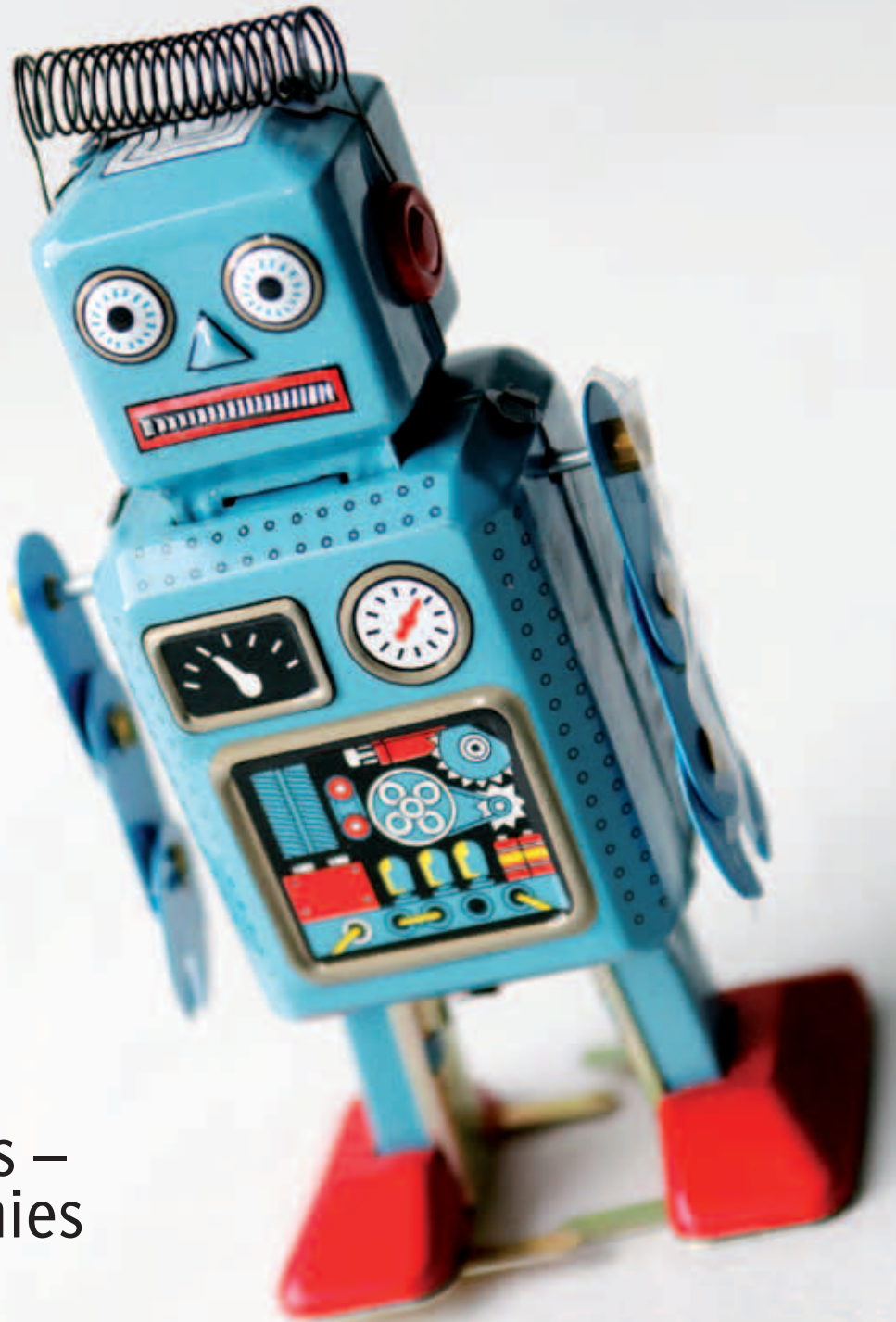


POLYSTEEKKI

Helsinki University of Technology – TTK – Magazine 2/2009



Theme:
Young
Entrepreneurs –
Young Companies



22 *One of the many busy days in CEO Maija Itkonen's life.*



28 *IPPEs project aims to create innovative micro fuel cell technology.*



32 *TV screen and DVD player without any cable connection? Sylvain Ranvier dissertated on multiple antennae in electronic devices.*

Editorial: Funding Crisis?..... 3
 News..... 4
 Column: Time Is Wasted 11
 From the Rector..... 13

Theme: Young Entrepreneurs – Young Companies

The Art Of ZenRobotics 14
 Bioadaptive Technology And a Bone Lengthening Device 16
 Transparent Entrepreneurship..... 18
 An Entrepreneurial Spirit 20
 Corporate Responsibility In Mind 20
 A Mathematician As an Entrepreneur..... 21
 Absolutely Entrepreneurial 22
 Engineers And Entrepreneurs an Apprenticeship Of 200 Years..... 26
 Power To the Laptops 28
 Column: From Space Probes To Buildings 31
 Nice Antennae..... 32
 Dissertations..... 33
 Change Management And Networking..... 36
 ‘The Times They Are A-Changin’ 38
 TKK In a Nutshell 39
 TKK International Study Programmes..... 40

PUBLISHER: HELSINKI UNIVERSITY OF TECHNOLOGY – TKK

Editorial council:
 Vice-rector Kalevi Ekman
 Timo Honkela
 Janne Luotola
 Panu Nykänen
 Pirkko Oittinen

P.O.Box 1100,
 FI-02015 TKK, Finland
 Fax: +358 9 451 2070

Editor-in-chief:
 Päivi Tainio
 Tel. +358 9 451 5494
 paivi.tainio@tkk.fi

Sub-editor:
 Minna Pasanen
 Tel. +358 9 451 2071
 minna.pasanen@tkk.fi

Journalist:
 Eeva Pitkälä
 Tel. +358 9 451 2009
 eeva.pitkala@tkk.fi

Translations/
 language checkings
 Ruth Vilmi Online
 Education Ltd
 www.writeit.to
 TKK Language Center

Change of address:
 TKK PoliAlumni
 Seija Sipilä
 Tel. (09) 451 5440
 Mobile +358 50 306 2788
 seija.sipila@tkk.fi

Cover layout:
 Adolfo Vera

Graphic Design:
 Crisme Kotilainen
 Edita Press Oy

Printing:
 Edita Prima Oy
 Helsinki 2009

Number of copies
 printed: 17,000
 ISSN 1455-9595

Funding Crisis?

In the midst of a global economic downturn in which jobs are being lost, confidence severely shaken, and finance markets in turmoil, one might think twice about becoming an entrepreneur. But one thing that all successful entrepreneurs share is that they thrive on challenge and we live in challenging times. One thing we know about economic downturns is that entrepreneurial risk-taking actually increases. The perceived risk of doing something on your own falls dramatically when employment prospects are poor. Moreover, entrepreneurs see opportunities where others see threats. To them, the glass is half full, not half empty. So what does it take to start out on your own?

The single most important ingredient of entrepreneurial success, in my opinion, is confidence. Building confidence implies that first and foremost you know yourself. What drives your passion to invest precious time in this opportunity more than anything else? What skills do you bring to the table and where do you need help? Do you have the confidence to start, knowing that you don't have all the resources you need at hand? Are you ready to leap on the basis of enough, not complete, information? Could you convince anybody to join your team or raise any funding/support from anyone else if you have not first convinced yourself?

Successful entrepreneurs also pursue opportunities in a disciplined and open-minded way. To discover how best to exploit an opportunity, successful entrepreneurs develop and test out hypotheses quickly and cheaply. Through "rapid opportunity prototyping", successful entrepreneurs learn very quickly whether their venture will work or not, and if so, how. Two points need to be emphasised here.

First, the scarcest resource available to you is the investment of time; if something isn't going to work out, learn that sooner as opposed to later. Second, the whole point of learning about an opportunity with an open mind is that rarely, if ever, do initial plans (Plan A) work. On the basis of insights gained from assessing the viability of Plan A, successful entrepreneurs raise support for Plan B and execute on the basis of that plan, which often bears little or no resemblance to Plan A. Investors fund Plan B, not Plan A.



High-growth ventures are also a team-based sport. Finding team members that augment your strengths, complement your weaknesses, and bring out the best performance of everyone involved is crucial for success. You want to surround yourself with people who share your passion. In return, you need to be prepared to bring them in as equity partners. Investors back teams, not individuals.

"So where can I raise funding?" you ask. Realistically, don't expect investors to back your start-up early on. What is invaluable early on is to actively engage an experienced mentor; someone who can act as a sounding board to help shape your go-to-market plan and provide moral support. Spending time together working out how best to exploit an opportunity also addresses a more fundamental risk any investor faces, namely whether they really know the people that they are backing. Find the right mentor and you may be on track to finding your first investor.

Where can you go to build your confidence, develop your plans, and find team members and mentors? The Aalto Entrepreneurship Society (AES) is an initiative that has been launched to address these challenges.

This community brings together all those individuals who share a passion for starting new ventures and helping entrepreneurial ventures to succeed. Aalto has entrepreneurial potential ready and waiting to be unleashed. Join in! ■

*Dr. Peter Kelly
Helsinki School of Creative
Entrepreneurship (HSCE)*

New master's students admitted – 52 different nationalities

TKK admitted a total of 593 students during the 2009 application cycle for its two-year master's degree programmes. Of them, 378 have a bachelor's degree from a foreign university, while 216 have one from a Finnish higher education institution. A total of 1 373 eligible applications were received by the closing date at the end of February.

The English-language master's degree programmes are particularly popular among applicants with bachelor's degrees earned in China, India, Pakistan, Bangladesh, Iran, Nepal or Turkey, while those offered in Finnish are popular among those with a prior engineering degree from a Finnish university of applied sciences (AMK in Finnish). In all, the newly admitted students come from 52 countries, the most distant ones from as far afield as Australia, Brazil and Venezuela. One fourth of the admitted students are women.

The most popular master's degree programmes included the Erasmus Mundus programme "Security and Mobile Computing", "Communications Engineering", "Service Management and Engineering" and "in Real Estate Investment and Finance". The most popular Finnish majors were those of structural engineering and building technology as well as architecture.

As of 1 January 2010, TKK will become part of the new Aalto University formed by TKK, HSE and TaiK; the students now admitted into TKK will eventually earn their degrees at Aalto University. ■

<https://eage.tkk.fi/?lang=en>
www.tkk.fi/en/prospective_students.

Researchers enhance spam call filtering

Researchers in Helsinki Institute for Information Technology HIIT are developing a new system for blocking spam calls in a flexible way. Spam calls (junk calls or Spam for Internet Telephony, SPIT) are unwanted calls often made by an automat playing a recorded advert.

As free Internet-based telephony is rapidly gaining popularity over traditional charged calls, the risk of spam calls is increasing. Skype is one of the best known providers of free calls using peer-to-peer networks.

HIIT researchers **Joakim Koskela**, **Juho Heikkilä** and **Andrei Gurtov** have created a system for filtering calls on peer-to-peer networks in a more flexible way than before. In the new system, users can accept calls from people who are unknown to the user, but amongst the contacts of friends, or even friends of these contacts. Before the user answers the phone, the system can warn the user that he does not know the calling person.

The flexibility makes spam call prevention more practical. This makes it possible to use the filtering more commonly than today. The new system can still completely block calls from unknown persons and let friends through, just like Skype today.

Future Internet is one of the research fields of Helsinki Institute for Information Technology HIIT. ■

www.hiit.fi

Product Design Gala 2009

Product Design Gala, held once again in April, is the annual seminar on PDP-course, celebrating the hard work done during the year. In the seminar, the results of the project work were featured to the public. After, in between and during the presentations the audience got familiar with the exhibition, and took a closer look at the prototypes and posters and discussing with the team-members and the hosts. ■

www.aaltdesignfactory.fi



Photo: Eeva Pitkälä

Nosferatu

– on
stage



Photos: www.teekkarispeksi.fi



New habitants have arrived to a castle near the small farm village: a nobleman accompanied by his party.

The lord mayor, who concerns the image of the village is utterly excited about the new inhabitant and especially about the possibility of new tax revenue.

Not everybody is satisfied, people have begun to disappear with no traces, the harvest is week within living memory and many of the villagers are bedeviled with a weird anemia....

Since 1990, a new skit, Teekkarispeksi, has been created every year by the most theatre enthusiastic technology students of the campus. This year's Speksi "Nosferatu" was again performed to a full house.

The Speksi is unique musical theatre based on interaction. The audience participates by shouting comments and suggestions to performers at any point.

The audience primarily shouts at the actors, but can also demand dancers or the band change to a different mode.

They may also shout to other members of the audience if these are causing too much of a disturbance. ■



Primary school kids challenge Aalto -university

The final of the Schoolchildren's technology competition final entitled *Tämä toimii!* (*This works!*), which is targeted at school children in years one to six of their basic education, was held at TKK on April 22. 2009.

In this yearly competition the task is always to invent and build, in groups of four, a moving toy from the materials provided by the technology sector organization Technology Industries of Finland, as well as to design an appealing advert for the toy and keep a diary of the different stages of the competition project.

– Toys are a part of everyday life for children, and inventing and building a toy is a pleasant way to find out about the diverse world of technology, says **Birgitta Ruuti**, from the Technology Industries of Finland.

– The aim of this competition is to encourage pupils to study technology-related subjects and to give them a positive experience of technology.

The competition consists of two different series, series A for years one to three and series B for years four to six. The best groups from each series are invited to participate in the final.

This year, 21,500 pupils all over Finland made more than 5,400 moving toys for the competition.

Technology education is part of the core curriculum for comprehensive schools in Finland. The aim of technology education is that young people understand what is meant by technology and learn to use and develop it. ■

www.teknologiateollisuus.fi/english



Low temperature physics network chosen for the European Research Infrastructure

The Microkelvin laboratory network, coordinated by the Low-Temperature Laboratory of TKK, has been chosen to become part of the European Research Infrastructure for the years 2009-2013. The EU is providing the European Microkelvin Collaboration projects with funding of 4.2 million euros.

