TU/e
Connecthor 32
Magazine of e.t.s.v. Thor and the department of Electrical Engineering at Eindhoven University of Technology
December 2015

NEW CWTE LABS

New labs in Flux give wireless research a boost

Graduate School | new **Board** department | **IEEE**Xtreme | BlueJay | Opening **Flux** | **Column**

Connecthor

Volume 8, issue 4 - December 2015

Connecthor is published by e.t.s.v. Thor and the department of Electrical Engineering at Eindhoven University of Technology. Connecthor is published quarterly with a circulation of 1400 copies and is free for all members of e.t.s.v. Thor and employees of the department of Electrical Engineering.

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Deadline copy next issue: 8 Jan 2016

At the moment of writing this editorial we are already almost one year in our new building Flux. We are used to "living' together with the department Physics and to our new building. And although most faces in the building seem familiar by now, we think it still important to highlight some persons and there activities with: "Whose desk is this?" Also new in Flux, are the CWTe labs. If you would like to know more about this special lab, read the article: New CWTe Labs give wireless research a boost

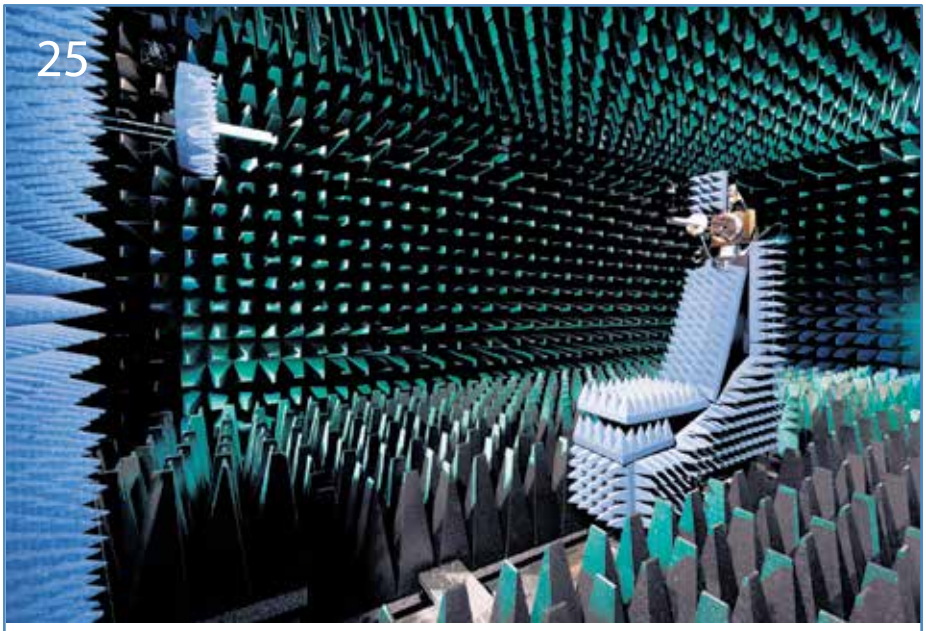
If you are looking for inspiration for an internship abroad, have a look at the article by Teun about his six-months internship in in Brazil. Our students also recently visited Prodrive and Thales. But if you want to know a bit more about doing a PhD you can read the personal story of Jean-Pierre Vaessen.

Of course we also inform you about the news in the department. Let's not forget that our board of the department has changed in this last period. Both Jolie Boot as managing director and Bart Smolders as dean have been appointed by the board of directors! And there is a lot more to read. So take your time during the Christmas recess to read about everything that has happened over the past months!

The editorial board is currently looking for new members. Are you up for a new challenge and would you like to contribute to our magazine? We are especially **inviting scientific staff** of the EE department to respond. As always, we will be glad to receive your suggestions and ideas for upcoming editions and you can contact us via connecthor@tue.nl.

We hope you will enjoy reading this new edition of the Connecthor and we wish everyone Happy Holidays and a Prosperous New Year!

