invasion dynamics and attractor inheritance. *Journal of Mathematical Biology*, 44: 548–560, 2002.

3. M. Gyllenberg, A. Osipov, and L. Päivärinta. The inverse problem of age-structured population dynamics. *Journal of Evolution Equations*, 2: 223–239, 2002.

4. Mats Gyllenberg and Timo Koski. Bayesian predictiveness, exchangeablity and sufficientness in bacterial taxonomy. *Mathematical Biosciences*, 177-178: 161–184, 2002.

5. Mats Gyllenberg, Kalle Parvinen, and Ulf Dieckmann. Evolutionary suicide and evolution of dispersal in structured metapopulations. *Journal of Mathematical Biology*, 45(2): 79–105, Nov 2002.

6. Mats Gyllenberg, Diana Preoteasa, and Kari Saikkonen. Vertically transmitted symbionts in structured host metapopulations. *Bulletin of Mathematical Biology*, 64(5): 959–978, Sep 2002.

7. Mats Gyllenberg and Ping Yan. The generalized lienard systems. *Discrete and Continuous Dynamical Systems - Series A*, 8: 1043–1057, 2002.

8. Eva Kisdi. Dispersal: Risk spreading versus local adaptation. *Am. Nat.*, (159): 579–596, 2002.

9. Andrea Mathias and Eva Kisdi. Adaptive diversification of germination strategies. *Proc. R. Soc. Lond. B*, (269): 151–156, 2002.

10. S. F. Matter, I. Hanski, and M. Gyllenberg. A test of the metapopulation model of the species-area relationship. *J. Biogeogr.*, 29: 977–983, 2002.

11. Thorsten Müller, Neli Noykova, Mats Gyllenberg, and Jens Timmer. Parameter identification in microbial population dynamics models of anaerobic wastewater treatment. *Mathematical Biosciences*, 2002.

12. Neli Noykova, Thorsten Müller, Mats Gyllenberg, and Jens Timmer. Quantitative analyses of anaerobic waste water treatment processes: identifiability and parameter estimation. *Biotechnology and Bioengineering*, 2002.

13. Kalle Parvinen. Evolutionary branching of dispersal strategies in structured metapopulations. *Journal of Mathematical Biology*, 45(2): 106–124, Jul 2002.

14. V-V. Rantanen, M. Gyllenberg, T. Koski, and M. S. Johnson. A dissimilarity matrix between protein atom classes based on gaussian mixtures. *Bioinformatics*, 18: 1257–1263, 2002.

15. K. Saikkonen, D. Ion, and M. Gyllenberg. The persistence of fungal endophytes in grass metapopulations. *Proc. R. Soc. Lond. B*, 269: 1397–1403, 2002.

16. Ping Yan and Jifa Jiang. On global asymptotic stability of second order nonlinear differential systems. *Applicable Analysis*, 81(3): 681–703, 2002.

Technical Reports

1. Mats Gyllenberg and Timo Koski. Tree Augmented classification of binary data minimizing stochastic complexity. Technical report, University of Linkoping, 2002.

2. Mats Gyllenberg, Andrej Osipov, and Lassi Päivärinta. On determining individual behaviour from population data. Technical Report 445, TUCS - Turku Centre for Computer Science, Jan 2002.

3. Mats Gyllenberg and Yi Wang. Dynamics of the periodic type-k competitive kolmogorov systems. Technical Report 492, TUCS - Turku Centre for Computer Science, 2002.

7.2.4 Data Mining and Knowledge Management Laboratory

Ph.Lic. Theses

1. Tomas Eklund. *Financial BenchMarking Using Self-Organizing Maps – A Study of the International Forest Products Industry*. Unpublished lic. thesis in information systems, Åbo Akademi University, Faculty of Economics and Social Sciences, Dec 2002.

Journal Articles

1. Adekunle Okunoye and Helena Karsten. Where the global needs the local: Variation in enablers in the knowledge management process. *Journal of Global Information Technology Management*, 5(3): 12–31, 2002.

Articles in Conference Proceedings

1. Barbro Back, Antonina Kloptchenko, Jarmo Toivonen, Hannu Vanharanta, and Ari Visa. Prototype-matching methodology applications in text mining. In H.Arabnia, editor, *International Conference on Information and Knowledge Engineering'02*, Jun 2002.

2. Adrian Costea, Tomas Eklund, and Jonas Karlsson. A framework for predictive data mining in the telecommunications sector. In Pedro Isiais, editor, *Proceedings of the IADIS International Conference WWW/Internet 2002*, pages 38–46. IADIS Press, Nov 2002.

3. Tomas Eklund, Barbro Back, Hannu Vanharanta, and Ari Visa. Assessing the feasibility of using self-organizing maps for data mining financial information. In *Proceedings of the 10th European Conference on Information Systems (ECIS) 2002*, volume 1, pages 528–537, Jun 2002.

4. Antonina Kloptchenko, Barbro Back, Ari Visa, Jarmo Toivonen, and Hannu Vanharanta. Towards content based retrieval from scientific text corpora. In S. Kawada, editor, *2002 IEEE International Conference on Artificial Intelligence Systems (ICAIS 2002)*, pages 444–450. IEEE Computer Society Printing House, Sep 2002.

5. Antonina Kloptchenko, Tomas Eklund, Barbro Back, Jonas Karlsson, Hannu Vanharanta, and Ari Visa. Combining data and text mining techniques for analyzing financial reports. In *Proceedings of the 2002 Eighth Americas Conference on Information Systems (AMCIS2002)*, pages 20–28, Aug 2002.

6. Eija Koskivaara. Artificial neural network models for analytical review procedures in auditing. Jun 2002.

7. Eija Koskivaara. Design science approaches in information systems research. In Shirley Gregor and Dennis Hart, editors, *The Information Systems Foundations: Building the Theoretical Base*, pages 205–216. Australian National University, Oct 2002.

8. Adekunle Okunoye. North in the south: Comparative analysis of information technology infrastructure in international vs. national research organiza. In P. Palvia and S. Ponnappa, editors, *Proceedings of the Third Annual Global Information Technology Management World Conference*, pages 140–143, Jun 2002. Global Information Technology Management Association. Receives Best Paper Award.

9. Adekunle Okunoye. Outsourcing as an IT management strategy for knowledge management in sub-saharan africa. In Mehdi Khosrow-Pour, editor, *Issues and Trends of Information Technology Management in Contemporary Organisations*, May 2002. Idea Group Publishing.

10. Adekunle Okunoye. Towards a framework for sustainable knowledge management in organisations in developing countries. In Brunnestein K. and Berleur J., editors, *Human Choice and Computers: Issues of Choice and Quality of Life in the Information Society*, pages 225–238, Aug 2002. Kluwer Academic Publisher.

11. Adekunle Okunoye, Erkki Innola, and Helena Karsten. BenchMarking knowledge management in developing countries: Case of research organizations in Nigeria, the gamb. Sep 2002.

12. Adekunle Okunoye and Helena Karsten. ITI as enabler of knowledge management: Empirical perspective from research organisations in sub-saharan Africa. Jan 2002. IEEE.

13. Adekunle Okunoye and Helena Karsten. Now and then: Internet use in research in sub-saharan africa. In Krishna S. and Madon S., editors, *Information and CommunicationTechnologies and Development: New Opportunities and Challenges*, pages 584–597, May 2002.

Technical Reports

1. Antonina Kloptchenko, Barbro Back, Ari Visa, Jarmo Toivonen, and Hannu Vanharanta. A prototype-matching system for scientific abstract collection semantic clustering. technical report 465, TUCS - Turku Centre for Computer Science, 2002.

7.2.5 Discrete Mathematics for Information Technology Laboratory

Ph.D. Theses

1. Vesa Halava. *The Post Correspondence Problem for Marked Morphisms*. PhD thesis, University of Turku, Apr 2002.

2. Ion Petre. *Commutation Problems on Sets of Words and Formal Power Series*. PhD thesis, University of Turku, May 2002.

3. Jan Manuch. *Defect Theorems and Infinite Words*. PhD thesis, University of Turku, Jun 2002.

4. Kalle Ranto. *Z4-Goethals Codes, Decoding and Designs*. PhD thesis, University of Turku, Oct 2002.

Ph.Lic. Theses

1. Jarkko Hiltunen. *Algebraic Methods in the Design of Space-Time Codes*. PhLic thesis, University of Turku, Nov 2002.

Books

1. Wilfried Brauer, Hartmut Ehrig, Juhani Karhumäki, and Arto Salomaa (editors). *Formal and Natural Computing. Essays Dedicated to Grzegorz Rozenberg*, volume 2300 of *Lecture Notes in Computer Science*. Springer-Verlag, 2002.

2. Werner Kuich, Grzegorz Rozenberg, and Arto Salomaa (editors). *Developments in Language Theory*, volume 2295 of *Lecture Notes in Computer Science*. Springer-Verlag, 2002.

Chapters in Book

1. Tero Harju, Juhani Karhumäki, and Wojciech Plandowski. Independent systems of equations. In *Algebraic Combinatorics on Words*, Encyclopedia of Mathematics and its Applications, chapter 14. Cambridge University Press, 2002.

2. Arto Salomaa. Synchronization of finite automata: contributions to an old problem. In I.H. Sudborough T. Mogensen, D. Schmidt, editor, *The Essence of Computation*, volume 2566 of *Lecture Notes in Computer Science*, chapter Computational complexity, pages 37–59. Springer-Verlag, 2002.

3. Juhani Karhumäki and Ion Petre. The branching point approach to conway's problem. Number 2300. Springer LNCS, 2002.

4. Alexandru Mateescu and Arto Salomaa. Nondeterministic trajectories. In W. Brauer, H. Ehrig, J. Karhumäki, and A. Salomaa, editors, *Formal and Natural Computing*, volume 2300 of *Lecture Notes in Computer Science*, chapter Words, Languages, Automata, pages 96–106. Springer-Verlag, 2002.

5. Arto Salomaa. DNA complementarity and paradigms of computing. In Oscar Ibarra and Louxin Zhang, editors, *Computing and Combinatorics, COCOON 2002*, volume 2387 of *Lecture Notes in Computer Science*, chapter Lecture Notes in Computer Science, pages 3–17. Springer-Verlag, 2002.

Journal Articles

1. M. Amos, G. Paun, G. Rozenberg, and A. Salomaa. Topics in the theory of DNA computing. *Theoretical Computer Science*, (287): 3–38, 2002.