Eleven research units from universities in eight countries are involved, as well as the company BlueFors Cryogenics, which is a spin-off from the Low-Temperature Laboratory at Helsinki. The project strengthens European cooperation in research in low-temperature physics. Research efforts are being concentrated mainly on the opening of the under-1-millikelvin (1-mK) temperature range to nano-research. ■

www.bluefors.com/

New understanding of nano-scale plasticity

Plasticity in certain semiconductor materials on the nano scale is actually linked to phase transformation rather than dislocation nucleation, as previously thought.

This is shown by the results of an international research team led by Professor **Roman Nowak** of the Nordic Hysitron Laboratory (NHL) at Helsinki University of Technology, just published in the Nature Nanotechnology journal in an article entitled "*An electric current spike linked to nanoscale plasticity*". The research is part of the Academy of Finland's FinNano research programme.

Plasticity has always been associated with defect movement or initiation, but Nowak's team has proved that plasticity can indeed start from non-dislocation processes, and that this phase transformation occurs in a stressed nanovolume, changing from one crystalline structure to another without affecting defect activity. The phenomenon, named the "Current Spike", is clearly

visible, and its explanation relies heavily on advanced physics.

"The implications of these findings are such that our understanding of material behaviour in the nano-regime may just need to be revised once again. If this approach is further developed to encompass other sets of materials than the ones studied here, this new evidence will certainly lead to many advances in pressure-sensing and pressure-switching applications, to name just one of many potential beneficiaries of these newly-revealed discoveries," Nowak says.

The main target of NHL is the mechanical characterisation of advanced materials and nanostructures using the nanoindentation testing technique. These experiments are complemented by computational methods, with the aim of exploring nanometer-sized contacts in the material and arriving at a final unique clarification. ■

www.nature.com/nnano/journal/vaop/ncurrent/abs/nnano.2009.49.html

Finnish Academy of Science and Letters PhD thesis award for Teemu Koponen

Finnish Academy of Science and Letters PhD thesis award for Dr **Teemu Koponen** for his dissertation in the field of computer science, titled "A Data-Oriented Network Architecture". In 1.-2.6.2009 Dr. Koponen was again rewarded, this time by the Finnish Information Processing Association, FIPA.

Koponen's dissertation was accepted by the faculty of Information and Natural Sciences at Helsinki University of Technology (TKK) in October 2008. The thesis work presents a novel network architecture for the Internet, providing a better match for the changing usage patterns. ■

Mobile drawings become context-aware

Helsinki Institute for Information Technology HIIT has launched Atwink mobile application which copies drawings from paper via pen to the web. The application also adds context information to the drawings on location, time, drawer and other drawers using the same application on site.

Atwink was designed and built by HIIT designers and researchers **Petri Saarikko** and **Tero Hasu** to be used by artists. Atwink allows the artist to draw on a digital paper notebook and after finalizing the drawing, she sends the picture from Bluetooth pen via mobile phone to the web.

In the mobile phone Atwink attaches GPS and other user sensitive information to the drawing as well as information about other pens within Bluetooth range. The drawer can also attach a mobile phone photo to the original drawing and view it via mobile optimized user interface.

Drawings and mobile photos can be managed online for personal desktop use or shared and aggregated to diverse social media services such as Atwink feed and Facebook. The application enables easy archiving of drawings as well as comparing the original drawing to other ones made in the same location. The application is also handy for a person preferring pen to keyboard for writing notes.

Network society is one of the research areas of Helsinki Institute for Information Technology HIIT. HIIT is a joint research institute of Helsinki University of Technology TKK and the University of Helsinki for basic and strategic research on information technology. ■

Video on Atwink:
www.youtube.com/watch?v=m4H7eP-H-C8

www.hiit.fi

A New Degree Programme on sustainable development

The Faculty of Chemistry and Materials Science of TKK is preparing a degree programme relating to renewable resources, bio-products and sustainable development. It is planned that the degree programme will start in September 2010.

Traditional industry, which makes extensive use of energy and natural resources, has difficult choices ahead of it in the future. Reserves of fossil fuels are starting to be exhausted and there is a shortage of food and pure water. Pollution and climate change threaten our environment.

In the new degree programme, the different modes of use of renewable resources will be critically examined. The teaching will include an in-depth examination of the durability and varied uses of raw materials, of biofuels, of the diverse utilization of fibre materials and of the environmentally friendly and energy efficient manufacturing and recycling of various materials. Four new main subjects are planned for the new degree programme: in the areas of biorefining technology, development of renewable materials, fibre and wood products and management of environmental issues.

Extensive and varied contacts with industrial sectors, which account for over half of Finland's foreign trade, ensure an interesting workplace for those that graduate from the degree programme. A course intake of 60 students is planned. ■

<http://chemat.tkk.fi/fi/>

New international master's degree programmes at TKK

TKK expands its selection of programmes taught in English in autumn 2010 by launching three new 2-year master's degree programmes:

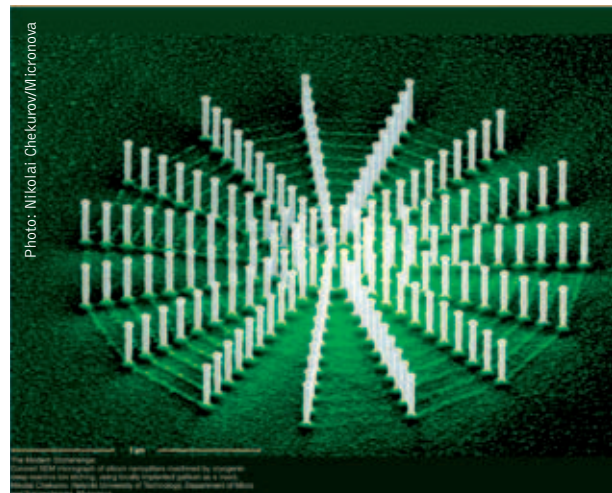
The Master's Programme in Communications Ecosystem (ComEcos) combines the following: the technological aspects of mobile networks and the Internet, the business aspects of services using telecommunication networks and finally, service usability challenges from a customer viewpoint.

Master's Programme in Environmental Technology promotes sustainable urban planning by educating multidisciplinary experts who specialise in environmental technology and in the management of urban environmental problems.

Master's Programme in Radio Science and Engineering consists of a wide range of courses in radio science and engineering, combining radio science and engineering with electromagnetics, space technology and circuit theory.

Each of the new programmes will admit 20 students in its first year. The application cycle will open at the beginning of November 2009, while teaching will start in the autumn semester 2010. The international master's degree programmes admit students who hold prior bachelor's degrees from a research-oriented university either in Finland or abroad or from a polytechnic (university of applied sciences) in Finland. ■

www.tkk.fi/en/studies/



Beautiful things in the microscope

"Sometimes the microscope reveals such stunningly beautiful things that I would like others to view them as well. Competitions in scientific imaging as art are a great way to show scientifically interesting images to the public as well," says a happy Nikolai Chekurov.

Nikolai Chekurov's "Modern Stonehenge" nanostructure image won a joint first prize in the 2009 MRS Spring Meeting Science as Art competition, held in San Francisco in April. The conference was attended by more than 3000 materials science researchers and the competition judges viewed more than 200 scientific images for their artistic value.

The conference, organised by the Material Research Society (MRS), is the premium international event in materials science. MRS is a pioneer in combining science and art; this is the 7th time the competition has been held. This is the first time a Finnish researcher has received the award.

In his work, Nikolai Chekurov utilises a combination of two methods, focused ion beam (FIB) and plasma etching (DRIE), in a novel way. The results were published in the January issue of Nanotechnology. Nikolai Chekurov works in the Micro and Quantum Systems research group at Micronova. ■

http://nano.tkk.fi/en/research_groups/mqs/

“Harnessing ICT-enabled collective social behaviour” funded by EU

The FP7 programme of the EU Commission has chosen the research proposal “Harnessing ICT-enabled collective social behaviour” (for short ICTeCollective) coordinated by the Centre of Excellence of Computational Complex Systems Research - COSY at TKK among the project to be funded. The project is coordinated by Dr. **Jari Saramäki** and Prof. **Kimmo Kaski**.

“Over the last decade or so electronic communication channels have changed the dynamics of social interaction at all levels ranging from individual to group

and societal level. The understanding of the interactions and their mechanisms in these complex social systems constitute the future challenges of ‘social technology’, tell the researchers in the project..

“In this project we investigate the structure and dynamics of ICT-enabled social networks from the level of an individual to societal level of millions of individuals, by exploiting the empirically collected data and large digital datasets.”

“One of the key goals is to understand how ICT moulds social interactions and expands social networks, and on the other hand how users of ICT mould the ICT for their own purposes. This multidisciplinary project contains researchers of network theory, computational science, social psychology and anthropology.”

The partners of the project are TKK, Oxford University, Torino Institute for Scientific Interchange, Budapest University of Technology and Economics, and Warsaw University. ■

www.becs.tkk.fi and www.lce.hut.fi

10th Anniversary of Master’s Programmes

Helsinki University of Technology is celebrating the 10th anniversary of its International Master’s Programmes.

The first programme, the Master’s Programme in Telecommunications, started in 1999, together with the

Departments of Electrical and Communications Engineering and Computer Science and Engineering.

Afterwards the programme was split into a Programme in Communications Engineering and a Programme in

Mobile Computing and Security, and both departments have established many new Master’s Programmes.

International education has been planned and developed since then as an integral part of the curriculum so that both domestic and foreign students meet at the same lectures and laboratory practicals.

The broad availability of courses taught in English on a Master’s level has increased the interest of exchange students in joining TKK. Recently, dual-degree programmes with European partner universities have started to emerge.

We have welcomed international students with their ideas, active questioning, and keen interest in working hard. Several hundred young people have graduated from TKK with M.Sc, Lic., and Doctoral degrees so far and the campus itself has become an international one. ■

Raimo Kantola and Anita Bisi.

<http://sahko.tkk.fi/en/>



TKK engineers in the top three of VENTURE CUP OPEN FINAL

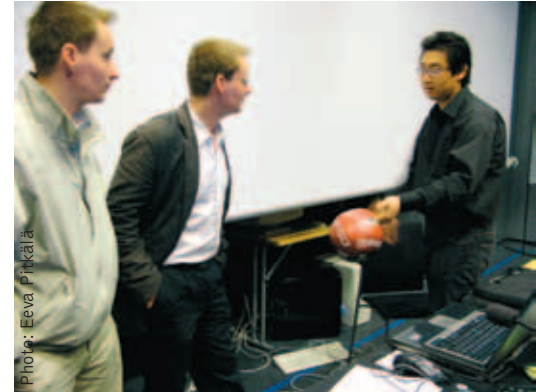
The winner of the business plan competition Venture Cup's Open Final 2008–2009 was Entetrainer, a company developing a product and service concept connected to sports. Their concept connects sports and mobile software technology as well as web software technology.

"We knew Venture Cup, and now the timing was perfect. My brother **Tomi Salmi** invented the core product idea last summer. The Open Final gave the required spark to develop the business plan", says **Timo Salmi** of Entetrainer, also priced in student idea contest at

TKK together with his brother **Tomi**. (Polysteekki 4/2008).

"This was excellent training for talks with capital investors ponders **Arto Aurola** of Pixpolar, former researcher of applied physics, in Optics and Photonics at TKK. Pixpolar came to a third place in the competition, and has developed an image cell technology for digital photography to enhance the image quality especially in conditions of insufficient light.

Tekes, the Finnish Funding Agency for Technology and Innovation, will offer the Open Final candidates financing up



to one million Euros. The jury consisted of several Finnish and international top level investors. Companies founded in 2004 or later were eligible for the Open Final. ■

www.venturecup.fi



Photo: Eeva Pitkälä

The President of Kazakhstan in Micronova

The President of Kazakhstan, Mr. **Nursultan Nazarbayev**, visited Micronova on March 25 in connection with his two day visit to Finland. His governmental host was Minister **Mauri Pekkarinen** and hosts at Micronova were President and CEO **Erkki KM Leppävuori**, Technology Director **Jussi Tuovinen** and Director **Veli-Matti Airaksinen**.

The purpose of the visit to Finland was to find new ideas to boost the economy in Kazakhstan. Minister Pekkarinen gave a presentation on the Finnish Innovation System of which Micronova is a good concrete example showing how research becomes business and new applications get to the market by spin off and start up companies. Technology Director **Jussi Tuovinen** gave a compact information package on research activities in Micronova.

Mr. Nursultan Nazarbayev was very interested in the new applications on Light Emitting Diodes (LED) - demonstrated by Dr. **Sami Suihkonen**, who has recently dissertated at TKK in the field of optoelectronics.

Furthermore, Carbon Dioxide Detectors and Terahertz Imaging, were demonstrated to the president. Director **Arttu Luukanen** from MilliLab told about a pilot camera, built by VTT researchers in Micronova, that will be put on test use in the Helsinki-Vantaa airport next Autumn. ■

www.micronova.fi

Marcus Wallenberg Prize to TKK alumni

Marcus Wallenberg Foundation has announced that the 2009 international Marcus Wallenberg Prize is awarded to Dr **Jouni Ikäheimo**, Mr **Vesa Kajander** and Mr **Bengt Welin**. The laureates have acted as pioneers and key persons within ABB to develop the new direct drive technology. Ikäheimo and Kajander earned their degrees at Helsinki University of Technology. The Prize sum is two million SEK.

Jouni Ikäheimo earned his doctorate in material physics in 1996, and Vesa Kajander earned a Master of Science in Technology in 1988 from the former TKK Department of Electrical Engineering. Bengt Welin studied at TKK Executive School of Business and earned his EuroMBA degree in 1996.

The innovation is based on the Permanent Magnet Synchronous Motor technology. If applied to all paper machines with a wire width exceeding 5 metres, DDS would have the potential to reduce energy consumption by approximately 400 GWh in Europe and more than 1 200 GWh in the world.