The Connecthor editorial board ■



In het Antenna Lab kunnen metingen aan antennes gedaan worden met een bereik van 500 MHz tot veertig GHz. foto Bart van Overbeeke

'Wifi 1000 keer sneller'

CWTe Labs boost wireless research

The Centre for Wireless Technology Eindhoven (CWTe) Labs in the our Flux building were officially opened. Read more about it on page 25.

What an adventure

Read about Teuns internship in Brazil on page 32.

IEEE Xtreme

'team Bram' reached the 126th place in the world on the IEEE Xtreme. Read it on page 10.

The oasis of Flux, furniture on the roof terrace.

Thor, together with 'Van der Waals', realized furniture for the roof terrace. Now you can enjoy your beer in the sun. Read about the process on page 11.

Re-design of master program in EE

By: Bart Smolders, Sonia Gomez Puente and Jan Vleeshouwers

In the Strategic Plan TU/e 2020 (2011) the TU/e has defined the ambition to educate 50% more engineers and to increase the variety of engineering profiles it offers. This requires a significant increase of the number of students, more electives in the curricula and improved rates of study success.

As a first step in achieving these ambitious goals, the Bachelor College was started in September 2012. As a logical next step, in 2013, a taskforce was assigned to deliver a vision on the Graduate School as part of the TU/e Strategic Plan. This has resulted in a new overall structure of all the master programs offered at TU/e. Similar to the Bachelor College concept, all master programs at TU/e have the same overall structure in the new set-up with 5 ECTS courses. In addition, a slot-scheduling system is used to accommodate students to choose electives from other departments. In 2014, a special committee, with scientific staff members and students from our department, was formed to define the new master program in Electrical Engineering. The committee has consulted all capacity groups of our department. This has resulted in the program as shown in Table 1. The mini-program I courses of the old master curriculum have been transformed into core-courses. Next to the core courses, we have defined specialization paths in which students can specialize themselves towards a specific capacity group. More details about the core, specialization, and elective courses can be found in Table 2.

Course name	ECTS	Quartile
Core courses	15	Q1
Specialization path	10	Q2 and Q3
Professional development I	5	any quartile
Elective courses	30	any quartile
Internship	15	Q1, year 2
Graduation project including professional development II	45	Q2-Q4, year 2

Table 1, program overview

The mentors within the Graduate School

Within the Graduate School program the teachers take a prominent role as mentors. With the increased diversity of backgrounds and career goals, early assessment is crucial to identify students' development needs. The main goal of mentoring is supporting the mentees in getting the best possible start to their career. Challenging the mentee to investigate his or her career goals is a big part of that, as that will help the student to put together a coherent education and development plan. This plan includes curriculum choices, professional and academic skills to focus on, and the student's view on his or her career after graduating. As mentors, the teachers can suggest challenging courses, introduce students to people in relevant research departments and companies, and help him or her choose a career profile or a combination of profiles. The mentee is responsible for designing an appropriate study plan. The teacher-mentor can offer the guidance and support.

Professional Development and the development of Professional Skills

Companies and research centers where our students go to work after graduation have emphasized the importance of professional skills. In the high-performance workplaces of today, people need to be able to present themselves, be creative, show (self-) leadership and adopt an entrepreneurial attitude towards their work and their lives. The Professional Skills are a relevant component of the Electrical Engineering (EE) master curriculum. Within our study program we devote 5 ECTS to the development of the professional skills. This comprises three modules, e.g. writing skills, presentation skills, and research setup and methodology.

The professional skills are integrated in the master courses and get deep attention in the form of assignments, feedback by the teachers and instructors, but also by the peers. *Peer feedback* is a key element of our program towards stimulating academic attitude by revising each other's assignments with the use of PEACH, an online platform.

Moreover, there are also opportunities for further practicing the professional skills through the TU/e online platform SkillsLab. Students can get access to information, videos, documents, etc.