2. Irène Charon, Iiro Honkala, Olivier Hudry, and Antoine Lobstein. The minimum density of an identifying code in the king lattice. *Discrete Mathematics*, page N/A, 2002. to appear.

3. Karel Culik, Juhani Karhumäki, and Jarkko Kari. A note on synchronized automata and road coloring problem. *International Journal of Foundations of Computer Science*, (13): 459–471, 2002.

4. Andrzej Ehrenfeucht, Tero Harju, and Grzegorz Rozenberg. Gene assembly in ciliates through circular graph Decomposition. *Theoret. Comput. Sci.*, (281): 325–349, 2002.

5. Jurriaan Hage, Tero Harju, and Emo Welzl. Euler graphs, triangle-free graphs and bipartite graphs in switching classes. *LNCS*, (2505): 148–160, 2002.

6. Vesa Halava and Tero Harju. Infinite solutions of Marked post correspondence problem. *LNCS*, (2300): 57–68, 2002.

7. Vesa Halava and Tero Harju. An unDecidability result concerning periodic morphisms. *LNCS*, (2295): 304–310, 2002.

8. Vesa Halava, Tero Harju, and Mika Hirvensalo. Binary (generalized) post correspondence problem. *Theoretical Computer Science*, 1-2(276): 183–204, 2002.

9. Tero Harju, Oscar Ibarra, Juhani Karhumäki, and Arto Salomaa. Some Decision problems concerning semilinearity and commutation. *Journal of Computer and System Sciences*, (65): 278–294, 2002.

10. Tero Harju and Dirk Nowotka. Density of critical factorizations. *Theoretical Informatics and Applications*, 3(36): 315–327, 2002.

11. Mika Hirvensalo. Computing with quanta - impacts of quantum theory on computation. *Theoretical Computer Science*, 1(287): 267–298, 2002.

12. Mika Hirvensalo. Quantum computing - facts and folklore. *International Journal of Natural Computing*, (1): 135–155, 2002.

13. Mika Hirvensalo. Universality and quantum computing. *Bulletin of the EATCS*, (78): 199–203, 2002.

14. Iiro Honkala. Triple systems for identifying quadruples. *Australasian Journal of Combinatorics*, pages 303–316, 2002.

15. Iiro Honkala, Mark Karpovsky, and Simon Litsyn. Cycles for identifying vertices and edges in binary hypercubes and 2-dimensional tori. *Discrete Applied Mathematics*, 2002.

16. Iiro Honkala and Andrew Klapper. Multicovering bounds from relative covering radii. *SIAM Journal on Discrete Mathematics*, 15(2): 228–234, 2002.

17. Iiro Honkala and Antoine Lobstein. On identifying codes in binary hamming spaces. *Journal of Combinatorial Theory (A)*, 99: 232–243, 2002.

18. Iiro Honkala and Antoine Lobstein. On the complexity of the identification problem in hamming spaces. *Acta Informatica*, 38: 839–845, 2002.

19. Iiro Honkala and Antoine Lobstein. On the density of identifying codes in the square lattice. *Journal of Combinatorial Theory (B)*, 85: 297–306, 2002.

20. Juha Honkala. The equality problem for parikh simple algebraic series. *Information Processing Letters*, 84: 57–60, 2002.

21. Juha Honkala. The equivalence problem for DF0L languages and power series. *Journal of Computer and System Sciences*, 65: 377–392, 2002.

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1. Ralph-Johan Back, Cristina Cerschi Seceleanu, and Jan Westerholm. Symbolic simulation of hybrid systems. In Pornsiri Muenchaisri Paul Strooper, editor, *Proceedings of the 9th Asia-Pacific Software Engineering Conference (APSEC 2002)*, number 1530, pages 147–155. IEEE Computer Society, Dec 2002.

2. Ralph-Johan Back, Luka Milova Nov, Ivan Porres, and Viorel Preoteasa. XP as a framework for practical software engineering experiments. In *Proceedings of the Agile Processes in Software Engineering XP2002Third International Confer*, May 2002.

3. Victor Bos and Jeroen J.T. Kleijn. Redesign of a systems engineering language. In Michael; Luettgen, Gerald; Mendler and Florence Maraninchi, editors, *Semantic Foundations of Engineering Design Languages (SFEDL'02)*, pages 100–118, Grenoble, France, Apr 2002.

4. Luigia Petre. Control systems development – a case study. In Eduardo B. Fernandez Bernhard Rumpe Robert Sandner Jan Jurjens, Maria Victoria Cengarle, editor, *Critical Systems Development with UML - Proceedings of the UML'02 Workshop*, pages 171–180. Technische Universitat Munchen, Sep 2002.

5. Ivan Porres. A framework for model transformations. In *Proc. of WITUML 02: Workshop on Integration and Transformation of UML models*, Jul 2002.

Technical Reports

1. Heikki Anttila, Ralph-Johan Back, Pekka Ketola, Katja Konkka, Jyrki Leskelä, and Erkki Rysä. Combining stepwise feature introduction with user-centric design. Technical Report 495, TUCS - Turku Centre for Computer Science, Dec 2002.

2. R.-J. Back, L. MilovaNov, I. Porres, and V. Preoteasa. An experiment on extreme programming and stepwise feature introduction. Technical Report 451, TUCS - Turku Centre for Computer Science, Dec 2002.

3. Ralph-Johan Back. Software construction by stepwise feature introduction. Technical Report 496, TUCS - Turku Centre for Computer Science, 2002.

4. R.J.R. Back and J. von Wright. Compositional action system refinement. Technical Report 464, TUCS - Turku Centre for Computer Science, Jun 2002.

5. Jos C.M. Baeten and Victor Bos. Formalizing programming variables in process algebra. TUCS Technical Report 493, TUCS - Turku Centre for Computer Science, Lemminkäisenkatu 14 A, Turku, Finland, Dec 2002.

6. Luigia Petre. Control systems development - a case study -. Technical Report 473, TUCS - Turku Centre for Computer Science, 2002.

7. Ivan Porres. A toolkit for manipulating UML models. Technical Report 441, TUCS - Turku Centre for Computer Science, Jan 2002.

8. Ivan Porres and Marcus Alanen. A generic deep copy algorithm for MOF-based models. Technical Report 486, TUCS - Turku Centre for Computer Science, Nov 2002.

9. Elena Troubitsyna. Integrating safety analysis into formal specification of safety-critical systems. Technical Report 498, TUCS - Turku Centre for Computer Science, 2002.

10. Elena Troubitsyna. Specifying fault tolerant software using statecharts and FMEA. Technical Report 497, TUCS - Turku Centre for Computer Science, 2002.

11. Mingsheng Ying. Reasoning about probabilistic sequential programs in a probabilistic logic. Technical Report 448, TUCS - Turku Centre for Computer Science, 2002.

7.2.16 Telecommunication and Digital Systems Laboratory

Articles in Conference Proceedings

1. Afshin David. Wavelet Kalman based reconstruction. IEEE, 2002.

2. Pasi Liljeberg, Imed Ben Dhaou, Juha Plosila, Jouni Isoaho, and Hannu Tenhunen. Interconnect peak current reduction for wavelet array processor using self-timed signaling. volume IV, pages 485–488. IEEE, May 2002.

3. Tero Nurmi, Li-Rong Zheng, Tuomas Valtonen, and Hannu Tenhunen. Power management in autonomous error-tolerant cells. In *Proceedings of the 15th Annual IEEE International*

ASIC/SoC Conference (ASIC/SoC 2002), Rochester, New York, USA, September 25–28, 2002., page 109–113, Sep 2002.

4. Tuomas Valtonen, Jouni Isoaho, and Hannu Tenhunen. The case for fine-grained re-configurable architectures: An analysis of conceived performance. In *Proceedings of the 12th International Conference on Field Programmable Logic and Application (FPL 2002), Montpellier, France, September 2–4, 2002.*, page 816–825, Sep 2002.

5. Tuomas Valtonen, Jouni Isoaho, and Hannu Tenhunen. Conceived performance of re-configurable IC architectures. In *Proceedings of the 8th Biennial Conference on Electronics and Microsystem Technology (BEC 2002), Tallinn, Estonia, October 6–9, 2002 (invited).*, page 19–27, Oct 2002.

6. Tuomas Valtonen, Tero Nurmi, Jouni Isoaho, and Hannu Tenhunen. Interconnection of autonomous error-tolerant cells. In *Proceedings of the IEEE International Symposium on Circuits and Systems (ISCAS 2002), Scottsdale, Arizona, USA, May 26–29, 2002.*, page IV: 473–476, May 2002.

7. Tuomas Valtonen, Pekka Rantala, Jouni Isoaho, and Hannu Tenhunen. Cell configuration in the autonomous error-tolerant cellular fabric. In *Proceedings of the 20th IEEE Nordic Event in ASIC Design (NorChip 2002), Copenhagen, DenMark, November 11–12, 2002.*, page 341–346, Nov 2002.

7.2.17 IAMSR

Ph.D. Theses

1. Vladimir Kvassov. *Information Technology and the Productivity of Managerial Work*. PhD thesis, Åbo Akademi University, Jun 2002.

Books

1. Christer Carlsson and Robert Fullér. *Fuzzy Reasoning in Decision Making and Optimization*, volume 82 of *Studies in Fuzziness and Soft Computing Series*. Springer-Verlag, Berlin, 2002. ISBN 3-7908-1428-8.

2. Mikael Collan. *Investment Planning: An Introduction*. Number 22 in TUCS General Publication. Turku Centre for Computer Science, Aug 2002.

3. Mikael Collan, editor. *Proceedings of the International Real Option Workshop*. Institute for Advanced Management Systems Research, May 2002.

Chapters in Book

1. Christer Carlsson and Robert Fullér. A fuzzy approach to taming the bullwhip effect. In M.van Someren H.-J.Zimmermann, G.Tselentis and G.Dounias, editors, *Advances in Computational Intelligence and Learning*, volume 18 of *The Kluwer International Series in Intelligent Technologies*, chapter Applications. Kluwer Academic Publishers, Fan 2002. ISBN 0-7923-7645-5.

Journal Articles

1. Christer Carlsson. Decision support in virtual organizations: The case for multi-agent support. *Group Decision and Negotiation*, 11: 185–221, 2002.

2. Christer Carlsson and Robert Fullér. A position paper on agenda for soft Decision analysis. *Fuzzy Sets and Systems*, 131(1): 3–11, 2002.