The Direct Drive System (DDS) developed by the group is radically renewing the traditional drive technology. This opens significant opportunities for new design concepts and process configurations of paper making lines with advantages related to the investment, operation, product quality, ergonomics and environmental impact of the paper making process. ■

The Marcus Wallenberg Prize is an international prize that was established in 1980 to acknowledge the lifetime activities and the memory of Marcus Wallenberg, the late Chairman of Stora Kopparbergs Bergslags AB (now Stora Enso).

www.mwp.org

Time Is Wasted

A curious asynchrony exists in Finnish society. All actors aim to optimise their own operations, but often it seems all this is a toll on citizens' time. You might say that everyone visits, without remorse, the common purse of everyday time. Our lives are ever more condensed, but the places we operate in on a daily basis are constantly further away and harder to reach.

Society as an apparatus is out of sync when viewed from the perspective of citizens and families. In an industrial application, this would not be tolerated. We Finns are busy but kind people. We dash with no complaints from one place to another, with only the odd brave person complaining about the lack of quality time or real presence.

Continental countries, with their old city culture, have for a long time practised a decisive time policy by synchronising society's schedules, opening hours, transport, and other functions for optimal time use. This requires the cooperation of everyone included – and also the consideration of the point of view of citizens suffering from a lack of time. This activity is called time planning.

TKK's Centre for Urban and Regional Studies (YTK) is working on developing a Finnish time management concept, as the models of Central Europe cannot be copied as they are. The first national trials show promising results. ■

*Liisa Horelli
Associate Professor
Centre for Urban and Regional Studies
TKK*



Photo: Eeva Pitkälä

Top experts on planetary robotics at TKK

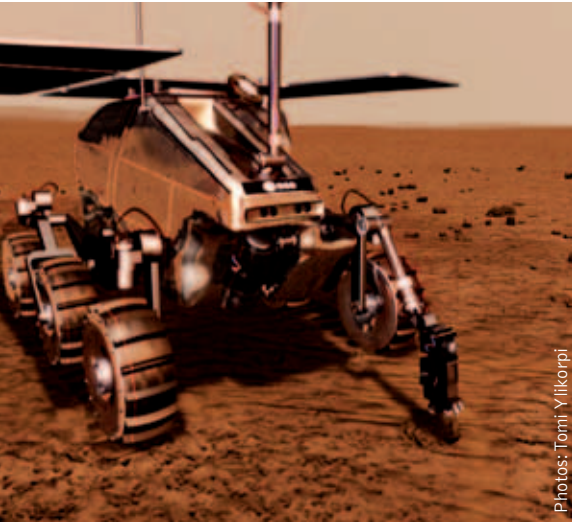
A lively and inquisitive audience attended when international top experts on planetary robotics met at the Planetary Rover Symposium in April, arranged by the TKK Faculty of Automation and Systems Technology. The topics of the symposium included

the robotics research of ESA, Mars and Moon rovers, and Soviet and Russian planetary and mobile robots between 1963 and 2007. The symposium was open to the public.

Dr. **Richard Volpe** (Manager, Jet Propulsion Laboratory, USA) told the audience about computer vision, JPL's rover missions to Mars, and the history of space robotics.

Gianfranco Visentin, Head of the Automation and Robotics Section (ESA/ESTEC), covered the robotics research of ESA.

Soviet and Russian planetary and mobile robots from 1963–2007 were presented by **Alexei Bogatchev** (Science & Technology Rover Company, St. Petersburg, Russia), and the Professor of Embedded Systems at the University of Oulu, **Juha Röning**, talked about robotics research at Oulu University and shared his experiences of the ESA Lunar Rover Challenge. ■



Photos: Tomi Ylikorpi

Aalto Entrepreneurship Society – AES

The Aalto Entrepreneurship Society is a student-led society formed by a group of students from TKK, HSE and TaiK in the early spring of 2009. Its goal is to create a culture at Aalto that encourages entrepreneurship; the best students should aim at becoming entrepreneurs. AES intends to shape attitudes, for instance, by creating success stories that serve as role models. However, AES will not try to bring about this change or create the success stories alone - it wants everyone to get involved.

AES organised the world's first Startup event in the Otaniemi Design Factory on 25–26 April 2009. The two-day event gathered a total of 50 students and a large number of entrepreneurs, investors and other professionals. The goal was to work together to develop four new business ideas further. Three of these ideas had gained access to the event through the AES Pitching Evening, during which entrepreneurs had two minutes to convince the judges of their business ideas. Similar events are now being planned for other Finnish cities as well as Moscow and the United States.

AES has already organised eight events during the spring, and will organise more in the autumn. The society is still taking form and all those interested can contact its members and join the open events – by working together we will save the Finnish economy! ■

Aalto Entrepreneurship Society

AES on Facebook: www.facebook.com/group.php?gid=37295947284

The blog: www.aaltoes.com

International recognitions to BIT Research Centre

The BIT (Business, Innovation and Technology) Research Centre of TKK has found a distinctive and recognised approach to project research. In the special issue of the International Journal of Project Management of March 2009, the visiting editor-in-chief **Hedley J. Smyth** points out the emergence of a 'Scandinavian school' in the research of project business and the strong representation of Finnish researchers in the field.

Drivers and Barriers for Adopting Services in Project-Based Firms (K. Wikström, M. Hellström, K. Artto, J. Kujala and S. Kujala)

Dimensions of Distance in a Network of Firms: Exploring Olkiluoto 3 Nuclear Power Plant Project (I. Ruuska, K. Artto, K. Aaltonen and P. Lehtonen)

Integrating the Change Program with the Parent Organization (P. Lehtonen and M. Martinsuo)

Response Strategies to Stakeholder Pressures in Global Projects (K. Aaltonen and R. Sivonen)

Furthermore, the article 'Project Business as a Research Field', co-authored by Head of the Project Business research group, Prof. Karlos Artto (TKK) and Prof. Jaakko Kujala (University of Oulu) has been awarded the Outstanding Paper Award of the Emerald Literati Network Awards for Excellence 2009.

Project Business as a Research Field (K. Artto, and J. Kujala)

International Journal of Managing Projects in Business. Volume 1, Issue 4, 2008, pages 469–497. ■

www.bit.tkk.fi/

The international campus of TKK is waiting for you

Summer is here now and the beautifully green campus can be seen through the windows of rector's office. Only some weeks ago the freshmen or "phuxis", the first-year students, received their new white caps with tassels and became full members of TKY, the Student Union of TKK.

Here in Finland, the engineering students, "teekkarit" in Finnish, are known for their great companionship and never-ending energy for innovative action. Activities in more than one hundred clubs give the students general societal competences, which are needed in working life. The University is proud of its capable and talented students, and their great spirit, which ties them closely to the Student Union and to the University Alumni for the rest of their lives.

Today, the TKK campus is more international than ever. More than 1300 foreign students of about ninety nationalities, about 10% of the total student body, study here yearly. The share of international staff is also getting close to 10 per cent of the total. For students, TKK offers 13 international master's programmes and three Erasmus Mundus programmes in English. And new international programmes are opened every year. Doctoral education is available in English in all study programmes. International graduates of TKK are working in all parts of the world and stay in contact with us through our alumni organisation.

Last year TKK, an institution now already 160 years old, celebrated 100 years as a university. In 1908 TKK

gained full university rights, including the right to grant doctoral degrees. Our long history has been full of development and changes, and more changes are coming through the new university law, which at present is being discussed in the Parliament. Through the years TKK has done its best to serve the engineering sciences and Finnish society. As the first engineering university in Finland, we have been the pioneer and pathfinder for Finnish technology. And it is our aim to continue in the same way. During the centennial year 2008 we opened two important research programmes, one in energy research and one in the field of digitalisation. The costs of the five-year-long programmes total 20 million euros and they are financed by donations from Finnish industry. In this way industry and our alumni support the University.

Increasing the entrepreneurial spirit of the students and harnessing research findings to business form part of the third mission of universities. In this issue of the Polysteekki magazine, some new companies and business ideas of the TKK community are opened to the public. The University supports its researchers and students in creating new businesses or commercialising their research through patenting and licensing. We work together with

organisations providing funding for start-ups and our campus is known for its good support networks for new businesses.

For the Finns, the summer is a time for relaxation and charging up their batteries. The students leave the campus and the teachers and researchers take their summer break. But in the autumn the students, including more than one thousand new ones, arrive with their dreams and ideas, bringing in new talent to the scientific community of TKK. And next autumn will see more foreign students and staff members than ever before entering the campus and adding their own dreams to ours. The international campus of TKK is waiting for you. ■

Rector Matti Pursula



Photo: Matti Kurkela

The Art Of ZenRobotics

Helsinki city centre in daytime: a hurly-burly teeming with the rolling flocks of schoolchildren, people rushing on lunch hour and the ever noisy cars queuing all over. As I slide down to a basement office the city hustle rapidly fades out. Here, in the headquarters of ZenRobotics Ltd., I meet a nicely straightforward and youngish city office.

A pack of wits

"For us there was no other option than having this software firm right here where all the life is: in the city centre", explains my host **Harri Valpola**, PhD, academy research fellow and Chief Scientist of ZenRobotics their expensive choice. "We simply want to enjoy working." PhD **Jaakko Särelä**, CEO of ZenRobotics, is nodding approvingly.

It is certainly easy to believe, that life here is "cool". Somewhere in the inner rooms, in the middle of all music and computers, a Rastafarian shock of hair keeps tapping away on his computer, and I also see a hint of long legs resting under another computer desk.

Consider Joining Us – We'll be the last to go! announces a young and brave software company on their website. ZenRobotics Ltd may also have the bottle to say it: cutting edge brain research produces artificial intelligence solutions for robotics, a field that has already attracted several top researchers to their ranks and now also among the finalists of the business idea competition, Venture Cup.

The long legs, I learn later on, belong to the CTO of ZenRobotics, PhD Tuomas J. Lukka, who some years ago dissertated in quantum chemistry at TKK as the youngest person dissertated ever in Finland, and thus greatly loved by the bills. Lukka has also years of industry experience in developing software and processor technology.

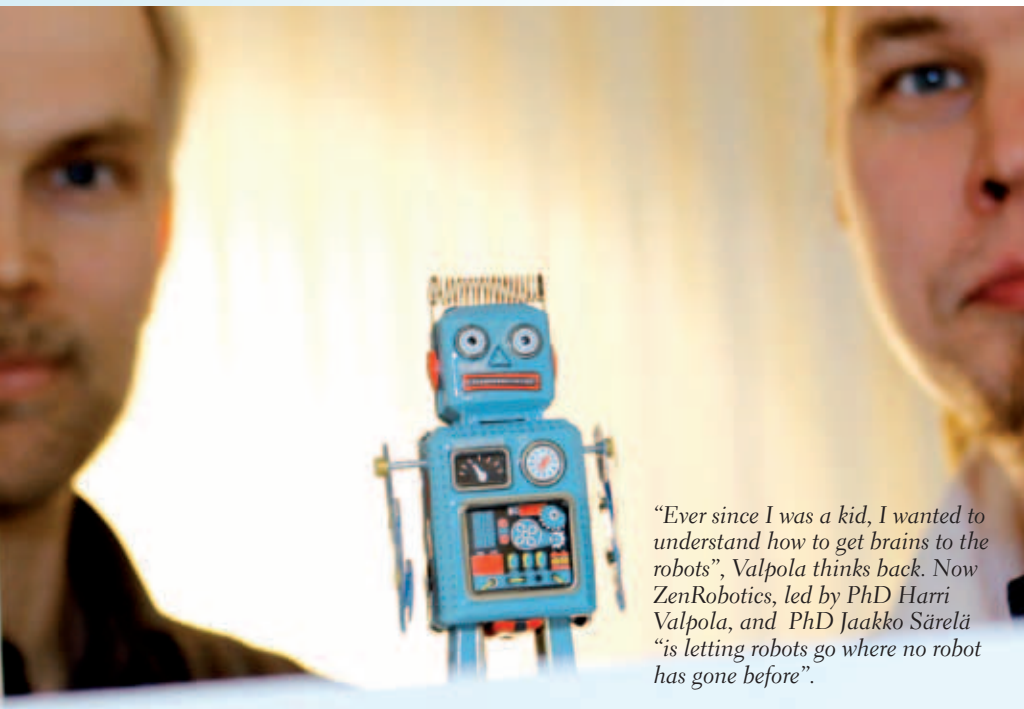
From under the Rastafarian shock of hair is found Mr. Jufo Peltomaa, who represents the Head of Special Operations of ZenRobotics.

It all started in brain research

The core competencies of ZenRobotics are robotics, machine learning, statistical and physical modeling and data mining & optimization. "Our field can be defined as software making, what we do here is we apply academic algorithms right to the factory floor."

Valpola and his group commercialize machine learning based on neural networks. They intend to develop the ways to apply these mathematical brain models, algorithms, to robotics. "Algorithms are applicable in everything that involves sorting products with indefinable sizes and shapes, in the mining industry, waste management, paper machinery and refuse incineration."

The leading brain of ZenRobotics, PhD Harri Valpola, has 15 years of experience in machine learning. The significant know-how behind the company's products is based on an advanced computational method, DSS, published by Valpola and Särelä.



"Ever since I was a kid, I wanted to understand how to get brains to the robots", Valpola thinks back. Now ZenRobotics, led by PhD Harri Valpola, and PhD Jaakko Särelä "is letting robots go where no robot has gone before".

"Actually, it all started a long time ago", Valpola thinks back. "Neural networks was my subject ever since upper secondary school and also led me to the acquaintance with the famous professor Teuvo Kohonen from TKK. I joined the physics students flock to be able to do brain research," Valpola admits readily. Today he works as a leader of a brain research group of his own at TKK.

"One day I am Research Fellow (in the Academy of Finland) at TKK and another day I am the Chief Scientist of ZenRobotics. It feels good to sit on two chairs at the same time. After all, entrepreneurship is an essential part of engineering, where the point always is hands-on experience", Valpola says.

Algorithms for sale!

"Our technology is highly adaptive and, furthermore, there are plenty of targets of application all over. Yet, to be honest, the algorithms of the academic world are quite hard to be sold. We simply try to find out what the customers problems really are and then sell them the right answers", Valpola explains. "It is all about transferring the results of this cutting edge research into commercial use.

From ZenRobotics point of view TKK is the research group, and the firm is a commercial part of that research group commercializing the results of the group. The research team receives commercial support and the firm gets the "products", the knowledge to be sold.