3. Christer Carlsson and Robert Fullér. Soft computing and the bullwhip effect. *Economics and Complexity*, 2(3): 1–26, 2002.

4. Christer Carlsson, Robert Fullér, and Péter Majlender. A possibilistic approach to selecting portfolios with highest utility score. *Fuzzy Sets and Systems*, 131(1): 13–21, 2002.

5. Christer Carlsson, J.P. Shim, Merrill Warketing, James F. Courtney, Daniel J. Power, and Ramesh Sharda. Past, present and future of Decision support technology. *Decision Support Systems*, (2): 111–126, 2002.

6. Christer Carlsson and Efraim Turban. DSS directions for the next Decade. *Decision Support Systems*, 33(2): 105–110, 2002.

7. Mikael Collan and Shuhua Liu. Fuzzy logic and intelligent agents: Towards the next step of capital budgeting Decision support. *Industrial Management and Data Systems*, Oct 2002.

8. Robert Fullér, Margit Kovacs, and Schuster György. Flexible linear programs with a restricted overall flexibility level. *Fuzzy Sets and Systems*, 127: 177–183, 2002.

Articles in Conference Proceedings

1. Christer Carlsson and Robert Fullér. Fuzzy real option valuation: A breakthrough theory. In *Proceedings of the International Real Option Workshop*, May 2002.

2. Christer Carlsson and Robert Fullér. Project scheduling with fuzzy real options. In Robert Trappl, editor, *Cybernetics and Systems '2002*, pages 511–513, Vienna, Apr 2002. Austrian Society for Cybernetic Studies. ISBN 3-85206-160-1.

3. Christer Carlsson, Robert Fullér, and Péter Majlender. Some normative properties of possibility distributions. In *Proceedings of the Third International Symposium of Hungarian Researchers on Computational Intelligence*, pages 61–71, Budapest, Nov 2002. ISBN 963 7154 12 4.

4. Christer Carlsson, Peter Majlender, and Mikael Collan. Black and scholes real options analysis: A fuzzy approach. In *6th Annual International Conference on Real Options Proceedings*, Jul 2002.

5. Mikael Collan, Christer Carlsson, and Peter Majlender. Fuzzy black and scholes real option pricing. In *12 t h Mini Euro Conference 2002*, Apr 2002.

6. Péter Majlender. On probabilistic fuzzy numbers. In Robert Trappl, editor, *Cybernetics and Systems '2002, Proceedings of the Sixteenth European Meeting on Cybernetics and Systems*

Research, pages 520–523. Austrian Society for Cybernetic Studies, 2002. Best Paper Award.

7. Péter Majlender. Optimal timing for the exercise of real options. In *Proceedings of the International Real Option Workshop*, 2002.

8. Tarja Meristö, Sami Leppimäki, and Mari Tammi. Future skills in the Finnish ICT sector. In *Proceedings of the 25th ISBA National Small Firms Conference: Competing Perspectives of Small Business and Entrepreneurship.*, volume 3, pages 1939–1964. The Institute for Small Business Affairs, ISBA, Leeds UK, Nov 2002.

Technical Reports

1. Francisco Augusto Alcaraz Garcia. On (fL,fR)-weighted possibilistic mean and variance of fuzzy numbers. Technical Report 494, TUCS - Turku Centre for Computer Science, 2002.

2. Francisco Augusto Alcaraz Garcia. Possibilistic hedging. Technical Report 480, TUCS - Turku Centre for Computer Science, 2002.

3. Francisco Augusto Alcaraz Garcia and Markku Heikkilä. Improving investment Decision-making by expanding key knowledge with real option tools. Technical Report 467, TUCS - Turku Centre for Computer Science, Jul 2002.

4. Christer Carlsson, Robert Fullér, and Péter Majlender. On constrained OWA aggregations. Technical Report 478, TUCS - Turku Centre for Computer Science, Oct 2002.

5. Christer Carlsson, Robert Fullér, and Péter Majlender. On possibilistic Cauchy-Schwarz inequality. Technical Report 476, TUCS - Turku Centre for Computer Science, 2002.

6. Mikael Collan and Stefan Långström. Flexibility in investments: Exploratory survey on how finnish companies deal with flexibility in capital budgeting. Technical Report 453, TUCS - Turku Centre for Computer Science, 2002.

7. Mikael Collan and Péter Majlender. Fuzzy multiplicator in including trend information in fuzzy capital budgeting: Problems and conclusions. Technical Report 452, TUCS - Turku Centre for Computer Science, 2002.

8. Robert Fullér and Péter Majlender. On possibilistic dependencies. Technical Report 477, TUCS - Turku Centre for Computer Science, Oct 2002.

9. Robert Fullér and Péter Majlender. On weighted possibilistic mean and variance of fuzzy numbers. Technical Report 466, TUCS - Turku Centre for Computer Science, Jun 2002.

10. Irina Georgescu. Fuzzy structural distance. technical report 456, TUCS - Turku Centre for Computer Science, Turku, Finland, Apr 2002.

11. Irina Georgescu. Rational and congruous fuzzy consumers. Technical Report 468, TUCS - Turku Centre for Computer Science, 2002.

12. Vladimir Kvassov. Linking personalization of information system to managerial productivity. Technical Report 444, TUCS - Turku Centre for Computer Science, 2002.

7.2.18 Other

Articles in Conference Proceedings

1. Timo Mantere and Jarmo T. Alander. Developing and testing structural light vision software by co-evolutionary genetic algorithm. In Petr Musilek, editor, *QSSE 2002 The Proceedings of the Second ASERC Workshop on Quantative and Soft Computing based Software Engineering*, pages 31–37, Banff, Alberta, Canada, Fan 2002. Alberta Software Engineering Research Consortium (ASERC) and the Department of Electrical and Computer Engineering, University of Alberta.

2. Timo Mantere and Jarmo T. Alander. Testing halftoning methods using genetic algorithms - comparing results using haar wavelet filtering. In Radek Matousek and Pavel Osmera, editors, *MENDEL 2002 - 8th International Conference on Soft Computing, June 5-7, 2002, Brno, Czech Republic*, pages 103–108. Kuncik Jan, Uvoz 82, Brno, Jun 2002.

3. Harry Virtanen. Vague domains, s-unification and logic programming. In Patrik Eklund and Manuel Ojeda-Aciego, editors, *Electronic Notes in Theoretical Computer Science*, volume 66, page 18. Elsevier Science Publishers, Dec 2002. http: //www.elsevier.com/gej-ng/31/29/23/120/show/Products/notes/cover.htt.

8 Courses and Seminars 2002

The collection of advanced level and research courses given in English, forms a central part of the TUCS Graduate School. Approximately 60 courses on this level are given each year, mostly as part of the ordinary teaching duties of the TUCS faculty and researchers. The courses can be taken by all TUCS students (and also by M.Sc. students at the departments), independently of which department or university they belong to.

The following courses have been given during the year. The courses are classified into the main research areas of TUCS as follows:

A - Algorithmics
DM - Discrete Mathematics
ES - Embedded Systems
ET - Electronics and Telecommunications
IS - Information Systems
MM - Mathematical Modelling
SE - Software Engineering

8.1 Courses

Spring 2002

Advanced IT in Accounting, 3/5 cu, IS
Barbro Back, Åbo Akademi University, Department of Information Systems
Contents: The course focuses on advanced information technologies in accounting and auditing. It encompasses methods of implementing large-scale ERP packages. We also look at E-commerce and Internet Security from the accounting point of view.
Literature:
- O'Leary, Daniel E. Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce, and Risk. Cambridge Univ Press, 2000
- Articles according to the teacher's instructions

Automata and Formal Languages (continues from fall 2001), 5 cu, A, DM
Juhani Karhumäki, University of Turku, Department of Mathematics
Contents: Automata theory constitutes a cornerstone of mathematical computer science, and in particular finite automata have turned out very useful tools in many areas of discrete mathematics. Different models of automata in classical Chomsky Hierarchy as well as corresponding grammars are considered and their generating power is compared. Basic unDecidability results are proved.
Literature:
- Hopcroft, J.E., Ullman, J.D.: Introduction to Automata Theory, Languages and Computation.

Computer Networks and Security, 3 cu, A, ES
Antero Järvi, University of Turku, Department of Computer Science
Contents: Understand the principles and practices of cryptographic techniques. Understand a variety of generic security threats and vulnerabilities, and identify and analyse particular security problems for a given application. Understand the design of security protocols and mechanisms for the provision of security services needed for secure networked applications.

Appreciate the application of security techniques and technologies in solving real-life security problems in practical systems. Apply appropriate security techniques to solve security problems.
Literature:

- Course textbook (Required reading): William Stallings, *Network Security Essentials: Applications and Standards*, Prentice-Hall, 2000 (or William Stallings, *Cryptography and Neworks Security*, Prentice-Hall, 1998). Material delt out during lectures
- Recommended reading: Bruce Schneier, *Secrets and Lies*, Johd Wiley & Sons, 2000. Bruce Scheier, *Applied Cryptography,*

Corporate Information Technology, 3/5 cu, IS

Christer Carlsson, Åbo Akademi University, Department of Information Systems
Contents: The course aims to show the role and impact of modern information technology on the management processes in the corporate world. The introduction of modern information technology will form processes of change, with an impact on sustainable competitive advantages for a company. Central themes in the course will be virtual organisations, business process reengineering and management in a global networked organisation.

- Modern information technology: an overview
- BPR and information systems design
- Virtual organisations
- IT support for modern management
- Future IT and corporate management systems

Literature:

- Hammer, Michael & Steven A. Stanton, The Reeingineering Revolution, Harper Business, 1995
- Hasselbein, Frances et al (eds), The Leader of the Future, New Visions, Strategies and Practices for the Next Era, Jossey-Bass Publishers, 1996
- Keen, P. & M.McDonald, The eProcess Edge, Osborne/McGraw-Hill, Berkeley, 2000
- Checkland, P. & S.Holwell, Information, Systems and Information Systems, John Wiley & Sons, London 1998
- Articles, selected cases and chapters of books

Data Mining, 3 cu, A

Timo Knuutila, University of Turku, Department of Computer Science
Contents:

- What data mining is
- How to represent data (input)
  - concepts, instances, attributes
- How to represent information (output)
  - a.k.a knowledge representation
- Basic ML methods
- Evaluation of results (credibility)
- Real ML methods
- Engineering input & output
- Future of DM
- Time permitting:
  - Java implementations of DM methods
  - case studies & alternative techniques

Literature:

- Witten & Frank: Data Mining
  - Morgan-Kaufmann 1999

  - main text of the course
  - practical and hopefully easy book

- Hand, Mannila & Smyth: Principles of Data Mining
  - MIT Press 2001

Electronic Commerce, 3/5 cu, IS

Pirkko Walden and Bill Anckar, Åbo Akademi University, Department of Information Systems

Contents: To give the students advanced level knowledge in electronic commerce. The course is designed to help students understand how internet-caused marketplace change unfold, and to provide them with the skills to turn them into an important source of competitive advantage. It bridges the gap between current management problems and technology available to solve them. As an essential part of the course we will concentrate on analysing and planning internet projects, and creating implementable solutions for the project companies.