"As it is, TKK is a university of technology where research is desired to have good connections to the industry. The tradition at the university, however, is, that the companies just order for Master's thesis, that's all. No discussions, no equal decision making."

Vast markets, ethical thinking

The markets are vast. It is clear that robotics is not an insignificant field of industry. The average yearly growth of

the amount of industrial robotics has been around 6-7 percent. There are at least one million industrial robots in the world, and the annual marketing is approximately 100.000 industrial robots.

"Time is ripe now for a new entre of robotics, as the computers have gained more capacity," Jaakko Särelä states.

"Yet, money making is not the only goal here. We think, that a good enterprise typically solves real, ethically justified problems of the world, and, furthermore, hosts a good spirit among the employed," Valpola says. "Moreover, we believe, that a shared vision and shared values gain the company a good spirit."

"For me personally the most important thing is "green work" , for instance at Dodo, a new environmental organization that avoids black-and-white views of the world and is named after the extinct Dodo bird, the first species known to have become extinct because of man.

ZenBrain™

At the moment, ZenRobotics sells The ZenBrain™ Software, that uses algorithms based on the cerebellum, the part of the brain responsible for motor skills and coordination. Now, the cerebellum has been mathematically modeled and can be used in these early robots.

"Like the human cerebellum, the ZenBrain Software operates in real-time, is robust and has a good tolerance for error situations. Just like a human knows, when throwing a ball, to slightly lean forward, all due to the lessons of having fallen on one's back as a child", the researchers describe their product.

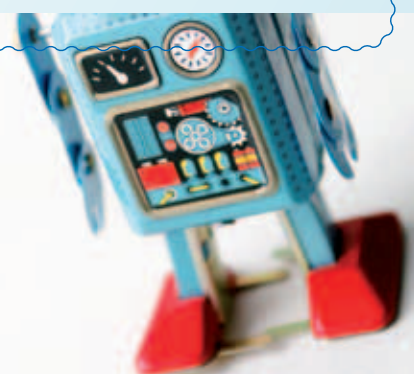
The interview is over and I slide out of the office to the noisy street. At once I bump into a passerby - and find myself hoping to have money enough to buy an algorithm for a more personal learning use as well. ■



Venture Cup

- Venture Cup is a Business plan competition in three phases:
- Idea Phase competition for business ideas
- Business Plan Phase for completed plans.
- An Open Final for registered companies. The prize in Open Final is 1M€ funding package from TEKES.
- The judges concentrate on innovativeness, growth potential and realistic implementation. Each entry receives written feedback, which will help develop the business.
- Venture Cup offers a free entrepreneurship training programme which revolves around the main themes of business planning.
- The national training sessions are held in Helsinki. Training is also available in other Venture Cup locations. Lectures are held mostly in Finnish.
- Venture Cup offers all participants the opportunity to get professional coaching on the problems they are facing in their own businesses.
- Areas of coaching are, among others, strategy, marketing, funding or legal issues.
- These advises are provided to participating teams by the coaches from nationwide Venture Cup network. Venture Cup coaches are experienced entrepreneurs, consultants and investors. The Venture Cup coaching is completely free for competition participants.
- All jury members sign a nondisclosure agreement.

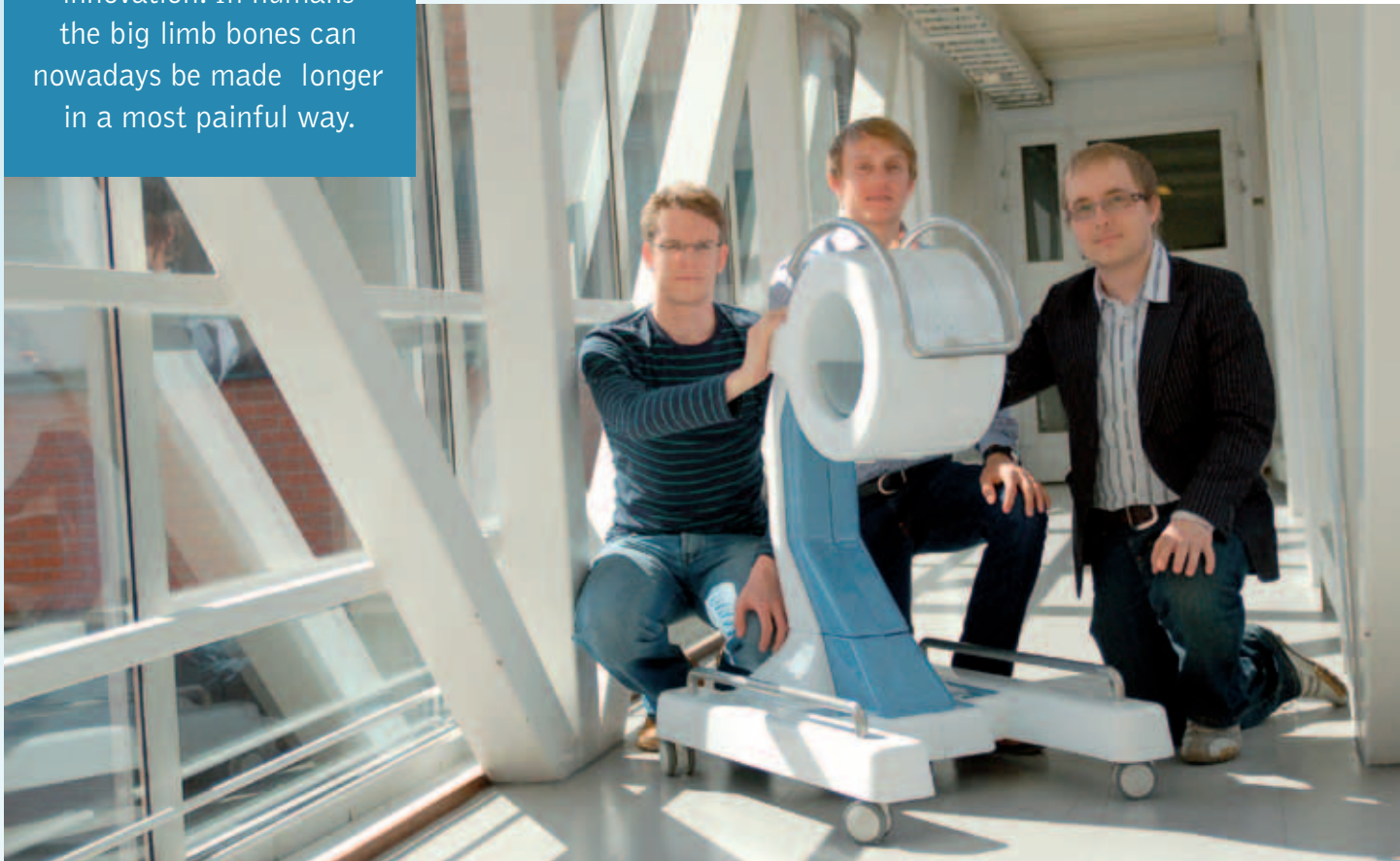
<http://web.venturecup.fi/>



There are innovations that come and go through the markets boosted by effective marketing, and then there are innovations that answer to a human need so sore and painful that they are born celebrities. In traditional distraction osteogenesis there has a need for an innovation. In humans the big limb bones can nowadays be made longer in a most painful way.

Bioadaptive Technology

And a Bone Lengthening Device



In the old method the bone ends are fastened to a frame outside the limb with long needles, directly through skin and muscle. Being the only reliable method for the lengthening procedure, painful, prone to inflammations and even ugly, there is no need

to say that the method is no favourite among the patients.

First hearers lost

One day the innovation centre in TKK received a phone call from three enthusiastic young engineers from the

"Bioadaptive technology should be seen as a possibility and unique expertise in Finland", think the students and entrepreneurs Juho Haaja, Harri Hallila and Antti Ritvanen.

Faculty of Electronics, Communications and Automation, **Juho Haaja, Harri**

Hallila and Antti Ritvanen. The students spoke something about an intramedullary nail containing certain magnetostrictive metal alloy, that can be implanted inside a Distraction ontogenesis patient's bone which then becomes longer...

"At this stage we lost our hearers. People most probably classified our message as a practical joke or something, which", the students admit readily, "solely was our fault, as we were not properly prepared to tell about it."

Fortunately, a reporter in a daily magazine of technological innovations wrote an article about them and that made things to get off the ground.

Magnetic forces and the bone lengthening

What the students actually created is a magnetostrictive needle and a magnetic device with an inductive circuit big enough that you can put your limb into it. The innovation here lies in the use of a magnetostrictive metallic alloy and that nobody had ever before thought applying within orthopedics.

"We haven't been using much new technology here. Predominantly, we have done rethinking and combined old innovations. The actual technology was created in the 80's. The first applications came out in the end of 90's but they turned out to be unreliable. The magnetostrictive metallic alloy itself was first developed in the 1950's at the Naval Ordnance Laboratory in America."

ORTON, TULI, and Venture Cup

The rest of the story is more about creativity and skill than fortune."I told about our first thoughts first to one of the orthopaedists in ORTON Orthopaedic Hospital and he assured that orthopaedics is just the research area where applications using wireless forces are needed, because of the big



forces needed in bones. He was really excited about this", the students tell. "Without ORTON we would not be this far. The specialists at ORTON have given us useful feedback all the way."

TKK TULI project at the Innovation Centre has helped enormously with advice, support, practical paper work and also financing.

Registering a patent is a long process, Synoste left the first application in 2008. In the end, the students found themselves a place in the sun: they won a third place in Venture Cup business plan competition. Venture Cup helped them to make a concise business plan."

Our ace in a hole

When operating, the bone is cut into two halves and the surgeon puts into the medullary a needle containing a piece of magnetostrictive metal alloy, which in a magnetic field expands slightly but with enormous force. As the expanding needle holds the two bone parts apart, the gap will be filled with new natural bone in time course. And so the longitudinal growth of the bone can be controlled by the external magnetic field. Resting his or her foot in the induction circuit, the patient may be cured at home.

"Our ace in a hole is that our machinery is simple, steady and wireless."

Future plans

"We really expect to see this working, so that people do not have to use the horrible frame anymore for bone lengthening. Bioadaptive technology is a very young field, but it can already be seen, that this should be seen as a possibility and unique expertise in Finland. ■

TULI programme

- Tuli is funded by Tekes – the Finnish Funding Agency for Technology and Innovation
- Tuli aims to give birth to new research-based business with the aid of license agreements, know-how transfers and new companies.
- Tuli aims to commercialize research results in Finnish universities and research institutes.
- runs from 2008 to 2013.
- In 2008-2009, 18 universities, 23 polytechnics and five research institutes – all in all, 46 research organization – are involved.
- The overall budget for the whole program is approximately 50 million euros.
- Tuli funding can be 55.000 euros in total, per one research-based invention or idea. Funding can be applied by researchers and research groups, not by companies.
- Tuli funding for the initial evaluation phase can be up to 5 000 euros, the evaluation phase can be up to 20.000 euros, both phases granted by a Tuli contact person, and for the refinement phase up to 30.000 euro, granted by the Tuli project group.
- Tuli is intended to be flexible, fast and able to take risks in a healthy manner.
- Tuli researchers, students and research groups are able to receive funding and versatile expert services in all fields of commercialization.
- Tuli all operations and communication are strictly confidential.

www.tuli.fi

Transparent Entrepreneurship

“It all started from the cycling circles”, the **Poikola** and **Karhila** think back, “especially it emerged from the cyclists’ subjective needs.”

The students want to make HILA a tool that really works in practice. “Actually, the cyclists are not the only group, who need a feedback channel.”

“Our basic aim has all the way been to promote collaboration between the citizens and the public sector; to be more precise, with this transparent feedback channel we aim to demolish the “Chinese wall” that exists between official authority and the citizens.”

“A flashy piece of software isn’t going to save anything or anyone by itself. You have to consider how all things are connected to each other and to the world.”

Testing internet openness

As such, the invention was no sudden brainwave. HILA got started in an idea contest called Sxxx Helsinki in last October. Nevertheless, the very idea of a feedback channel had already been incubating in many other heads before we made it real. **Poikola**, **Karhila** and **Nurminen** already knew each other from a cycling community.

Little by little they began to realize that their idea could be useful enough to carry into entrepreneurship. As the idea of an open channel had started to develop, **Poikola** went on a wild googling spree and put together the principles for connecting social media and public government.

“On the one hand, everybody knows that the cycling paths around the city of Helsinki should be taken better care of, but the civil servants do not always know what is wrong and where. The cyclists themselves, on the other hand, have plenty of knowledge that they want to share.”

To solve the problem, media technology researcher at TKK **Antti Poikola**, information technology student **Reima Karhila** ja **Janne Nurminen**, a student from the University of Helsinki have developed an internet channel open for debate and feedback, called HILA.

“I myself was lucky enough to get a foot in the door in SOMUS, Social Media for Citizens and Public Sector collaboration, a two year research project between the years 2009-2010 funded by the Academy of Finland. Research work in SOMUS helps in many ways to see what we have to work on with HILA. In SOMUS we test internet openness, for example to what extent we can publish meeting memos in wiki.

The first client

Technology student **Reima Karhila** works in the laboratory of information technology at TKK.

“The role of TKK has been essential with HILA. I could do coding even without being a student here at TKK, but working in a team like HILA it has been essential. Furthermore, we have found all the important contacts for HILA here at TKK. And here in the laboratory of Media technology you definitively have an atmosphere that encourages entrepreneurship.”

The TULI program at the Innovation centre was helpful in many ways. “Those guys gave us concrete and wonderful support, and helped in paperwork and financially. I mean, we were not even sure of what we had, and then the guys in TULI said that they can give us a consult for free for one week’s try out, just to see would there be any potential with our idea in the markets. That was encouraging indeed! After that we started to believe our idea is worth something. They also made us find a customer: they gave us 25 000 euros funding with the wise precondition that the money comes as soon as we have a customer.”

Another helping hand has been Venture Cup Business plan competition, that offers a free entrepreneurship training programme. HILA came to the finals in 2009 competition.

Up till now the students have, almost, a contract with the City of Helsinki. “Almost, because we have not yet founded a company, but as soon as that happens, we will have it. We aim to



It all started from the needs of cycling circles. Little by little Antti Poikola, Reima Karhila ja Janne Nurminen, began to realize that their idea of an internet channel could be useful enough to carry into entrepreneurship.

publish it all in the beginning of June. This pilot project will last until the end of this year.

Good entrepreneurship?

"The question is, of course, about how fast you want to drive. We wouldn't want to burn both ends of the candle, it would be nice to do a steady day's work and then go home. We don't want (?) to live a life that is somewhere in the future, we want to live now"

"Good entrepreneurship does not include greediness but creates something good. We want neither to produce nor to sell anything that is unnecessary or useless and don't feel like just coming up with Garbage of the Year."

"The product that we are selling should be socially relevant and something really smart - a mere ringtone for a mobile phone is not enough.

"We do not want blood thirst gambling either - instead, we want to create networks with other entrepreneurs.

We want to do something we can do well enough and keep openness and transparency in the front line. The business should go on without any secrets, and we have to be so good at what we do that we do not have to hide anything.

"Of course, if we are the only ones who think this way, our story is rapidly finished," the students sigh, but with a laughter. Finishing is not the word they think now at the beginning of their entrepreneurship. ■

An Entrepreneurial Spirit

From being a student of computer science at TKK, Arttu Laine has gone on to commercialise numerous innovations and has sold multiple companies profitably. At present he is developing an archive service for the public sector at the Start-Up Centre.

The three years of dedicated labour Mr **Arttu Laine** and his partners put in still show in the Student Union's communications network. Between 1992 and 1995 he was responsible for the connectivity of the buildings of the Student Union, day and night. The initial figure of 30 computers installed eventually grew to 1500.

At the same time, his interest in communications security and encryption technology attracted Mr Laine to the corporate world, and his alma mater didn't seem to be able to offer much more.

Laine was one of the founding partners of Eunet. The company grew into an international business with 100 employees, and was sold in 1998. A couple of years later Mr Laine went into

the business of customising products for the educational market. That company was sold profitably as well, and there were always smaller enterprises on the side, too.

Currently Mr Laine is an entrepreneur at Sofistone Ltd, with minimal fixed costs.

"In a sense, I've now been retired for a couple of years, while quietly developing a new service product without external financial pressure. I'm working on a government archive security service project, something I think should have been in use ages ago."

The best things about entrepreneurship are the freedom to work on exactly what one holds dear and to utilise one's skills

freely, he thinks. Results are visible, and do not disappear, as tends to happen in larger companies.

"With big business, you are juggling several things at the same time. In a small company you can focus on the work and re-focus when necessary. You are also free to work hours that are as crazy as you could possibly want."

For Mr Laine, the founding and the sale of a company are routine. The challenge is in daring to take the risk and hire more people, even without having definitely confirmed a new business to support expansion.

"For me, satisfied customers bring happiness and motivation to my work. A small company needs to produce quality and added value for the customer. The most important goal is to make the customer's life easier."

Sofistone's system is entering its trial phase soon



Corporate Responsibility In Mind

After completing her PhD on corporate environmental reporting in 2005, Laila Törnroos has since been involved in the development of the international ISO 26000 standard. She runs a company which helps customers gain the full business benefit of the standard, scheduled to be ready in 2010.

"As a corporate agenda, social responsibility is on the rise and will be on a par with environmental compliance. In fact, I prefer to use the term corporate responsibility, which covers both. The new standard will further expand the concept to include staff policy issues. Regarding staff, it is important to manage for motivation, well-being, and for an inspired workforce. This allows the staff to be creative, come forward with any issues, and be innovative."

Last summer **Laila Törnroos** founded Eltekon Ltd to implement her vision. The expert consultancy offers coaching and instruction in responsibility for corporations and other organisations.

"Expertise in this field is in high demand internationally. As mine's still a small, new company, I strive to put quality first. After the first six months the client base and the networks are starting to take shape."

For a fledgling entrepreneur, thorough preparation is crucial, she thinks.

"Starting your company is quite a process and you learn a lot. You must have your personal finances sorted. A solid entrepreneurial vision to start with is a must, as is the skill of adapting your expectations, to enjoy the ride without extra pressure."



A clear vision is vital

"At this stage entrepreneurship is a process; the blocks are falling into place one by one. When you know where you want to go, you have more strength to face the hurdles that arise.

A company must prosper and make a profit, but money is a neutral means to the end of fulfilling the company's vision."

This is the time to check your own attitudes and values, as well.

"If you decide people are important, you treat them well.

You must be compassionate, to yourself, too, and not push yourself too much, and then later place the same demands on your team. The way you work in the beginning by yourself reflects how your team will operate later."

Laila Törnroos has worked in varying and international settings. Through VTT, the Technical Research Centre of Finland, she worked for the Nordic Innovation

"Early-stage companies are often overly optimistic about their product schedules. It pays to study and prepare things with care, and to reserve time for testing."

Working next door to multiple start-ups, Mr Laine remarks that entrepreneurs must be prepared to lower their standard of living.

"The first years will be frugal living, or you have to live off your savings, as it is a rare start-up which can immediately set up an income stream."

He also recommends a shareholders' agreement.

"It is a bit like a prenuptial agreement. In addition to the basics, you should state how ownership is relinquished and how the share price is calculated. Without a prior agreement, it may be remarkably difficult to arrive at a price."

Mr Laine also sees the economic downturn also as an opportunity for many.

"The current layoff packages offer an excellent chance to move into entrepreneurship. With guaranteed pay for some time, you can take a moment to develop your own company's products or services." ■

Centre, based in Oslo, participating in innovation research and projects to remove barriers to trade.

She also participated in the environment-related work of the European Committee for Standardisation (CEN), based in Brussels.

A trained chemist, Törnroos is familiar with chemical legislation, and has worked in numerous environment and impact assessment projects.

As an entrepreneur, she wants to provide her customers with an international viewpoint on new challenges and opportunities.

"I want to bring in the trends prevalent in international discourse, and show how implementing a new standard adds value."

Laila Törnroos emphasises that in the end corporate responsibility is always a part of a profitable business.

"The impact of corporate responsibility must be considered at the level of the board of directors and its effect seen in all business operations, including management or communications." ■

A Mathematician As an Entrepreneur

Founded by three doctors, QSA Ltd develops quantitative risk management for financial institutions such as insurance companies. Although it is a relatively uncommon method in Finland, a number of financial institutions have taken up the company's analysis tools.

After receiving his PhD from the University of Washington in 1999, **Teemu Pennanen** worked for five years as a researcher with the Academy of Finland before founding his own company.

In addition to running his own business full-time, he's also an associate professor at both Helsinki School of Economics and the Systems Analysis Laboratory at TKK.

"The company's strength is a complete model for financial institutions' funding risks. Our mathematical risk management methods offer an analytical description of an uncertain future, from the decision-maker's point of view."

The company targets pension providers, insurance companies, banks, mutual funds, and financial institutions in the public sector.

"For example, the authorised pension providers have lacked models that consistently account for both market risks and the technical provision risks of insurance. Additionally, the risk analyses of many asset managers do not consider the technical provisions related to pension providers. Neither are such risk analyses independent of the investment activity, as sound

risk management practice would demand."

The idea behind the enterprise is that mathematicians too can commercialise their research and transfer their knowledge to business.

"After 20 years of studying and researching mathematical theories, it feels good to benefit from the knowledge and put food on the table with it. We're constantly developing our models for new application areas. We sell a service, but the models can also be applied as software. We also offer training. Every new customer and deal is a further source of motivation."

Located in HSE's Start-Up Centre, the company aims to expand its customer base and believes the current financial crisis will, in the long run, result in new customers.

"Once the worst is over and the economy begins to strengthen, people will start paying more attention to risk management. That is a good stage for us."

The entrepreneurs think it is problematic that companies and organisations lack an understanding of quantitative risk management.

"That means the risks are usually not viewed in the way that complex operational environments require."

Furthermore, there is no training in Finland in quantitative risk management. Internationally, the field is well established, e.g. in the US, in the UK, and in the Netherlands.

"Aalto University would be in a good position to develop research in the field by combining HSE's financial know-how and TKK's mathematical expertise. Aalto University could also think of marketing mathematics as a science and a toolkit to companies." ■

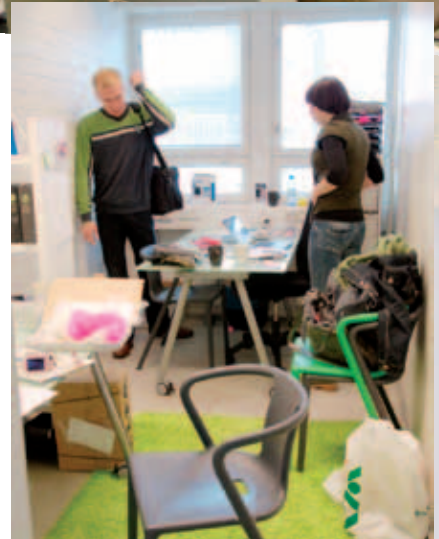


THEME

Text and photos: Eeva Pitkälä



Design Factory is one of the projects of the new Aalto University. Design Factory is the symbiosis of the state-of-the-art conceptual thinking and cross-disciplinary hands-on doing and provides a collaboration environment for students, researchers and business practitioners.
www.aaltodesignfactory.fi





Absolutely Entrepreneurial

Entrepreneurship is an often used word in today's world. There are plenty of books written of good entrepreneurship and people often have an opinion about how a successfully entrepreneurial person is like. Polysteekki met one young entrepreneur, Maija Itkonen, CEO in Powerkiss Ltd, a young ten worker company, to find out what she is made of.

Why her? Well, **Maija Itkonen** is ranked as one of the tremendously good young entrepreneurial persons in Finland. "Her innovation is making a revolution in the charging of electronic devices", cry the headlines of newspapers." A musician, a mother, a wife, an engineer and even a designer she definitively is an absolutely entrepreneurial person, if anyone.

An enthusiastic vision

For the first, Maija Itkonen certainly has an enthusiastic vision, one of the first criteria also mentioned in books written on entrepreneurial features. Moreover, Itkonen's vision is shared by most people. "Who would not like to be freed from the trouble of constantly losing nerves with cable wires and off shut uncharged electric devices, like mobile phones, navigators, iPod's, MP-players etc.?", she asks. "Would it not be

nice to be able put the out-of-power run mobile phone on coffee table, and get it charged. And, even better would it be, if also the always out-of-power running computers had charging places like this."

An innovative mind

The real innovation Maija Itkonen has made is furniture equipped with an induction circuit that again creates spots for charging the phones. So far, Powerkiss has produced small charging devices for Nokia mobile phones, being only half the size of a memory stick. These charging devices use resonance induction for electron transfer.

A desire to achieve

The desire to achieve is another important criteria for an entrepreneurial person. Being born in 1977, Itkonen seems to have achieved quite >>



A hard worker, a stress taker and tackler of uncertain situations

Maija Itkonen has, at the moment, devoted her life to the freeing of people from all wires and cables, and she works long and hard days for it. Polysteeikki followed in her footsteps for one busy day, as the team was making the last two days preparing for a D-day - a launch of their new products with Martela.

It takes a stress taker to lead a team. Being the chief planner, the leader and the chief economist in the company brings you face to face with the most uncertain situations. However, a positive self concept, firm reliance on good luck, and well trained nerves as well, seem to bring one over all the troubles of the entrepreneurial world, like, say, non functioning demo devices, unfinished last minute works, constant hurry and even a reporter with her camera hanging around while working.

www.powerkiss.com





a lot in her life. Her CV reveals an educational background in Helsinki School of Economic, International Design Business Management 2006—2008, Helsinki University of Technology, Product development 2004—2007, University of Art and Design, Helsinki, Industrial and Strategic Design 2002—2007.

Opportunity sensing

At the moment Itkonen works as CEO at her own company Powerkiss, founded in 2007. She is also the former Design Manager at d-Switch, and a former research assistant at TKK, Machine Design and former coordinator an IDBM -program. So she also seems to be an opportunity sensing person and a moderate risk taker, too. "I do enjoy all new challenges", she admits readily.

A competitor

She certainly is a competitor and seems to like tackling unfamiliar but

interesting situations. With her business idea she has at least defeated several competitors. In the 2008 Venture Cup, she won a partial competition for the best innovative speech to sell her product, and furthermore, and she has been a real celebrity these two years yet for another reason as well: she was a finalist in all stages in Venture Cup 2008, the yearly business plan competition for young entrepreneurial talents.

Orientation to the future

She also tends to think ahead and have orientation to the future. By now, the tables charge wireless for example mobile phones with the same power as is in a usual cables. "In future, bigger devices like laptops can be charged by Powerkiss as well", Itkonen says "So far, we have managed to enter into contracts with two significant Finnish furniture corporations, first Martela, who helped her in developing the concept of the charging furnitures, and then Isku,

whose interests lay in making school furniture. Our next step is New York, and then, who knows."

The world out there certainly is wide open, it only takes an absolutely entrepreneurial person to conquer it. ■



Engineers And Entrepreneurs, an Apprenticeship Of 200 Years

In the 1850s, Mr August Carl Osberg and Mr August Herrman Bade, students of technology in their twenties, decided to start improving Osberg's father's coppersmith's shop in Helsinki. The end result of their endeavour, after some bankruptcies and mergers, forms a large part of the modern wood-processing industry in Finland.

In the middle of the 19th century, during the formative years of engineer training in Finland, the instruction mainly provided practical skills. The education aimed to rebuild the structures of the Finnish economy.

Studies in the Technical Realschule were aimed at fostering entrepreneurship. The 1858 rules state that successful completion of the school's full curriculum grants the right to run a business, and frees the graduate from any guild obligations. The desired result was reached in 1868 and in 1879 the guild system was abolished.