- Rethink the business strategies
- International virtual projects
- Field work

Literature:

- Westland, J. Christopher and Theodor H.K. Clark, Global Electronic Commerce. Theory and Case Studies. The MIT Press, 1999
- Shaw, M., R.Blanning, T Straderand, A.Winston (Editors): Handbook on Electronic Commerce, Springer-Verlag 2000
- Articles and chapters in books

Ethical Decision Making And Information Technology, 2 cu

Annamari Soini, Åbo Akademi University, Department of Computer Science

Contents: The aim of this course is to raise sensitivity to ethical circumstances involving information technology, to provide a process for analyzing such situations and for making ethically defensible Decisions in response to them. The main emphasis will be on studying problem situations modeled on real life cases.

Literature:

- The course book, Kallman & Grillo: Ethical Decision Making And Information Technology, is currently out of print, but will be made available for copying.

Graph Theory, 5 cu, DM

Vesa Halava and Tero Harju, University of Turku, Department of Mathematics

Contents: This is an introductory course in the theory of graphs covering planarity, colouring and labelled directed graphs. Graph theory has a wide range of application in mathematics, linguistics, genetics and other areas. In the theory of communication networks it is the basic tool of research.

Literature:

- Wilson, R.J.: Introduction to Graph Theory, 3rd edition.

Hardware/Software Codesign, 3 cu, ES

Seppo Virtanen and Johan Lilius, Åbo Akademi University, Department of Computer Science

Contents: Traditional embedded system design views the design of software parts of the system as a separate task from the design of hardware parts. The purpose of hardware/software codesign is to provide an integrated way for designing hardware and software. The design work starts from a system description that is not biased towards either hardware or software. This system description is then refined into software and hardware components. Typically the refinement step is done automatically by synthesising assembler and VHDL from the system

description. The Decision about which parts go into into hardware and which into software (a process called partitioning) is done by estimating the performance of the system on the system model level. The advantage of this is that it makes it possible to fully explore the design space and find an optimal solution to the design problem. The aim of this course is to introduce the student to fundamental issues in hardware/software codesign:

- Basic issues in system design, and various conceptual models that can be used to capture system behavior
- Algorithms and techniques for system partitioning and estimation
- Algorithms and techniques for synthesis of software and hardware

Human Computer Interaction and Interface Design, 3/5 cu, IS

Franck Tétard, Åbo Akademi University, Department of Information Systems

Contents: HCI is recognized as a vital component of successful computer applications. Attention for Interface Design (ID) has grown due to the advent of Web-based electronic commerce and the recognition of the positive effects of interface design on individual productivity. New applications of information technology such as Interactive-TV and mobile commerce lead us to pay more attention to usability issues. HCI as a discipline has been mainly taught in psychology and computer science study programs, but it has been recently incorporated to Information Systems (IS) programs more frequently. The course is mainly targeted to students majoring in information systems, and will therefore be customized accordingly. The objectives of this course are threefold:

- to give a general introduction to the topics of HCI and ID principles
- to enable those with a background in IS to usefully incorporate HCI requirements when designing and developping IS
- to aid creative users of IS to understand, require and optimize usability in the systems they introduce in their organizations.

Literature:

- Dix A. and J.Finlay, "Human-Computer Interaction", Prentice Hall, 1998
- Nielsen, J., "Designing Web Usability", New Riders Publishing, 1999
- Articles and various Web sources

Image and Video Compression, 5 cu, A

Jarkko Kari, University of Turku, Department of Mathematics

Contents: The course introduces the mathematical backround of image compression. Different approaches to image compression are discussed and various algorithms are presented and analysed. Topics include entropy and information, symbol coding, lossless image compression, lossy compression and rate-distortion theory, scalar and vector quantization, image transformations including discrete cosine transform and wavelet transforms, motion estimation and compensation and image and video compression standards.

Literature:

- K.Sayood: Introduction to data compression, 1996;
- R.J.Clarke: Digital compression of still images and video, 1995;
- M.Rabbani: Digital image compression techniques, 1991;
- W.B.Pennebaker: JPEG still image compression standard, 1993;
- I.H.Witten: Managing Gigabytes, compressing and indexing documents and images, 1999;
- G.Strang and T.Nguyen: Wavelets and filter banks, 1997.

Information System Design, 3 cu, SE

Ivan Porres, Åbo Akademi University, Department of Computer Science

Contents: This course is a practical introduction to object-oriented software modeling and design. We'll study how to design software-intensive systems using objects and components and

we'll learn how to express these designs using the Unified Modeling Language (UML). The course includes modeling exercises that we will solve using UML tools.

IS Evaluation, 3/2 cu, IS

Jarmo Tähkäpää and Olli Järvinen, Turku School of Economics and Business Administration and University of Turku

Contents: This course focuses on issues in information systems evaluation. The course gives an economical view to the evaluation, as well as view, how to evaluate the usability of information systems. Topics like Decision-making, costs, benefits, usability, different perspectives in evaluation (e.g management, users) and evaluation methods are discussed in this course. The aim is to learn different ways and perspectives to evaluate information systems and their utilisation and to use these methods in practise. The course consists of seminar works and lectures. In the seminar work student evaluates an information system and reports it to the lecturers and presents it in the seminar session.

Management of IS Projects, 5 cu, IS

Hannu Salmela, Turku School of Economics and Business Administration, Information Systems Science

Contents: The objective of this course is to provide knowledge and skills required from project managers in IS/IT projects. The course consists of two parts. The first part comprises weekly exercises in a virtual learning environment. In each week, students are expected to prepare one project planning document, e.g. project proposal. Weekly small group discussions concentrate on analysing problems and challenges in different types of IS/IT projects. The term paper comprises an essay about tasks and responsibilities of a project manager and a self-evaluation of how the student would qualify as a project manager. The exercises are all made in a virtual learning environment and they are scheduled to the first period of Spring Term. Students participating in the course should ensure that they reserve sufficient time for making the exercises during this period. The second part (2 cr) is optional and consists of a project practice report that contains a literature review and a detailed description of an actual IS project from an agreed perspective. The report can be based on interviews of project managers but it can also result from actual participation in an IS/IT project. The schedule for returning the project practice report is flexible and can be agreed with the course teacher.

Literature:

- MURCH, RICHARD, Project Management: Best Practices for IT Professionals, Prentice Hall, 2001 (or MURCH, RICHARD, IT-projektinhallinta, IT-Press, 2002).
- A collection of articles

Management of IT, 3 cu, IS

Professor Gary Dickson, North Carolina State University

Contents: This course is intended to give students a appreciation of key issues in contemporary IT management and mechanisms for dealing with them. Early in the course, key technology trends and their implications will be identified along with issues critical to successful IT management. Traditional topics such as organization for IT, IT budgeting, IT planning and control, IT project management, IT application cost/benefit analysis, and assessment of the IT function will be supplemented with newer ones including global IT, pervasive computing, electronic commerce, as well as the changing legal, political, and social environment in which IT must be managed for competitive success.

Literature:

- McNurlin & Sprague, Jr., Information Systems Management in Practice
- Dickson, DeSanctis & Assoc., IT and the Future Enterprise: New Models for Managers

Mathematical Modeling, 5 cu, MM

Stefan Geritz, University of Turku, Department of Mathematics

Contents: Mathematical models play an important role in almost all scientific disciplines. The aim of the course is to provide training in the formulation, the analysis and the interpretation of mathematical models. The course consists of roughly two parts: (1) models of dynamical systems in discrete and continuous time, and (2) optimization models and game theory. Examples include population dynamics, physiology, medicine, epidemics, evolution, and human behavior.

Mobile Commerce, 3/5 cu, IS

Christer Carlsson and Pirkko Walden, Åbo Akademi University, Department of Information Systems

Contents: The course aims to trace the emerging methods, technologies and business models of mobile commerce and to show the role and impact of mobile technology on the management processes in the corporate world. Mobile commerce products and services are new entities in both B-to-B and B-to-C markets and will introduce processes of change, with an impact on sustainable competitive advantages for a company. Central themes in the course will be the substance and form of new products and services, business models, emerging markets and information technology to support the mobile commerce production and logistics processes.

- Mobile commerce: a state-of-the-art
- Emerging products and services
- Business models and emerging markets
- Wireless technologies
- Intelligent support systems on mobile platforms

Literature:

- Articles, selected cases, White Papers, Internet papers and chapters of books.

MPEG 4, 2 cu, A, IS

Jan Westerholm, Åbo Akademi, Department of Computer Science

Contents: The newly formulated MPEG-4 (Moving Picture Experts Group) standard provides a flexible platform for the compression and transmission of digital audio and video. In addition to multiple streams it provides the framework for interactive multimedia and user profiling. This course explains the general structure of MPEG-4, the synchronization of multiple hierarchical streams, and interactive digital TV and video.

Literature:

- John Watkinson: The MPEG Handbook, Focal Press

Neural Networks, 4-5 cu, A, IS

Timo Järvi, University of Turku, Department of Computer Science

Contents: The aim of this course is to give a solid and practical introduction to neural networks - computational models inspired by the brain. The basic concepts and technology underlying such models will be explained. Then it will be shown how these models can be applied to the solution of diverse problems in science and engineering.

Literature:

- Neural Networks; Algorithms, Applications, and Programming Techniques, James A. Freeman, David M. Skapura (Contributor) / Hardcover / Published 1991

Program Semantics, 3/5 cu, A, ES, SE

Joakim von Wright, Åbo Akademi University, Department of Computer Science

Contents: Program semantics is the assignment of a formal meaning to programs. The course resents various classical kinds of semantics: operational, axiomatic, and denotational. The main

differences between the semantics for imperative and for functional programs is described. The use of fixpoints for giving the meaning of loops and for recursive programs is explained. To show the practical application of program semantics, examples are included illustrating the role of semantic methods in program language design and in program verification and program transformation.