Out of the first 21 technology graduates, four did their life's work as entrepreneurs or craftsmen. **Otto Roland Mellin** eventually became Princess **Aurora Karamzin's** court goldsmith. Three graduates ended up in industrial occupations, with **A. J. J. Axelson** later running his own firm in Zaritsyn. Two worked as merchants, with **Rudolph Bandy's** merchant house operating in both Paris and Moscow. As far as is known, the occupations of the rest of the original Teekkaris (students of technology and engineering) were a proprietor, surveyor, architect, banker, captain, and a scientist. The architect

Carl Mellgren was eventually honoured with the title of Councillor of State.

Until the 1870s the instruction in technology taught a prescribed set of work tasks and technical issues. The makers of society's technological systems, for example the architects and construction engineers, received their training alongside the governmental administration trainees. Industry itself did not generally come to appreciate engineer training before the 1930s. It was possible to develop industrial production further with methodology applied from craftsmen's practices, or by acquiring ready-made technology from abroad. This in turn led to the percentage of dropouts being relatively high until the outbreak of the Second World War.

The technological development of society eventually led to the need to improve the larger technological systems, and also to the need to monitor the industrial activities of the state. The first strictly regulated field of technology in Europe was steam power in the 1860s. Societal monitoring quickly spread to occupational safety. The old administration training regime was dismantled and the responsibility for

training the future builders of society's infrastructure was invested in the Polytechnic Institute. Here architects, surveyors, and construction engineers found themselves in the same school as mechanical engineers and chemists. This was the inception of the 'university of technology' as we know it.

It was intended as early as in the 1870s that education for commerce would join the corpus of architects, surveyors, and construction engineers, but the state's coffers did not allow it at the time. This resulted in the highest-level training in economics being the responsibility of a private institution.

Towards the end of the 19th century the instruction in technology became more theoretical and academic. It was recognised that as the forces of nature also bound technology, knowledge of the appropriate theories would assist in making the applications of technology increasingly more productive. For example, the theorists in mechanical technology, who in Finland were internationally competitive, knew very well where mathematics and the



A gold bracelet from 1877 by Mellin, once owned by Ms. Anna Schauman, who was chosen the official tier of laurel wreaths of 1877 at the graduation ceremony in the University of Helsinki.



developing natural sciences were needed in industrial production. Transferring this knowledge to the conservative world of manufacturing was not achieved, however. The gap between technological research and real-life applications had grown too great.

The problem was inherent in the educational system and the solution was the same throughout Northern Europe. For practical training in technology, a series of practical, secondary-level engineering schools was founded. At the same time, engineers were divided into diploma engineers with a university-level degree and engineers who were graduates of the engineering schools. In Finland the need for training was constantly higher than the training resources and the graduate output

Studies in the Technical Realschule were aimed at fostering entrepreneurship. Out of the first 21 technology graduates, many did their life's work as entrepreneurs or craftsmen. Otto Roland Mellin (1834 - 1904), who continued his studies in St Petersburg, eventually became Princess Aurora Karamzin's court goldsmith.

allowed. This brought about confusion in occupational titles until the 1960s, although the system itself was relatively straightforward.

The diploma engineers (MSc Eng) graduating from the University of Technology were seldom entrepreneurs. Finland did not develop a similar small-business entrepreneurial culture to that which employed the body of engineers in e.g. the UK or the USA. In Finland their place was taken by a number of co-ops or limited companies, with their ownership spread over a large body of shareholders, or where the owner was the state or a family.

In Finnish industry, a diploma engineer was often a powerful man, who worked for the company as an employee. Only seldom did they

become entrepreneurs themselves. A typical entrepreneurial engineer dropped out of school, at least after completing their general-level studies. There are notable exceptions, however, one of the best known being **Gottfried Strömberg**. Mr Strömberg founded his electrical engineering company (today ABB) having earned his engineering degree, after his post-graduate studies in Germany, and while building the electrical engineering laboratory for the University of Technology.

The architectural bureaux and engineering shops in the construction industry are also based on applying entrepreneurs' expertise at their own risk. The international rise of Finnish architecture in the 1920s was mainly the work of private architectural companies. It is not often that they are perceived as private enterprises, however.

After the Second World War, industry's demand for diploma engineers was considerably higher than the



available supply. The situation allowed a new type of engineering consultancy to work in the service of industry as subcontractors or consultants.

The 1950s saw the birth of a new generation of technology companies, many of which were founded by graduates of the University of Technology. This group includes people such as **Jaakko Pöyry** (Pöyry Group), and **Ensio Miettinen** (EM Group, Ensto Ltd etc), who both started building their now internationally-known corporations soon after graduating.

In the 1980s, when the information technology industry was developing, the demand for diploma engineers once again rose to levels far surpassing the available trained workforce. The field saw the entry of a group of private companies, some of which gained international success and grew into notable employers. The phenomenon was, in practice, similar to the earlier birth of engineering companies to complement the manufacturing industry of the time.

By the end of the 20th century, technological education in Finland had reached a point where an entrepreneur with an engineering degree was not at all a rarity, but where there was no real link between entrepreneurship and engineering training.

The need to combine technology, the arts, or entrepreneurship has not disappeared, even though since the 1950s science has risen to play a prominent role in solving societal and industrial problems. Education in the art of technology, the science of technology, and economics all contributes to the skill set of a successful entrepreneur.

The era of the new Aalto University offers a solution to this challenge. Entrepreneurial activity is, in the end, the seed from which future international corporations begin. ■

Power

It happens with almost every electric device - they run out of power. Presently, a large part of the worldwide research activity in the field of small fuel cells is directed towards using mobile and portable fuel cells to replace batteries and find small-sized, lightweight, yet efficient and long-lasting power sources for mobile devices.

Biofuel cells, that have been actively studied at TKK since the early 1990s, may still offer a solution. IPPES project aim to create scientific basis and new technology for a micro fuel cell system intended for portable electronic appliances of power range 0.5 – 20 W.

The principle of fuel cells was first invented already in the mid-19th century, the first fuel cell generator being constructed in 1845. The principle of biological fuel cells was described as early as in the early 20th century. The technology was rediscovered in the 1960s in connection with space exploration programmes.

"As the trend in consumer appliances has been going towards more and more power-hungry devices, like 3G, the battery technology is struggling to keep up with it", professor of automation technology at TKK **Aarne Halme** thinks back in Otaniemi in his work room crowded with A4-size papers, books and scientific articles.

"Our automation technique research group has a long history of the development of a biocatalytic fuel cells intended for low-power electronic appliances: they have been actively studied at the Automation Technology Laboratory at Helsinki University of Technology (TKK) since the early 1990s."

The catalyst material that makes the difference

"For the first, we might want to define a biofuel cell", professor Halme says, leaning back in his chair as if for a lesson.

"A traditional PEM fuel cell burns hydrogen, meaning it connects hydrogen to oxygen through a semipermeable membrane or sheath. Electricity is being produced when an electron is stolen from the hydrogen atom at anode and circulated through an electric load to the cathode. Therefore, oxygen is reduced forming water with the protons that come to the cathode directly through the electrolyte membrane. The environmentally friendly waste product here is pure water. Also other fuels, like methanol, can be used, the burning product being for example carbon dioxide.

"Bio fuel cells operate on the same principles as the metal catalyst fuel cells. It is the catalyst, however, that makes the difference: in biological fuel cells the catalytic power derives

To the Laptops

from a microorganism or an enzyme, not platinum of the traditional metal catalysts. Hydrogen, however, cannot be burned directly in biofuel cells, but a biodegradable fuel, like a sugar or alcohol is needed.

"In principle, biocatalytic fuel cells offer inexpensive catalyst and component materials. Furthermore, in biofuel cells many types of fuel can be used. But, as it is, the performance values of the metal catalyst fuel cells have, so far, still been at least 10 times better."

A power generator in the deep sea

"In 1989 a new PhD student, Mr. Xia-Chang Zhang, a biochemical engineer, suddenly arrived from China to Finland, to work with me in our bio-group, which that time was focused on bioreactor control problems. Few years later Zhang then took his D.Sc. (Tech.) at Helsinki University of Technology," professor Halme thinks back.

"We became interested in biofuel cells round 1991 through an interesting unsolved problem provided us by a Finnish maritime company: How to make an autonomous electric power generator in the bottom of deep sea in complete darkness without feeding it from the surface.

We formed a two-man research group and ended up to the concept of biological fuel cell, which utilize bacteria as catalyst and plankton as the fuel. We succeeded to develop functioning biofuel cells using bacteria isolated from mud in the bottom of sea

and burn plankton - even fish meat in it". This did not, however, lead to any further development.

Small disposable bio-batteries

The small research group continued working with biofuel cells using other bacteria and glucose as fuel to develop the concept on a more firm scientific ground. In 1997 a new concept was created, the goal being a small-scale power source again, but this time with enzymes as the catalyst, not any more living bacteria. A functioning power source with methanol was achieved around 2001.

>>

Professor Arne Halme is the leader of the multidisciplinary IPPES-project, Innovative biofuel cell system for portable electronics applications.



”Biological fuel cells have a good energy density in the fuels they use, whereas they do not have a high power density. Therefore, they suit well to the applications where high powers are not needed. Furthermore, the highly environmental friendliness, is a valuable property to be utilized.”

”Using this method, our new idea was to make small disposable, environmentally friendly bio-batteries using printing techniques to manufacture them. These batteries, like tags of paper, were put together like sandwiches can be thrown away like any garbage as soon as they are finished.”

”Our concept obviously touched some chord in TEKES, the Finnish Technology Innovation Foundation, and we were given a million euro and 3 years to work on the project”, professor Halme tells. ”Here VTT (Technical Research Centre of Finland) also came along. They did not know much, but they were fast to learn and as we finished this research line, they started a next step project of their own, to carry on with the sugar-based biofuel cell.”

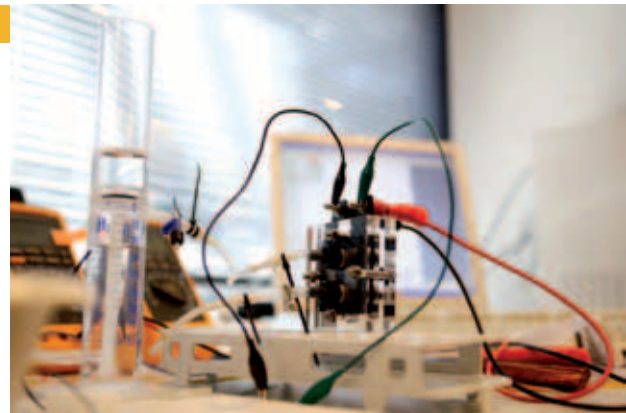
So far, the research group had grown bigger and included four to five researchers. Also the markets had

woken up. Researchers **Jussi Suomela, Anja Ranta** and Zhang won the business plan competition Venture Cup with the biofuelcell concept.

In summer 2002, Enfuel Cell Company was set up, getting into full operation mode at the beginning of 2005, Dr. Zhang as it’s CTO, the starting point being a new completely environmentally-friendly battery, flexible enough be used like a sticker in various applications, and, furthermore, fully disposable, in order to get rid of the environmental load of today’s batteries.

A new concept

Meanwhile, the core research group at TKK continued with basic research on small-scale power sources and went into cooperation with Dr Matti Korhola, a biochemist in the University of Helsinki. Dr **Korhola** had been doing research on an enzyme that breaks down methanol, methanol dehydrogenase or MDH, originally found in a bacteria *Methylobacterium extorquens*.



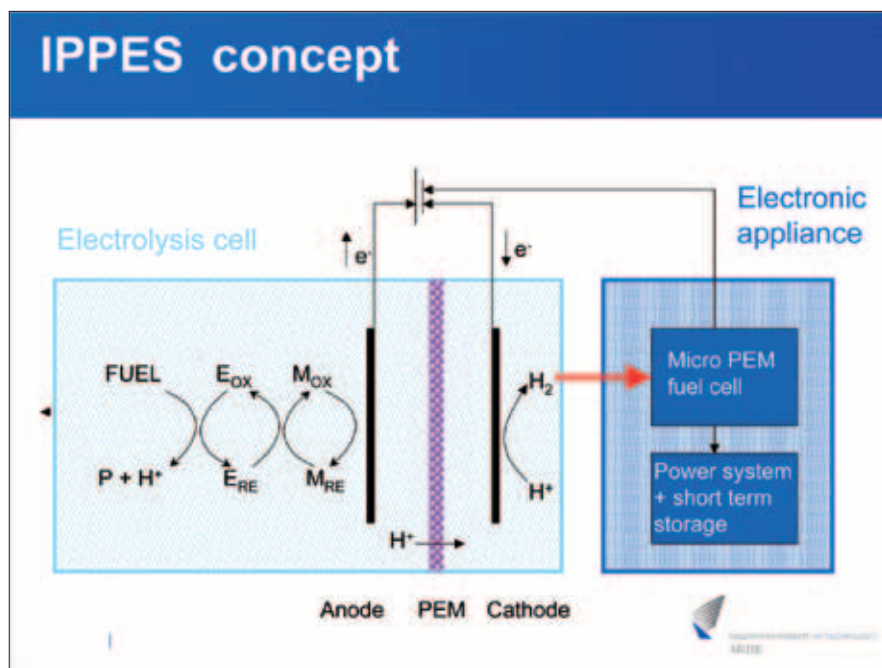
In 2006. Halme’s research student **Anja Ranta** dissertated on the biofuel cells using MDH. The method, DMBFC, Direct Methanol Biocatalytic Fuel Cell technology, is named on the basis of its operating principle, methanol dehydrogenase.

”The power source now developed is the basis for further research, on the way towards small disposable power sources based on biocatalytic energy generation”, Ranta wrote in her dissertation.

Multidisciplinary research in IPPES

Today, four years later, the biofuelcell research has enlarged to other research areas as well. It is now carried on a multidisciplinary research project IPPES, funded by the Multidisciplinary Institute of Digitalisation and Energy at TKK and coordinated by Aarne Halme. The main goal of IPPES is to create scientific basis and new technology for a micro fuel cell system intended for portable electronics appliances of power range 0.5–20 W.

”Here, the technology is based on a somewhat different principle and it has developed further from DMBFC. What we want is to get the power density higher and the process more controllable. Now we use both hydrogen and a micro - PEM fuel cells. However, here the hydrogen is made from methanol by a catalyzed electrolysis on ”in-situ” and ”on-demand” bases.