Literature:

- M. Hennessy: The Semantics of Programming Languages. Wiley, 1990. Introductory book, focuses on structured operational semantics.
- G. Plotkin: A Structural Approach to Operational Semantics. Technical Report DAIMI FN-19, Aarhus University, September 1981. The origins of structured operational semantics (SOS), concisely described but with lots of examples.
- G. Winskel: The Formal Semantics of Programming Languages. MIT Press, 1993. More advanced textbook, with focus on denotational semantics, but also on operational semantics for parallelism (process algebras).

Programming III, 3 cu

Antero Järvi, University of Turku, Department of Computer Science

Contents: After we have gotten familiar with the basic concepts of the object paradigm on courses Programming I and Programming II, it is time to learn more deeply how they are used. By combining the mechanisms of an object-oriented language intelligently, we may implement flexible and easily modifiable program entities, so-called design patterns. Design patterns are kind of templates which solve problems recurring often in practice. On the other hand, components are pieces of software which hopefully change our view of programming: they are like "lego" toys which can be easily combined with each other. As examples of this technology, we study the relevant component architectures. Frameworks and product lines are bigger entities, entire application architectures that can be adapted to each environment where they are used. At the end of the course we study how application frameworks are built.

Software Architecture, 3-5 cu, ES, SE

Kaisa Sere, Åbo Akademi University, Department of Computer Science

Contents: This advanced level course at Spring 2002 aims at teaching you how to design, understand, and evaluate systems at an architectural level of abstraction. After the course you should be able to recognise different architectural styles, describe an architecture accurately, and generate and evaluate architerural alternatives.

Literature:

- M. Shaw and D. Garlan, Software Architecture, Prentice Hall 1996
- L. Bass, P. Clements, and R. Kazman, Software Architecture in Practice, Addison-Wesley 1998
- P. Donohoe, Software Architecture, Kluwer 1999
- E. Gamma, R. Helm, R. Johnson, and J. Vlissides, Design Patterns, Addisson-Wesley 1995

Special Course on Embedded Systems (Industrial Algorithms), 3 cu, ES, SE

Risto Lahdelma, University of Turku, Department of Computer Science

Contents: The course demonstrates the prototyping approach in embedded system development: introduction of application-specific theory, prototyping and simulation of algorithms in a high-level environment (Maple), converting the algorithms into a C-implementation, testing and analysing the implementation, and cross-compiling it for a small microprocessor.

Two applications are covered: a measurement device for human ventilatory response and algorithms for a hybrid navigation system.

Special Course on Networks and Virtual Environments, 2 cu, A, SE
Timo Kaukoranta, University of Turku, Department of Computer Science
Contents: A networked virtual environment (NVE) is a software system in which multiple users interact with each other in real-time, even though users may be located around the world. Application areas include teaching, distributed design, multiplayer computer games and military simulations. This course introduces the basic properties and requirements for the NVEs. Problems in the design of NVE system are considered and some design approaches are described. In addition, some existing applications are discussed.

Telecommunications Protocols, 5 cu, SE
Aulis Pirinen, Åbo Akademi University, Department of Computer Science
Contents: The course aims to give a thorough and extensive knowledge of telecommunications protocols, mainly dealing with their building blocks and structures used nowadays widely in designing and in realized data and telecommunication networks. Especially protocol stacks, functioning principles and common mechanisms, features and challenges in service providing are discussed. Most protocols being considered serves in transmission, signalling, switching, transport and OAM actions. The study is based on OSI- and Z-architectures, and on several wide-spread telecommunication softwares as those used in Ethernet, Frame Relay, Internet, ISDN, B-ISDN, GSM. Protocol environments, production and testing are also treated.
Literature: There are two main course books:

- A.S.Tannenbaum, Computer Networks, 3rd Edition (Prentice Hall 1996) and
- F.Halsall, Data Communications, Computer Networks and Open Systems, 4th Edition (Addison-Wesley 1996).

Theory of Banach Algebras, 5 cu, MM
Mats Gyllenberg, University of Turku, Department of Mathematics
Contents: The theory of Banach algebras is fundamental for modern operator theory and harmonic analysis. It has a wide range of applications in the sciences, especially in physics, but also in biology and engineering. The purpose of the course is to present the basic theory of Banach algebras and prepare the student for further studies in both pure and applied mathematics. Basic theory of Banach spaces, noncommutative and commutative Banach algebras, Gelfand-Naimark theory, spectral analysis, symbolic calculus, C*-algebras and von Neumann algebras, applications to the theory of bounded linear operators acting on a Banach space and to harmonic analysis on groups.

Fall 2002

Advanced Course on Databases, 3 cu, A
Jukka Teuhola, University of Turku, Department of Information Technology
Contents: The course explains several features of modern database management systems, such as query processing, concurrency control, recovery and security. The database design process is also an important topic. A large part of the course is devoted to object-oriented databases: the related data model, storage architecture, languages, existing systems and applications, as well as object-relational databases, which are a compromise between object-oriented and relational databases. Also some more exotic database types, such as deductive, active, spatial, temporal and multimedia databases, are briefly introduced.
Literature:

- R. Elmasri and S.B. Navathe: Fundamentals of Database Systems, 3ed., Benjamin/Cummings 2000.

- R.G.G. Cattell: Object Data Management, Object-Oriented and Extended Relational Database Systems, Revised ed., Addison-Wesley 1994.

Artificial Intelligence, 3 cu, A, DM

Timo Knuutila, University of Turku, Department of Information Technology

Contents: Attempts to define artificial intelligence (AI) vary on two dimensions. One axis concerns thought processing or reasoning, the other addresses behavior. Success in both of these can be measured either against human performance or against an ideal concept of intelligence: rationality. We follow the approach presented by Russell where the goal of AI is to build up systems that act rationally: intelligent agents. Main topics covered on the course are problem solving, knowledge representation and planning.

Literature:

- Nilsson, Nils J.: Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, 1998.
- Russell & Norvig: Artificial Intelligence: A Modern Approach, Prentice-Hall 1995.

Coding and Encryption in Telecommunication, 5 cu, ET

Valery Ipatov, University of Turku, Department of Information Technology

Contents: The main target of the course is to familiarize students with basic issues of telecommunication links design comprising information compression, channel error control and data security. Topics to be considered are: information measures and quantities, source models, efficient source coding, digital and continuous data compression (with speech, image and multimedia compression illustration), fundamental channel coding theorems, block coding and classic code parameter bounds, linear codes, syndrome Decoding, cyclic codes (with a concise insight into finite fields and polynomials), trellis (convolutional) codes and algorithm Viterbi, spectral-efficient transmission and trellis-coded modulation, data ciphering, public key cpyptosystems, authentification algorithms. All parts of the course are supported with examples of systems currently in operation or forward-looking (GSM, cdmaOne, 3G mobile radio, etc.).

Literature:

- R. B. Wells, Applied Coding and Information Theory for Engineers, Prentice Hall, 1999

Computer Supported Work, 3 cu, IS

Eija Karsten, University of Turku, Department of Information Technology

Contents: The aim of the course is to put information technology into the context of human activity as work and as business. Starting from the fundamental level of business work processes information technology is regarded as means which enables and supports business activity in terms of production and quality. The individual as the subject of the work processes is emphasised, and the principles of flexible organisation of work is defined in terms of work roles. Information technology is incorporated into this activity.

Current Issues in Information Systems Research, 3/5 cu, IS

Markku Nurminen, University of Turku, Department of Information Technology

Contents: The information systems group is engaged in research in a number of key areas. To invite creative interaction, one area of research is studied in depth with international lecturers, focusing on issues they are currently studying.

Literature:

- Current journal and conference articles. Working papers by the lecturers.

Design and Analysis of Algorithms, 3 cu, A
Olli Nevalainen, University of Turku, Department of Information Technology
Contents: The course concentrates on the design and analysis of efficient computer algorithms. The topics include design principles, complexity theory and approximation techniques.
Literature:
- Gilles Bressard, Paul Bratleg: Fundamentals of Algorithms, Prentice-Hall, 1996

Electronic Commerce, 3/5 cu, IS
Pirkko Walden and Bill Anckar, Åbo Akademi University, Department of Information Systems
Contents: To give the students advanced level knowledge in electronic commerce. The course is designed to help students understand how internet-caused marketplace change unfold, and to provide them with the skills to turn them into an important source of competitive advantage. It bridges the gap between current management problems and technology available to solve them. As an essential part of the course we will concentrate on analysing and planning internet projects, and creating implementable solutions for the project companies.

Information Economics, 5 cu, IS
Jonna Järveläinen, Turku School of Economics and Business Administration, Information Systems Science
Contents: The aim of the course is to broaden the understanding of the economic impacts of information production and use. Also the issue of how to define and measure the value of information as a business management tool is raised. Further, the aim is to investigate the most important economic theories that are applicable in understanding the impact of information systems on business and business structures. The course design is adapted from a similar course held in Helsinki School of Economics designed by Virpi Tuunainen.
Literature:
- Article collection
- SHAPIRO, CARL; VARIAN, HAL R., Information Rules: a Strategic Guide to the Network Economy. Boston, Harvard Business School Press 1999.
- Kelly, Kevin: New rules for the new economy: 10 radical strategies for a connected world; New York: Viking, 1998

Intelligent Systems in Business, 3/5 cu, IS
Barbro Back, Åbo Akademi University, Department of Information Systems
Contents: The course aims at deepening the participants' knowledge in modern computer supported problem solving. We look at the state of the art in advanced knowledge based systems, at new technological developments and emerging paradigms in intelligent systems.

Introduction to Biocomputing, 3 cu, DM, A
Ion Petre, Åbo Akademi University, Department of Computer Science
Contents:
- Basic introduction to Molecular Biology
- Physical Mapping
- DNA sequencing
- Investigation of similarities between DNA
- Construction of phylogenetic trees
- Bioinformatics databases and tools
- Models for Biocomputing

Literature:
- R. Dubin, S. Eddy, A. Krogh, G. Mitchison, Biological Sequence Analysis : Probabilistic Models of Proteins and Nucleic Acids, Cambridge University Press, 1999.