The basic philosophy here is that only a portion of the hydrogen produced is needed to generate the electricity for the electrolysis and the rest can be used for an application purposes. This is possible in catalyzed electrolysis of methanol unlike in water electrolysis. In our case we use again biocatalyst instead of noble metals.”

Multidisciplinary work

The participants in IPPES are coordinator, Professor Aarne Halme, professor of physical and electrochemistry **Kyösti Kontturi**, professor of applied thermodynamics **Markku Lampinen**, professor of microfabrication **Sami Fransila** and professor of biochemistry **Simo Laakso**.

With the vast technological experience is IPPES, the first research plan in detail has been done including selection of materials for the first research phase. There research has also done on a thermodynamical model, and, furthermore, a test bench is done for biocatalytic electrolysis and for a first micro-PEM prototype. Finally, a first fuel cassette prototype and the prototype system tests.

”Right now we are working on a proof of concept, which means that we like to validate the main idea behind that reasonably more electrical energy can be obtained in practical situations trough electrolysis of methanol than which is consumed to produce it. Then it will be possible to make disposable fuel cartridges to power our laptops or phones. With printing techniques the price will not rise too high.

This concept will in time course live independent life outside TKK, perhaps concur on markets with for example the direct methanol fuel cell,” professor Halme summarizes his speech. ”At that time we basic researchers have gone back to our laboratory and continue the work on some other research topic that is in a need of a closer look.” ■

From Space Probes To Buildings

A user interface allows the operation of technology to suit human needs. A comparison of the number of technology versus user interface innovations at TKK shows that the university develops remarkably few user interfaces.

The purpose of Aalto University is to bring under one roof the complete process of developing a technological invention into a finished product. A new technology can only break through if it can be applied in a way that appeals to its audience. However, if the user interface is not approachable, the audience cannot meet the technology.

Through its user interface, technology can enter the service of man in three ways. It can be tangible, as in computers or mobile phones. It can be so small that it can enter the body, for example medical instruments, or conversely so large that people can enter it, e.g. a building.



The fourth possibility, that technology would distance itself from man, much like space probes do, is not an option. TKK’s research often resembles a space probe – so far away from the common man that its meaning cannot be perceived.

Usually, the discussion of user interfaces involves the first meaning, especially in information technology, for example Microsoft Windows, or Nokia Ovi (door).

Windows and doors point to the best of all user interfaces – a building. Buildings are easily approachable, and a part of everyday life. Not only are buildings advanced technology themselves, they also contain high technology. Two examples from TKK this spring: the winning Manhattan entry for Helsinki’s architecture competition is a technological innovation; the building does not rise up but rather cascades down, with overhead gardens. Likewise, the zero-energy building that is Finland’s entry for the Solar Decathlon competition is jam-packed with high technology.

No wonder architects are admired. Presently, buildings are the best-utilised user interface, though others could do as well. ■

Janne Luotola
Chief editor, *Polyteekkari*

Nice Antennae

“Devices in the same room could all utilise the 60-GHz band and move data up to several GB per second,” states researcher Sylvain Ranvier. For his doctorate, Mr Ranvier studied high-frequency radio wave propagation.

During the last decade multiple-input, multiple-output MIMO systems in the 2- and 5-GHz bands have been researched extensively. But these frequencies are already in heavy use.

Mobile gigabits

Much higher frequencies offer greater potential. The 60-GHz band is licence-free.

– In my dissertation I studied the behaviour of radio waves at this high frequency, and what happens with multiple simultaneous signals.

– For example, multiple antennae in devices such as TV screen and DVD player, would make it possible to really watch videos without any cable connection. The current data transfer speeds do not allow that.

French diploma

Sylvain Ranvier built himself an antenna that uses the 60-GHz band.

– I had the opportunity to go on a one-year research exchange at the Nice - Sophia Antipolis university, France, an institute known for its expertise with antennae. As a result, I learned a lot and was able to apply that in my own research.

Ranvier is a French national. He arrived at TKK in 2003 while pursuing his French diploma.

– In France, a diploma work may consist of a practical project and a written part. I did not want to do my project in a company, but chose to work in a research institute instead. I wanted to go abroad to improve my English skills. Initially, I was with TKK for six months.

International exchanges

– At TKK mobile communication is a popular research area, and that also interests me. I was lucky when Professor Pertti Vainikainen chose me to be in

his group and I was able to continue my work. In this way I completed my licentiate.

In the future, such international co-operation will be more and more common at TKK. The PhD students are encouraged to go on an international exchange as a part of their degree. Ranvier’s experience has been positive.

– I studied in Villejuif, near Paris. In comparison, Finland seems a very quiet and safe place. More importantly, here people respect one another and are polite.



Sylvain Ranvier dissertated on high frequency radio wave propagation at TKK.

Smartphone face time increasing



”The usage of new smartphone applications: the mobile Internet, games, multimedia and map applications, has been increasing among smartphone users”, says **Hannu Verkasalo**, who dissertated at TKK in April.

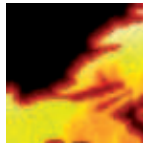
”Most of the usage is, however, still based on voice and text messaging.” As many as 90% of smart phone users wish they had computer like functionalities in their phones. 40% of aggregate face time is based on Internet browsing, multimedia features or some other new applications. Nevertheless, potential usage of new applications could be even higher. The results published in the dissertation indicate that only 31% of smartphone users, who would like to use mobile email with their smartphones actually use email in practice. For multimedia messaging this ratio is 70%, and for mobile Internet browsing, it is 72%.

Internet browsing, multimedia messaging, and multimedia applications face the highest demand out of new smart phone features. In contrast, wireless file sharing applications, instant messaging and mobile Internet calls are not that attractive, when asked from consumers. ■

Hannu Verkasalo: "Handset-Based Analysis of Mobile Service Usage"

*Faculty of Electronics,
Communications and Automation*

Images at work



”Although ours is the civilization of image, in their identification our thought remain trapped into ‘representation’: the privilege of meaning, manifest referent, language and linguistics.”

In choosing **Steven Holl’s** entry for Kiasma and Lordi’s image, **João Figueira** proceeds by acknowledging the fundamental aspect of empathy that they convey and from the mapping of their materials and reminiscences.

”Despite the obvious difference between Holl’s and Lordi’s images, it will emerge that both constitute rich montages of heteroclit materials and both blur disciplinary and hierarchic distinctions, that is, they are “images” in the full sense of the word. Lordi is reminiscent of cornerstones of Western imagination such as the devil of the 11th-16th centuries, opera, publicity and ancient chimerical creatures.

Holl’s images have deep artistic sources, something that his interlocutors could not have missed.” In this thesis, **Aby Warburg** (1866–1929), **Sigmund Freud** (1856–1939), French thought of the 1960s–70s and, among others, **Georges Didi-Huberman** (b1953) play a major role. ■

João Francisco Figueira, "IMAGES AT WORK. Holl’s entry for Kiasma and Lordi, the works of two over-determined images"

*Faculty of Engineering and
Architecture*

Solving hard problems



The history of formal logic goes back to the 4th century BC. For the vast majority of that time logicians have made their proofs by hand, first by using Aristotelean syllogisms, and after the advances of the 19th century with truth tables or axiom schemata.

These methods are laborious and can be used only for small examples—the truth table of a formula with only six propositional atoms already has 64 rows and each additional atom doubles its size.

Computational logic is a young branch of logic whose ultimate purpose is to solve practical problems with mathematical logic. The formalizations of most problems are far too large to be examined by hand as they often have thousands, hundreds of thousands, or even millions of atoms.

Tommi Syrjänen’s thesis examines computational logic in the form of answer set programming (ASP) that is an offshoot of logic programming. The thesis looks at the issues that arise in defining, implementing, and using an answer set language. ■

Tomi Syrjänen: "Logic Programs and Cardinality Constraints: Theory and Practise"

*Faculty of Information and Natural
Sciences*

– Initially, it also helped that everyone speaks English here.

But let’s get back to the antennae.

Supercharged home wireless

– An antenna working in the 60-GHz band is extremely small. Thus it is possible to install multiple antennae in a single device, which allows the frequency to be used in parallel. In my research I was trying to find the best

possible antenna configurations, and to ascertain the possible transfer speeds.

– It should be noted that in this band the range of the signal is only about 10 metres.

The 60-GHz MIMO systems are considered one of the best solutions for future high-speed short-range transmission, as found in, for example, Wireless personal area network (WPAN) systems. This would allow e.g. wireless home theatre systems.

When can we expect applications in our homes?

– There is a need for further multidisciplinary research in the area to bring the technology to home users. Further research is required in, for example, circuit design, says Sylvain Ranvier.

– Maybe in a couple of years’ time the technology will be ripe. ■

More Light !

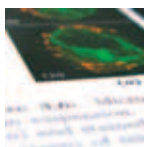


”As energy is a fundamental service for human development and economic growth, the demand for it is constantly on the rise worldwide. Lighting energy use makes a significant contribution to the total energy consumption of buildings”, states **Pramod Bhusal** in his thesis.” The use of energy efficiency measures can reduce this kind of energy consumption”. The main objectives of Bhusal’s work were to review different aspects of lighting quality and energy efficiency and to test the existing technologies for efficient lighting. An additional aim of the work was to examine the new opportunities provided by LED technology in providing lighting in rural areas of developing countries and to compare LED lighting with existing fuel-based lighting. The work presents a study and evaluation of traditional pine stick lighting and new white LED-based lighting used in rural Nepali villages. The use of different renewable energy sources in combination with efficient lighting technology is found to be a realistic and sustainable option to provide clean and efficient lighting services in developing countries.

Pramod Bhusal: ”Energy-Efficient Electric Lighting for Buildings in Developed and Developing Countries”

Faculty of Electronics, Communication and Automation

Micro-rotation imaging and 3D cell structures



Micro-rotation fluorescence microscopy is a novel, optical imaging technique developed with a cell rotation system. The imaging system enables individual living cells to be rotated in suspension under microscopic dimensions, and allows us to acquire a series of images of the cells, simultaneously during the rotation. **Laksameethanasan’s** thesis presents four alternative methods for reconstructing 3D objects from a series of micro-rotation images. All the proposed reconstruction methods clearly increase capability to visualise 3D object structures, as shown by both simulations and experiments with real micro-rotation data. The results indicate, that quality of the reconstructed object highly depends on the accuracy of image alignment, and that micro-rotation reconstructions with the current imaging system always contain poor resolution in the tangential direction of the rotation. Future research would be the combining of the micro-rotation protocol with extended depth-of-focus microscopy that could strengthen the tangential resolution.

Danai Laksameethanasan: ”Three-Dimensional Reconstruction Methods for Micro-Rotation Fluorescence Microscopy”

Faculty of Information and Natural Sciences

Pulsed Radar Measurements and Related Equipment



The purpose of the thesis by **Mikko Puranen** has been to develop novel methods for pulsed radar measurements, creating practical tools for verifying the operation of a modern pulsed radar, and to build working prototypes suitable for field use. Very little information has been published in the radar field perhaps due to the military nature of many research projects. Methods and equipment are typically researched by different armed forces. In this thesis, some tools for frequency, power and waveform measurements are presented. Even the most modern commercial measuring instruments, however, are not capable of measuring a pulsed radar signal, mostly due to the short (even tens of nanoseconds) pulse length. The limitations of conventional measuring devices are discussed also. The first publication demonstrates a radar calibration system, based on a fiber-optic delay line and two frequency measurement methods for short-term stability evaluation are presented. Two new instrumentation radars are also presented.

Mikko Puranen: ”Pulsed Radar Measurements and Related Equipment”

Faculty of Electronics, Communications and Automation

Studies of Static and Driven Lattice Systems



Study of static and dynamical properties of two dimensional lattice systems has become an important topic in nanoscience. Competition between the intrinsic ordering of adsorbed layers and the underlying substrate often leads to the appearance of spatially modulated structures. Important examples include spin density waves, charge density waves, vortex lattices in superconducting films with pinning centers and weakly adsorbed monolayers. In addition to static properties of such systems, their dynamics under external driving force is of great importance in tribology to understand the microscopic origins of friction.

The thesis by **Cristian Achim** deals with the static and dynamic properties of adsorbed layers under the influence of a driving force using an extended version of the Phase Field Crystal Model. In the thesis, the nonlinear response to a driving force on an initially pinned commensurate phase was studied via overdamped dynamic equations of motion for different values of mismatch and pinning strengths. Also, structural changes of the system were characterized in some detail close to the depinning transitions.

Cristian Vasile Achim: ”Studies of Static and Driven Lattice Systems with the Phase Field Crystal Model”

Faculty of Information and Natural Sciences

Metabolic engineer of lactic acid bacteria



The main goal of **Miia Helanto's** thesis was to metabolically engineer lactic acid bacteria (LAB) for the use as efficient production hosts of commercially interesting rare sugars and sugar alcohols.

LAB are a very diverse group of gram positive bacteria. It is a group of bacteria that is originally identified by their ability to synthesize lactic acid.

The main function of sugar metabolism in LAB is to generate the energy necessary for growth and maintenance of cell functions. Hence, their sugar metabolism is generally not connected to their limited biosynthetic activity.

The possibility of modifying catabolic pathways of sugars without disturbing the biosynthesis of cell components makes the sugar metabolism of LAB attractive targets for metabolic engineering. LAB have also the GRAS (generally regarded as safe) status which makes them suitable production hosts for food and pharmaceutical applications.

In the first part of the thesis mannitol production of *Leuconostoc pseudomesenteroides* was improved by random mutagenesis. Mannitol is a naturally occurring six-carbon sugar alcohol, which is widely used in the food, chemical and pharmaceutical industry. In the second part of the thesis *L*-arabinose metabolism of *Lactobacillus plantarum* was modified.

Miia Helanto: "Metabolic Engineering of Lactic Acid Bacteria for Production of Mannitol, L-Ribulose and L-Ribose"

Faculty of Chemistry and Materials Sciences

Dielectric Properties of Colloidal Suspensions



The thesis of **Lei Dong** focuses on theoretical research of dielectric properties of colloidal suspensions. Colloids have enormous advantages of being experimentally accessible.