- D. Gusfield, Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, Cambridge University Press, 1997.
- A.M. Lesk, Introduction to Bioinformatics, Oxford University Press, 2002.
- P. Pevzner, Computational Molecular Biology : An Algorithmic Approach, MIT Press, 2000.
- J. Setubal, J. Meidanis, Introduction to Computational Molecular Biology, PWS Publishing Company, 1997.
- R. Shamir, Lecture Notes on "Algorithms in Molecular Biology", University of Tel Aviv, 2002.
- M. Waterman, Introduction to Computational Biology: Maps, Sequences and Genomes, CRC Press, 1995.
- G. Paun, G. Rozenberg, A. Salomaa, DNA-Computing - new computing paradigms, Springer, 1998.

Introduction to Program Refinement, 5 cu, SE

Linas Laibinis, Åbo Akademi University, Department of Computer Science

Contents: The Refinement Calculus is a calculus for rigorous program construction by stepwise refinement. Stepwise refinement is a paradigm for problem solving, where a problem formulation is gradually transformed into a solution of the problem. In program refinement, an initial specification is transformed step by step into an implementable program using transformations that introduce data structures and control structures. The aim of this course is to make the participants familiar with the Refinement Calculus, its foundations and its applications.

Literature:

- R.J.R. Back and J. von Wright: Refinement Calculus - a Systematic Introduction. Springer-Verlag 1998.

Knowledge Sharing in High Technology Environments, 3+2 cu, IS

Gary Dickson/Inger Eriksson, North Carolina State University and course assistant Adekunle Okunoye, University of Turku, Department of Information Technology

Contents: To investigate how knowledge can be effectively shared and created in organizations in the fast-moving high technology environment of the 21st century. The course orientation is one that joins information technology perspectives with management perspectives in an integrated fashion.

Literature:

- Journal articles and research papers.

Lattice Theory, 3 cu, DM, SE

Reino Vainio, Åbo Akademi University, Department of Mathematics

Contents: A thorough treatment of ordered sets and intersection structures in the beginning of the course provides a firm foundation on which to build the theory of CPO's (complete partial orderings) and domains. These structures are studied, applied, and finally related to Scott's information systems. Fixpoint theory is presented both in the classic setting of complete lattices and, as most applications demand, in the setting of CPO's.

Literature:

- B.A. Davey and H.A. Priestley, Introduction to Lattices and Order, Cambridge University Press.

Linking Information Technology and Business Strategy, 3/5 cu, IS

Christer Carlsson, Åbo Akademi University, Department of Information Systems

Contents: Underlying every function in a business, whether it is an industrial or a service organization, is information technology (IT). This technology serves as an essential enabler for

creating and implementing business strategies suited for the 21st century corporation. It allows companies to go beyond efficiency and effectiveness improvement and create business opportunities in the new world of the networked corporation and the information society. Moreover, IT is drastically impacting management and business processes, changing the competitive balance between companies, and increasingly blurring the boundaries of several industries. This course focuses on how IT can create or transform the business strategy of a firm.It discusses the impact of Internet and wireless commerce as a new locus of value creation.

Linux and System Programming, 3 cu, ES

Risto Lahdelma, University of Turku, Department of Information Technology

Contents: The course introduces C/C++ and the standard UNIX interface eg. the file system, process management, interprocess communication and network programming. During the course students will become familiar with structure of the LINUX kernel. The aim is to understand different layers of operating system and their implementations. The course provides with practical skills for developing UNIX applications and LINUX device drivers.

Literature:

- Neil Matthew & Richard Stones: Beginning Linux Programming, 1996 WROX Press
- Alessandro Rubini: Linux Device Drivers, 1998 O'Reilly

Parallel Programming, 3 cu, SE

Mats Aspnäs, Åbo Akademi University, Department of Computer Science

Contents: The course presents parallel programming using message passing.

The course covers the following topics:

- Parallel computer systems
- Parallel program design
- Parallel programming using MPI
- Efficiency of parallel programs

Literature:

- Barry Wilkinson and Michael Allen, Parallel programming, Techniques and Applications Using Networked Workstations and Parallel Computers, Prentice Hall, 1999.
- Peter Pacheco: Parallel Programming with MPI, Morgan Kaufmann, 1997.

Project Course, 5 cu, ES, SE

Elena Troubitsyna, Åbo Akademi University, Department of Computer Science

Contents: The aim of the course is to study an entire software development process by developing a realistic system. The participants are organized in groups of 3-6 persons. Each group is acting as an independent development team, which solves a single problem. The "customer" (the lecturer) and each team will have regular meetings in the whole course of the project. The course puts an emphasis on the methodological aspect of software development. The participants learn how to develop software in a well- structured way. The course is an opportunity to gather experience with both managing and participating in a comparatively large project.

Literature:

- Will be given to each team according to the task.

Self-Organizing Systems, 5 cu, ET

Juhani Peltonen, University of Turku, Department of Information Technology

Contents: Using electronic study materials students become familiar with learning systems. Principles and theory of neural and adaptive systems; various neural netwoks; linear classifiers, non-linear networks; competing networks; SOM (Self Organizing Maps); the potential use and

adaptions of neural networks, e.g. in data processing. The interactive electronic course book includes a considerable number of computer based exercises.
Literature:

- J. C. Principe, N. R. Euliano & W. C. Lefebre, Neural and Adaptive Systems, John Wiley & Sons, 1999.

Semigroups I, 2,5 cu, DM

T. Petkovic, University of Turku, Department of Mathematics
Contents: The course is an introduction to Semigroup Theory. Besides basic notions, Green's relations, semigroups that are unions of groups, regular semigroups, as well as completely regular semigroups and their generalisation, Archimedean semigroups, will be discussed. Free semigroups and transformation semigroups will be used as important examples. Special attention will be devoted to the part of the software package GAP developed for studying finite semigroups.
Literature:

- J. M. Howie: An Introduction to Semigroup Theory (1976)
- A. H. Clifford and G. B. Preston: The Algebraic Theory of Semigroups I, II (1961,1967).

Semigroups II, 2,5 cu, DM

T. Petkovic, University of Turku, Department of Mathematics
Contents: This is an advanced course based on the course Semigroup Theory I. It is mainly devoted to composition and Decomposition methods used for constructing semigroups or analysing their structure. Our attention will be focused mostly on semilattice Decompositions, various ideal extensions and band Decompositions. Moreover, the connections between the structure of semigroups and the identities satisfied by them will be considered.
Literature:

- M. Petrich: Introduction to Semigroups (1973)
- M. Petrich: Lectures in Semigroups (1977).

Software Quality, 5 cu, ES, IS, SE

Aimo Törn, Åbo Akademi University, Department of Computer Science
Contents: In software engineering software quality has become a topic of major concern. As software is becoming critically important for an organization to be competitive in its business, the requirement that the software is highly supportive for the organization in achieving its goals means that the software should have high utility and user quality. It has also been recognized that software maintenance is becoming the main activity in software work. With the growing collection of software in organizations this cost is becoming substantial. The amount of maintenance needed and the effort needed to perform a certain maintenance task is critically dependent on the technical quality of software resulting from the software development process. The student will learn and understand what quality means, how it can be measured, and how a measurement program can be implemented. (Execises, Course Paper, Examination).
Literature:

- Fenton N.E. and S.L. Pfleeger: "Software Metrics - A Rigorous & Practical Approach", International Thomson Computer Press, London 1997 (Second edition).

Special Course in Embedded Systems, 3 cu, ES

Jerker Björkqvist, Åbo Akademi University, Department of Computer Science
Contents: The course will give the basics for understanding digital video broadcasting systems, especially the one selected by the European Broadcasting Union (EBU), also used in Finland for Digital Broadcasting. The essential building blocks of Digital Video Broadcasting are presented.

Special Course in Software Engineering, 3 cu, SE
Iván Porres, Åbo Akademi University, Department of Computer Science
Contents: The special course on software engineering presents new topics, methods and technologies that represent and advancement in the field of software development but are not yet part of the undergraduate curriculum in Software Engineering. The course contains regular lectures, self studying articles, a programming assignment and guest presentations. The actual contents of the course will change every year.
Contents for this year:

- Scripting Languages: Functional and metaprogramming with Python.
- Continuous Testing: Write-test-before-code approach and JUnit.
- Aspect Oriented Programming: AspectJ.
- Agile Software Processes: Extreme Programming and SCRUM.
- Stepwise Feature Introduction. Guest presentation.

Telecommunication Software, 3 cu, SE
Luigia Petre, Åbo Akademi University, Department of Computer Science
Contents: The aim of this course is to give students a thorough understanding of network technologies and applications, both from the conventional approach and from the object-oriented perspectives.
Literature:

- Stefan Boecking: Object-Oriented Network Protocols, Addison-Wesley 2000.

ULSI Design, 5 cu, ET
Juha Plosila, University of Turku, Department of Information Technology
Contents: The course aims to give the students sound knowledge of limitations that increasing integration in the future will cause in the electronic design of system level ULSI circuits. The focus of the course is on the errorless internal communication within the circuit and on the design of low-noise power distribution network. Scaling of circuit technology and its effect on the operation of circuit on transistor and circuitry level. Conductors as part of the design process. Noise in digital systems, and its effect on the operation and capacity of the system. Power feed strategies for minimising noise. The coding of signals and transferring methods on chip and board level. Examples of signalling circuits. Timing and synchronising. Clocking and distribution of clock pulse. Examples of timing circuits.

8.2 Short Courses and Seminars

Spring 2002

Research Seminar on Information Systems, 1-3 cu, IS
Eija Karsten, University of Turku, Department of Computer Science
Contents: The research seminar on information systems is intended as a forum for those carrying out their own research projects. The core of the participants will be formed by current and future doctorate students, but also more senior research fellows and ambitious Master's students are very welcome.
The seminar will consist of three kinds of activities

- presentation of own research, others give feedback (1-2 cr) OR a selected theme on research (1 cr)
- reading and reviewing recent theses (1 cr)

Seminar on Logic Programming, 3 cu, A
Risto Lahdelma and Timo Knuutila, University of Turku, Department of Computer Science
Contents: Some advanced topics in logic programming are covered. These may include constraint logic programming, combination of optimization and logic programming, Visual Prolog, parsing and code generation, code analysis.
Literature:
- John Hooker: Logic-Based Methods for Optimization, John Wiley, 2000
- articles

Seminar on Techniques for Low Power Optimization of Software, ES
Johan Lilius, Åbo Akademi University, Department of Computer Science
Contents : A common problem for embedded systems is the power consumption. Low Power Software Techniques are becoming recently a important issue due to the increasing popularity of portable device like mobile phones and PDA's. Some of those systems don't take this power constraint as a main priority, like a GPS embedded in a cargo ship who it will be supply though the engine power generator. But it will be completely different for a portable GPS embedded in a sailing boat and connecting to a battery ! To extend the life time of a system only two possibilities exist, either you increase the battery size or you Decrease the system power consumption. This seminar will focus only on software techniques used to reduce the power consumption.

Fall 2002

Seminar: Fractals, 2 cu, A, DM
Aleksandr Mylläri, University of Turku, Department of Information Technology
Contents: The course gives an introduction to the fractal geometry. It starts with an empirical introduction to the problem, followed by advanced mathematical topics. Applications in Computer Graphics and other fields are discussed.
Literature: lecture notes based mainly on:
- Robert L. Devaney and Linda Keen (eds.): Chaos and Fractals: The Mathematics Behind the Computer Graphics, AMS, 1989
- Jens Feder,: Fractals (Physics of Solids and Liquids), Plenum Pub Corp, 1988
- Heinz-Otto Peitgen, Hartmut Jurgens and Ditmar Saupe: Chaos and Fractals: new frontiers of science, Springer-Verlag, 1992
- Paul S. Addison: Fractals and Chaos: an Illustrated Course, Institute of Physics Publishing, 1997
- Michael F. Barnsley: Fractals Everywhere (2d Edition), Academic Press Professional, 1993.

Research Seminar: Artificial Intelligence in Computer Games, 2 cu, A, SE
Jouni Smed, University of Turku, Department of Information Technology
Contents: This research seminar aims to familiarise students with some depth with one specific algorithmic problem, provide ability to understand and analyse existing solutions and further develop them. The seminar will emphasise research orientation, and its purpose is to have ideas reported, for example, in international publications. The active participant will gain 3 credit units by analysing and implementing various methods, and by reporting the results. The course format may lead to restrictions in the number of participants.

8.3 Short Courses

Spring 2002

Vizualization, A, SE, IS
Dr. W. Gregory Wojtkowski, Boise State University, USA (Idaho)
Contents: This course introduces students to the field of Vizualization.The main topics are: the fundamental philosophy of data visualization and essence of good and bad visualization techniques. Our lectures will not require a strong mathematical background.

Soft Decision Analysis, 2 cu, A, IS, MM
Professor Robert Fullér, Eötvös Lorand University, Budapest (Åbo Akademi University)
Contents: The process of aggregation of imprecise and uncertain information appears in many applications related to the development of intelligent systems. One sees aggregation in neural networks, fuzzy logic controllers, vision systems, expert systems and multi-criteria Decision aids. Fuzzy logic resembles human reasoning in its use of imprecise information to generate Decisions. Some of the essential characteristics of fuzzy logic relate to the following:
In fuzzy logic, exact reasoning is viewed as a limiting case of approximate reasoning.
In fuzzy logic, everything is a matter of degree.
In fuzzy logic, knowledge is interpreted a collection of elastic or, equivalently, fuzzy constraint on a collection of variables.
Inference is viewed as a process of propagation of elastic constraints.
Any logical system can be fuzzified. Fuzzy set theory provides a host of attractive aggregation connectives for integrating membership values representing uncertain information. These connectives can be categorized into the following three classes union, intersection and compensation connectives. Union produces a high output whenever any one of the input values representing degrees of satisfaction of different features or criteria is high. Intersection connectives produce a high output only when all of the inputs have high values. Compensative connectives have the property that a higher degree of satisfaction of one of the criteria can compensate for a lower degree of satisfaction of another criteria to a certain extent.
The main goals of the short course are to explain

- how to make Decisions under strict uncertainty
- how to make Decisions with risk
- how to choose appropriate aggregation operators to Decision process where trade-offs are allowed;
- how to solve linear programming problems with soft objective function and constraints;
- how to model the Decision maker's preferences by fuzzy sets;
- how to "solve" multiple objective programs using fuzzy logic;
- Literature: Christer Carlsson and Robert Fullér, Fuzzy Reasoning in Decision Making and Optimization, Studies in Fuzziness and Soft Computing Series, Vol.82, Springer-Verlag, Berlin-Heildelberg, 2001, 338 pages.

Fall 2002

Individual and Group Decision Making in Fuzzy Environments
Lecturer: Mario Fedrizzi, University of Trento
Contents:

- Normative and descriptive Decision theories.
- The bounded rationality paradigm.

- Decision processes in organizations.
- Uncertain knowledge in Decision making.
- Basics of fuzzy sets and possibility theory.
- Bellman-Zadeh's approach to Decision making in fuzzy environments.
- Group Decision making and preference aggregation. How to escape from impossibility theorems using fuzzy preference relations.
- Consensus reaching as a hierarchical pooling process. Approximate reasoning in the modeling of consensus. A dynamical network model for soft consensus reaching.
- GDSS's and coalition formation among rational agents.

Wavelets and Number Theory

Lecturer: Prof. Teodor Krenkel, Moscow Technical University for Communications and Informatics, Department of Computer Science, Russia

Contents: An introduction to wavelets.

- Semiorthogonal wavelets and the Battle-Lemarie wavelets.
- Polylogarithms, Hurwitz zeta functions, and the Kubert identities.
- Higher Stickelberger ideals and cyclotomic units.
- p-adic zeta-funtions and Bernoulli numbers.
- Construction of biorthogonal discrete wavelet transforms using interpolatory splines.

9 Conference Participation 2002

During the year 2002, TUCS has financed conference participation and other travel expenses for a total of 74,515.39 EUR, of which 62,986.24 EUR has been used on journeys made by postgraduate students, 6,105.27 EUR by postdoctoral researchers and 5,423.88 EUR by TUCS researchers. The departments and research projects in TUCS have also financed conference participation for the researchers.

The following conference participations have been financed by TUCS during the year:

9.1 Graduate Students

Alcaraz, Francisco

- 12th Mini Euro Conference, Brussels, Belgium, 2 - 5.4.2002

Alford, Gordon

- Workshop on Membrane Computing, Curtea d´Arges Romania, 19 - 23.8.2002

Arvo, Jukka

- The Gathering 2 Conference, London, UK, 13 - 14.6.2002
- Research visit to Helsinki University of Technology, 19.9.2002
- Research visit to Helsinki University of Technology, 15.11.2002

Auranen, Esa

- Visit to Medicel, Helsinki, Finland, 9.12.2002

BenMoussa, Chihab

- Business&Economics Society International Conference Montreal, Canada, 24 - 29.7.2002

Björklund, Dag

- DATE02 Conference, Paris, France, 4 - 8.3.2002
- The Tenth International Symposium on Hardware/Software Codesign Estes Park, Colorado, 6 - 8.5.2002
- The Third International Conference on Integrated Formal Methods Turku, Finland, 15 - 17.5.2002

Celiku, Orieta

- The Third International Conference on Integrated Formal Methods Turku, Finland, 15 - 17.5.2002
- Summer School on Specification, Refinement and Verification Turku, Finland, 19 - 30.8.2002
- 4th International Conference on Formal Engineering Methods Shanghai, China, 21 - 25.10.2002

Cerschi, Cristina

- The Third International Conference on Integrated Formal Methods
  Turku, Finland, 15 - 17.5.2002
- 9th Asia-Pasific Software Engineering Conference
  Gold Coast, Australia, 3 - 6.12.2002

Collan, Mikeael

- 12th Mini EURO Conference, Brussels, Belgium, 2 - 5.4.2002
- 6th Annual International Conference on Real Options: Theory Meets Practice
  Paphos, Cyprus, 4 - 6.7.2002

Cosmin-Codrea, Marius

- Kinetic Fluorescence Imaging of Plants Workshop, Nove Hrady
  Czech Republic, 22 - 25.7.2002
- The 2nd IASTED International Conference Visualization, Imaging and Image Processing, Malaga, Spain, 9 - 12.9.2002

Costea, Adrian

- Central&Eastern European Workshop on Efficiency&Productivity Analysis
  Bucharest, Romania, 27 - 29.6.2002
- IADIS International Conference WWW/Internet 2002
  Lisbon, Portugal, 13 - 15.11.2002

Eklund, Tomas

- Xth European Conference on Information Systems and Ph.D. Consortium,
  Gdansk, Poland, 6 - 8.6.2002

Enqvist, Henrik

- The Third International Conference on Integrated Formal Methods
  Turku, Finland, 15 -17.5.2002
- The 10th Nordic Workshop on Programming and Software Development Tools and Techniques, Copenhagen, Denmark, 18 - 20.8.2002

Georgescu, Irina

- Jyväskylä Summer School, 11 - 18.8.2002

Gyenesei, Attila

- The 2002 International Conference on Fuzzy Systems and Knowledge Discovery, Singapore, 17 - 22.11.2002
- SWAT Conference, Turku, Finland, 3 - 5.7.2002

Halava, Vesa

- Journees Montoines on Theoretical Computer Science, Montpellier, France, 9 - 11.10.2002

Han Shengnan

- The International Conference on Decision Making and Decision Support in the Internet Age, Cork, Ireland, 3 - 8.7.2002
- 25th Information Systems Research in Scandinavia Conference
  Copenhagen, Denmark, 10 - 13.8.2002

Hirkman Piia

- XML Finland 2002, Helsinki, Finland, 21 - 22.10.2002

Hirvensalo Mika

- MFCS 2002, Varsova, Poland, 26 - 30.8.2002

Isaksson Joakim

- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002

Kadyté Vaida

- Oslo Summer School in Comparative Social Science Studies 2002, Norway, 29.7 - 2.8.2002

Kaitovaara Petteri

- The International Conference on Decision Making and Decision Support in the Internet Age, Cork, Ireland, 3 - 8.7.2002
- ICIS 2002 Doctoral Consortium and Conference, 11 - 19.12.2002

Kivijärvi Juha

- 4th Asia-Pacific Conference on Simulated Evolution and Learning, Singapore, 18 - 22.11.2002

Kloptchenko Antonina

- 2002 Americas Conference on Information Systems, Dallas, USA, 9 - 11.8.2002
- The 2002 International Conference on Information and Knowledge Engineering, Las Vegas, USA, 24 - 27.6.2002

Koskivaara Eija

- ECIS-2002 Doctoral Consortium, Gdansk, Poland, 2 - 5.6.2002
- Information Systems Foundations: Building the Theoretical Base Workshop, Canberra, Australia, 28.9 - 7.10.2002

Lainema Timo

- IRIS Conference, Copenhagen, Denmark, 10 - 13.8.2002
- ISAGA Conference, Edinburgh, UK, 23 - 31.8.2002