Atomic size scale, time scale of diffusion and tunable interactions of colloids make them as ideal tools for fundamental investigations. Effective dielectric constant plays a key role in the investigation of the properties of colloidal suspension. Many applications such as dielectrophoresis (DEP) and electrorotation are useful to study the effective dielectric constant. In the first part of the thesis, it is found that, at low frequency, the DEP force can be enhanced (reduced) significantly for the longitudinal (transverse) field case due to the presence of multiple images. The second part of the thesis investigates the dielectric properties of functionally graded materials using different methods.

Lei Dong: "Dielectric Properties of Colloidal Suspensions"

Faculty of Information and Natural Sciences

Nanostructures and controlled assembly



Even though spontaneous self-assembly can be used to create diverse nanostructures, the structures, as such, are typically polydomain, consisting of locally ordered small domains that lack mutual orientation and/or long range correlation. As a result, the material remains macroscopically isotropic and disordered. The aim here is to explore feasible ways, on one hand, to control the assembly and, on the other hand, to obtain macroscopically anisotropic materials and functions.

Ari Laiho's thesis deals with a common drawback that is often encountered in self-assembled nanostructured soft matter. In the thesis is shown how charge-transfer complexation between C60 fullerenes and electron-donating units of block copolymers can enable control of the morphology and properties of fullerene based materials. The thesis also deals with the alignment of randomly oriented domains of nanostructured material over macroscopic length scales. A real-time rheo-optical apparatus in combination with more detailed ex-situ structural characterization is used. Finally, control of the nanoscale morphology in polymer/fullerene nanocomposite thin film devices is shown to allow tuning of the electrical switching that can enable construction of a memory unit.

Ari Laiho: "Pathways Toward Controlled Assembly of Functional Polymer-Based Nanostructures"

Faculty of Information and Natural Sciences

Statistical methods in machine learning research



A fundamental problem in machine learning research, as well as in many other disciplines, is finding a suitable representation of multivariate data, i.e. random vectors.

Linear algebra has become a key tool in almost all modern techniques for data analysis. Linear models constitute a special class of general models because of their tractable analytical properties. In **Zhijian Yuan's** thesis, the problem of linear source separation is discussed. Yuan's thesis addresses the problem of independent component analysis (ICA) and nonnegative matrix factorization (NMF). These methods allow solving many difficult signal processing problems in different application domains. The ICA-based methods have shown to be very successful, and widely used, for performing blind source separation in the general case. In this thesis, the theoretical conditions for the linear ICA model to qualify as blind separation model were reviewed.

Zhijian Yuan: "Advances in Independent Component Analysis and Nonnegative Matrix Factorization", Faculty of Information and Natural Sciences

Change Management And Networking

In the towering meeting room of the Tieto building student cafeteria **Kaisa Hänninen** puts her diploma work on the table. Her status as a student of information networks came to a head on 25 March with her graduation. And the fact that her thesis work was awarded the highest grade must put some added spring in her step.

A 2002 major in the Information Networks degree programme, Hänninen has worked for the past three years at SimLab. A friend pushed her to start thinking about a subject for her thesis work from the start of her studies. Hänninen took the advice, and she says the idea for the topic came to her about three years ago. The cover of the thesis puts it succinctly: Verkottuneiden liiketoimintaprosessien muutoksen johtaminen – Tapaustutkimus lentotoimialalta

The subject of her diploma thesis is exactly what you would expect from someone who has balanced the study of information networks with an industrial engineering and management minor. Ms Hänninen states that her topic has not been a common topic of research, and that the two SimLab development projects for Finnair provided excellent source material for her study.

But before venturing deeper, what exactly is SimLab, and in what capacity does Hänninen work? Is she a consultant or what? According to

Fresh graduate Kaisa Hänninen has readily established herself in the corporate world. Here she describes what exactly enthralled her about networks and the business world, and where interest in such matters may eventually lead.

its website, SimLab is a research and teaching unit for graduate students of networked business, based in the Innopoli building. SimLab promotes multidisciplinary research into networked business practices, with an emphasis on co-operative development and innovations. SimLab was founded in 1998 by Professor **Riitta Smeds**, and she continues to be the driving force of the project.

In practice, the student groups at SimLab accept development projects from companies, not very differently from consultancies. There is the added distinction that the SimLab crew are students, and they don't necessarily turn into consultants upon graduation. This includes Ms Hänninen, who does not know what she's going to do when she is an adult. She has tried to avoid planning things all the way, and would rather like to proceed one step at a time: now she's concentrating on her post-graduate

studies, and after those are finished, she will see where the road leads.

Kaisa Hänninen finally took the time to write her thesis a year ago in April 2008, though she had had the idea for years. Having advanced from her part-time transcribing job to being a project manager, she had been busy with SimLab work, but, on the other hand, the development projects gave her experience that proved important in the thesis work.

For the thesis, she parsed two separate Finnair projects into the empirical part of her work, and proceeded to the task she thinks is the most boring, the writing itself. "The literature review was by far the most tedious stage, as there is a plethora of literature on change management. To someone focused on the practical, the empirical side was much easier," says Hänninen.

Her recommendation is that a thesis writer should, after carefully choosing

MSc. (Tech) Kaisa Hänninen from Information Networks degree programme has worked for the past three years at SimLab. Luckily, a friend pushed her to start thinking about a subject for her thesis work already at the start of her studies.

and limiting the topic, prune all the superfluous material at this stage and concentrate on just the core that is the writer's main interest.

Her own focus was on the network of change management, something that had not been Finnair's primary focus in the development projects with SimLab. It was beneficial for the theory review, however, that thanks to the projects there was plenty of relevant material.

But what were the case studies really about? For the first SimLab project Finnair wanted to develop their flight preparation process, where the plane is prepared for take-off with numerous collaborators. Behind the project was a sizable IT systems upgrade, which allowed the centralisation of work that previously had been divided between various subcontractors. Finnair wanted to understand the existing process as a single whole, and come up with functional improvements for the new processes.

The second case was for the further development of the transit travel process, for example that of a passenger arriving at Helsinki-Vantaa from Delhi, and embarking for Frankfurt after changing planes.

These two development projects gave Hänninen the initial feel for her thesis material, which she developed further with interviews. Finally, the results were beginning to be visible: successfully managing the networked process change breaks down into e.g. how strategy-driven the change is from the point of view of all the key stakeholders, the assistance of a neutral facilitator in a change situation, common views and aims throughout the network, and the skill of identifying win-win schemes for the participants.



“The change in a networked business process is visible first and foremost to the workers in the process, but also perceivable from the customer side as improved service.”

In Ms Hänninen's view business development projects are especially interesting in the extremely dynamic world of modern aviation. On the other hand, she finds development projects

appealing: “No company can risk stagnating in the constantly changing business environment of today. As a developer of processes you are often allowed a glimpse of the core of the business.” And this is exactly what the young first-year student Hänninen dreamed of working on one day. ■

'The Times They Are A-Changin'

First election of the Representative Council of Aalto University Student Union (AYY) took place in April 2009.

According to the final results of the proportional election for the AAY Representative Council, the winning electoral alliances were Luova Liitto and iThink with 5 seats

each. As regards electoral circles, Avainrengas was the winner with 13 seats, followed by Jämerä (12 seats) and Ratas (11 seats); **Pipsa Penttinen** received the highest number (81) of personal votes.

Altogether 456 candidates stood for election through 5 electoral circles and 22 electoral alliances. Preliminary statistics show that 5,327 students voted in the election, indicating a total turnout of 34.7%. At the Helsinki School of Economics, the turnout was 1 400 students, i.e. 47.9%, while the corresponding figures at the University of Arts and Design Helsinki and Helsinki University of Technology were

*Vote here today!
Advertisement for the election of
the Representative Council of
Aalto University Student Union
(AYY) in Otaniemi campus.*



560 voters (32%) and 3.367 voters (31.5%) respectively. The electorate consisted of all those students of the three merging schools who had enrolled as present at their home university for spring 2009 at their university and paid the associated student union membership fee.

The Student Union of the Helsinki School of Economics (KY), the Student Union of the University of Art and Design Helsinki (TOKYO) and the Student Union of Helsinki University of Technology (TKY) will merge into the Aalto University Student Union on 1 January 2010.

History of TKY at TKK

The representative body of the students of Helsinki University of Technology was established following the proposal of Rector **Martti Levón** in 1952. By that time, the student body of the University had become so large that a general assembly was no longer an effective decision-making body.

The ideology prevailing in the post-war years was 'No politics to Poli'; in other words, the University did not want to be involved in party politics. Party politics were first introduced to the student union activities in 1968–69; these years ushered in an era of intensive party politics, during which student organisations were not afraid to show their political conviction. By the end of the 1970s, political activity faded out, and the student union of the late 1980s was much less engaged in party politics than its predecessors.

The engineering students' association Polyteknikkojen Yhdistys built its first student house in 1885, while 1903 saw the construction of the Vanha Poli building. The current capital of the student union dates back to this era. KY built its dormitory in the late 1930s. In the late 1940s, both KY and TKY raised money through so-called 'charity trade', a State-subsidised form of selling certain consumer goods. TKY used most of its share of the profit to build the student village, Teekkarikylä, while KY used it to fund activities.

Since the beginning of the 1970s, the TKK students have had official representatives in the workgroups and committees of TKK. ■

Founded in 1849, received university status in 1908

- Four faculties, 25 departments
- Nine separate institutes
- 13 degree programmes in English
- 250 professors
- 15 000 under- and postgraduate students
- ca. 1000 Master's degrees awarded and 160 doctorates each year
- Total funding from state and other sources 223 million euros (2007)

Faculty of Chemistry and Materials Sciences

Department of Biotechnology and Chemical Technology
Department of Chemistry
Department of Materials Science and Engineering
Department of Forest Products Technology

Faculty of Electronics, Communications and Automation

Department of Automation and Systems Technology
Department of Electronics
Department of Micro and Nanosciences
Department of Radio Science and Engineering
Department of Signal Processing and Acoustics
Department of Electrical Engineering
Department of Communications and Networking
Metsähovi Radio Observatory

Faculty of Engineering and Architecture

Department of Architecture
Department of Energy Technology
Department of Engineering Design and Production
Department of Surveying
Department of Structural Engineering and Building Technology
Department of Applied Mechanics
Department of Civil and Environmental Engineering

TKK Lahti Center

Centre for Urban and Regional Studies YTK

Research Institutes

Center for Energy Technology (CET)
Institute of Building Services Technology

Faculty of Information and Natural Sciences

Department of Biomedical Engineering and Computational Science
Department of Mathematics and Systems Analysis
Department of Media Technology
Department of Applied Physics
Department of Information and Computer Science
Department of Computer Science and Engineering
Department of Industrial Engineering and Management
BIT Research Centre
Language Centre

Centres of Excellence

Adaptive Informatics Research (2006–2011)
Computational Complex Systems Research (2006 – 2011)
Computational Nanoscience (COMP) (2006 – 2011)
Low Temperature Quantum Phenomena and Devices (2006 – 2011)
Systems Neuroscience and Neuroimaging Research (2006 – 2011)
Generic Intelligent Machines Research (2008 – 2013)
Smart Radios and Wireless Research (SMARAD) (2002 – 2007, 2008 – 2013)
Algorithmic Data Analysis Research (2008 – 2013)
Inverse Problems (2006 – 2011)

Outstanding Junior Research Groups 2006 – 2008 nominated by TKK

The junior research groups at TKK are groups of young doctoral researchers who have the potential to raise the standard of their research to that of a centre of excellence at the Finnish and the international level in just a few years.

Model Checking Research Group
Planck — The Key to the Universe
Facility Services Research (FSR)



Photo: Eeva Pitkälä



JOIN THE INTERNATIONAL CAMPUS AT TKK

TKK has thirteen international Master's degree programmes, three Erasmus Mundus Master's Programmes, six international non-degree and a number of courses provided in English at each department. For further information see http://www.tkk.fi/en/prospective_students/

International students can apply to TKK to pursue studies as a degree student, as an exchange student or as a non-degree student.

Master's degree student

Students pursuing studies towards a Master's degree at TKK. In order to qualify to apply, international student should have completed a Bachelor's degree at a university. The degree should be in the same or applicable field as that in which he/she wishes to study. Please note that there are no Bachelor's degree programmes offered completely in English at TKK.

Doctor's degree students

(post-graduate students)

The basic requirement is a university level Master's degree or equivalent. The admission is based on the applicant's individual academic merits as presented in the application form and the required documentation.

Exchange students

Visiting students from partner universities entering TKK through an official bilateral agreement or an exchange programme. Please contact the International Office of your own university for further information.

Non-degree student

International students having a degree at a university in another country and wishing to pursue supplementary studies at TKK for example in order to deepen their professional knowledge. Study possibilities include the international non-degree programmes as well as individual courses.

FACULTIES

There are four faculties at TKK:

Faculty of Chemistry and Materials Sciences
Faculty of Electronics, Communications and Automation
Faculty of Engineering and Architecture
Faculty of Information and Natural Sciences

MASTER'S DEGREE (M.Sc.) PROGRAMMES IN ENGLISH

There are thirteen Master's degree programmes offered completely in English:

Bioinformatics
Communications Engineering
Electrical Engineering
Forest Products Technology
Foundations of Advanced Computing
Geoinformatics
Machine Learning and Data Mining
Micro- and Nanotechnology
Mobile Computing – Services and Security
Process Systems Engineering
Real Estate Investment and Finance
Service Design and Engineering
Service Management and Engineering

There are three Erasmus Mundus double degree programmes offered in English:

NordSecMob
– Master's Programme in Security and Mobile Computing
SpaceMaster
– Joint European Master in Space Science and Technology
EMMEP
– Erasmus Mundus Minerals and Environmental Programme

INTERNATIONAL NON-DEGREE PROGRAMMES

International Architecture Programme
European Mining Course
Modern Technology in the Pulp and Paper Industry
International Business Programme
Industrial Enterprise of the Future
(Framtidens industriföretag)
EMEC Recycling course



HELSINKI UNIVERSITY OF TECHNOLOGY