Lanedri Anas

- The International Academy of E-business Conference in Florida, USA, 6 - 11.3.2002
- Business Innovation in the Knowledge Economy Conference, Warwick, England, 12.6.2002
- 6th Pacific Asia Conference on Information Systems, Tokyo, Japan, 2 - 4.9.2002

Lafond Sebastién

- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002
- System on Chip Seminar, Tampere, Finland, 19 - 21.11.2002

Li Chang

- Lipari Summer School for Computer Science Researcher, Lipari, Italy , 30.6 - 13.7.2002
- Summer School on Specification, Refinement and Verification, Turku, Finland, 19 - 30.8.2002
- Nordic Workshop for Programming Theory 2002, Tallin, Estonia, 20 - 22.11.2002

Majlender Peter

- 16th European Meeting on Cybernetics and Systems Research, Vienna, Austria, 2 - 5.4.2002
- 6th Annual International Conference on Real Options: Theory Meets Practice, Paphos, Cyprus, 4 - 6.7.2002
- 3rd International Symposium of Hungarian Researchers on Computational Intelligence, Budapest, Hungary, 14 - 15.11.2002

Marghescu Dorina

- The Jyväskylä Summer School, 11 - 24.8.2002

Milovanov Luka

- The International Summer School on Models, Algebras and Logic of Engineering Software, Marktoberdorf, Germany, 30.7 - 11.8.2002
- Summer School on Specification, Refinement and Verification, Turku, Finland, 19 - 30.8.2002

Munsin Jonas

- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002
- The 10th Nordic Workshop on Programming and Software Development Tools and Techniques, Copenhagen, Denmark, 18 - 20.8.2002

Nikkanen Anu

- Return train ticket to Tampere to participate Teodor Krenkel´s lecture, 19.3.2002
- Lukuteorian päivät, Helsinki, Finland, 23 - 24.5.2002

Okunoye Adekunle

- Information Reseources Management Association Conference (IRMA 2002, Seattle, USA, 19 - 22.5.2002
- International Federation for Information Processing (IFIP) WG 9.4 Conference 2002, Bangalore, India, 29 - 31.5.2002
- Global Information Technology Association (GITM) World Conference 2002, New York, USA, 23 - 25.6.2002
- Traintickets, Turku – Helsinki

Olofsson Svante

- Communications, Internet and Information Technology Conference, Virgin Islands, USA, 18 - 20.11.2002

Petre Ion

- Weighted Automata: Theory and Applications Workshop, Dresden, Germany, 4 - 8.3.2002
- The International Conference on Graph Transformations, Barcelona, Spain, 7 - 12.10.2002

Petre Luigia

- Critical Systems Development with UML, Dresden, Germany, 30.9 - 4.10.2002

Preoteasa Viorel

- Extreme Programming 2002 Conference, Alghero, Italy, 26 - 30.5.2002
- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002

Rimvydas Ruksenas

- Summer School on Specification, Refinement and Verification, Turku, Finland, 19 - 30.8.2002

Rosendahl Petri

- One trip from Norway to Finland

Rossi de Mio Ruggero

- Xth European Conference on Information Systems and Ph.D. Consortium, Gdansk, Poland, 2 - 8.6.2002
- The International Conference on Decision Making and Decision Support in the Internet Age, Cork, Ireland, 3 - 7.7.2002

Rönkä Matti

- The Third Conference for Ph.D. Students in Computer Science, Szeged, Hungary, 1 - 4.7.2002

Salehi Saeed

- The 10th International Conference on Automata and Formal Languages, Debrecen, Hungary, 13 -18.8.2002

Sell Anna

- The International Conference on Decision Making and Decision Support in the Internet Age, Cork, Ireland, 3 - 8.7.2002

Smed Jouni

- 6th Virtual Reality Special Interest Group Seminar, Tampere, Finland, 15.4.2002
- Computer Games and Digital Cultures Conference, Tampere, Finland, 6 - 8.6.2002

Steinby Paula

- Conference of Ph.D. Students on Computer Science, Szeged, Hungary, 1 - 4.7.2002

Truscan Dragos

- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002
- Protocol Professor Designer´s Forum, Stockholm, Sweden, 18.6.2002

- FDL ´02 Conference, Marseille, France, 24 - 27.9.2002
- System on Chip Seminar, Tampere, Finland, 19 - 21.11.2002
- Seminar on Transport Triggered Architectures, Tampere, Finland, 25 - 26.11.2002

Tsygankov Victor
- Doctoral Seminar on Organizational Design, Brussels, Belgium, 11 - 15.3.2002
- IRIS 25 Conference, Denmark, 10 - 13.8.2002

Valtonen Tuomas
- IEEE International Symposium on Circuits and Systems, Scottsdale, Arizona, USA, 26 - 29.5.2002

Virtanen Seppo
- The Ninth IEEE/DATC Electronic Design Proceesses Workshop, Monterey, Califoria, 21 - 23.4.2202
- Protocol Professor Designer´s Forum, Stockholm, Sweden, 18.6.2002
- The 20th IEEE Norchip Conference, Copenhagen, Denmark, 11 - 12.11.2002

Westerlund Tomi
- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002

Yan Lu
- Summer School on Specification, Refinement and Verification, Turku, Finland, 19 - 30.8.2002

9.2 Postdoctoral Researchers

Aittokallio Tero
- ECMTB2002, Milano, Italy, 2 - 6.2002
- BIOTEC 2002 Conference, Helsinki, 18.9.2002
- Differential Gene Expression 2002 Conference, USA, 12 - 15.10.2002

Bos Victor
- The Third International Conference on Integrated Formal Methods, Turku, Finland, 15 - 17.5.2002

Dhaou Imed Ben
- Travel costs Stockholm – Turku

Fernandes Miguel
- Travel costs from Portugal to Finland
- System on Chip Seminar, Tampere, Finland, 20 - 21.11.2002

Haiyi Zhang
- The 15th International Conference on Industrial&Engineering, Cairns, Australia, 17 - 20.6.2002

- Applications of Arificial Intelligence&Expert Systems, Cairns, Australia, 17 - 20.7.2002

Holub Stepan
- Journées Monotoises on Theoretical Computer Science, Montpellier, France, 9 - 11.9.2002

Kaukoranta Timo
- 6th Virtual Reality Special Interest Group Seminar, Tampere, Finland, 15.4.2002
- Computer Games and Digital Cultures Conference, Tampere, Finland, 6 - 8.6.2002
- SWAT Conference, Turku, Finland, 3. - 5.7.2002

Nastac Dumitru Iulian
- Travel costs Romania – Finland

9.3 Researchers

Fullér Robert
- Travelexpenses, TUCS Short Course, Software Decision Analysis

Karsten Eija
- HICSS-35, Hawaii, USA, 7 - 10.1.2002

Seceleanu Tiberiu
- Forum on Specification & Design Languages, Marseille, France, 24 - 27.9.2002

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TUCS General Publications

5. **Wolfgang Weck, Jan Bosch, Clemens Szyperski (Eds.)**, Proceedings of the Second International Workshop on Component–Oriented Programming (WCOP '97)
6. Working Material from the School on Natural Computation, SNAC
7. **Mats Aspnäs, Ralph-Johan Back, Timo Järvi, Tiina Lehto (Eds.)**, Turku Centre for Computer Science, Annual Report 1997
8. **Reima Suomi, Paul Jackson, Laura Hollmén and Mats Aspnäs (Eds.)**, Teleworking Environments, Proceedings of the Third International Workshop on Telework
9. **Robert Fullér**, Fuzzy Reasoning and Fuzzy Optimization
10. **Wolfgang Weck, Jan Bosch, Clemens Szyperski (Eds.)**, Proceedings of the Third International Workshop on Component–Oriented Programming (WCOP '98)
11. Abstracts from the 10th Nordic Workshop on Programming Theory (NWPT'98)
12. **Edward M. Roche, Kalle Kangas, Reima Suomi (Eds.)**, Proceedings of the IFIP WG 8.7 Helsinki Working Conference, 1998
13. **Christer Carlsson and Franck Tétard (Eds.)**, Intelligent Systems and Active DSS, Abstracts of the IFORS SPC-9 Conference
14. **Mats Aspnäs, Ralph-Johan Back, Timo Järvi, Martti Kuutti, Tiina Lehto (Eds.)**, Turku Centre for Computer Science, Annual Report 1998
15. **Tero Harju and Iiro Honkala (Eds.)**, Proceedings of the Seventh Nordic Combinatorial Conference
16. **Christer Carlsson (Editor)**, The State of the Art of Information System Applications in 2007
17. **Christer Carlsson (Editor)**, Information Systems Day
18. **Ralph-Johan Back, Timo Järvi, Nina Kivinen, Leena Palmulaakso-Nylund and Thomas Sund (Eds.)**, Turku Centre for Computer Science, Annual Report 1999
20. **Reima Suomi, Jarmo Tähkäpää (Eds.)**, Health and Wealth trough Knowledge
21. **Johan Lilius, Seppo Virtanen (Eds.)**, TTA Workshop Notes 2002
22. **Mikael Collan**, Investment Planning – An Introduction
23. **Mats Aspnäs, Christel Donner, Monika Eklund, Pia Le Grand, Ulrika Gustafsson, Timo Järvi, Nina Kivinen, Maria Prusila, Thomas Sund (Eds.)**, Turku Centre for Computer Science, Annual Report 2000-2001
24. **Ralph-Johan Back and Victor Bos**, Centre for Reliable Software Technology, Progress Report 2003
25. **Pirkko Walden, Stina Störling-Sarkkila, Hannu Salmela and Eija H. Karsten (Eds.)**, ICT and Services: Combining Views from IS and Service Research
26. **Timo Järvi and Pekka Reijonen (Eds.)**, People and Computers: Twenty-one Ways of Looking at Information Systems
27. **Tero Harju and Juhani Karhumäki (Eds.)**, Proceedings of WORDS'03
28. **Mats Aspnäs, Christel Donner, Monika Eklund, Pia Le Grand, Ulrika Gustafsson, Timo Järvi and Nina Kivinen (Eds.)**, Turku Centre for Computer Science, Annual Report 2002

Turku Centre for Computer Science
Lemminkäisenkatu 14
FIN-20520 Turku
Finland

http://www.tucs.fi

University of Turku
- Department of Information Technology
- Department of Mathematics

Åbo Akademi University
- Department of Computer Science
- Institute for Advanced Management Systems Research

Turku School of Economics and Business Administration
- Institute of Information Systems Science