Code	Name	ECTS	Quartile
2DME00	Complex and Functional Analysis	5	Q1
5CCA0	Semiconductor Physics and Materials	5	Q1
2DME10	Discrete Mathematics	5	Q1
5CHA0	Classical and Modern Physics	5	Q1
5CPA0	Computational Physics	5	Q1
2DME20	Nonlinear Optimization	5	Q1
5CRA0	Random Signals and Processes	5	Q1
5CSA0	Modeling Dynamics	5	Q1

Table 2a, Core courses (select three out of eight)

The EE master study program provides opportunities for further professional development as well. In this regard, our program includes a course on Project management and on Cultural Integration Processes.

International experience

Because of the 60-plus nationalities in our faculty staff, and almost as many nationalities among the EE students, studying Electrical Engineering in Eindhoven is an international experience in itself. For students who want more, the companies in the Eindhoven region provide internship and graduation project options with an even more international scope, with respect to multicultural content of the teams involved as well as the location of the projects.

Apart from that, the faculty offers students opportunities to study abroad, through the International Coordinator, Lies Termeer, or through all research contacts of the EE staff. ■

Abbreviation	Research Group
CS	Control Systems
ECO	Electro-Optical Communication
EES	Electrical Energy Systems
EM	Electromagnetics
EPE	Electromechanics and Power Electronics
ES	Electronic Systems
MSM	Mixed-Signal Microelectronics
PHI	Photonic Integration
SPS	Signal Processing Systems

Table 2b, Research group abbreviations

Path	Code	Name	ECTS	Quartile
CS	5SMA0	Model-based Control	5	Q2
	5SMB0	System Identification	5	Q3
ECO	5STA0	Optical Fibre Communication Technologies	5	Q2
	5STB0	Optical Fibre Communications Systems and Networks	5	Q3
EES-1	5SEC0	Planning and Operation of Power Systems	5	Q2
	5SEB0	Decentral Power Generation and Active Networks	5	Q3
EES-2	5SVA0	High Voltage Technology	5	Q2
	5SVB0	Electromagnetic Compatibility	5	Q3
EM-1	5SPA0	Advanced Electromagnetics and Moments Methods	5	Q2
	5SPB0	Microwave Engineering and Antennas	5	Q3
EM-2	5SPA0	Advanced Electromagnetics and Moments Methods	5	Q2
	5SPC0	Wavefield Representations	5	Q3
EPE	5SWA0	Design of Electrical Machines	5	Q2
	5SWB0	Design and Realization of Power Converters	5	Q3
ES	5SIA0	Embedded Computer Architecture	5	Q2
	5SIB0	Electronic Design Automation	5	Q3
MSM-1	5SFC0	Advanced CMOS Design	5	Q2
	5SFA0	Data Converters 1: Fundamentals	5	Q2
MSM-2	5SFC0	Advanced CMOS Design	5	Q2
	5SFB0	RF Transceivers 1: Fundamentals	5	Q2
PHI	5SHA0	Photonic Integrated Devices	5	Q2
	5SHB0	Photonic Integration: Technology and Characterization	5	Q3
SPS	5XSB0	Signal Analysis and Estimation	5	Q2
	5SSB0	Adaptive Information Processing	5	Q3

Table 2b, specialization paths

In Memoriam
Prof. Alfred Fettweis

Op 20 augustus is Prof. Alfred Fettweis overleden. Hij was van 1963 tot 1967 'gewoon hoogleraar' aan de afdeling Elektrotechniek van de toenmalige Technische Hogeschool Eindhoven, met als leeropdracht 'Theoretische Elektrotechniek', en behoorde daarmee tot een kleine groep docenten van de nog zeer jonge Eindhovense instelling. In 1967 verhuisde Fettweis naar de Ruhr-Universität in Bochum (Duitsland), die nog jonger was dan de TU/e en kortgeleden pas haar 50e verjaardag vierde. Prof. Fettweis is 88 jaar oud geworden. Hij was tot aan het einde van zijn leven actief in het vak, en werkte nog gedurende zijn laatste levensdagen aan een nieuw boek, samen met een jongere Amerikaanse collega. Ook trad hij nog regelmatig op bij congressen en gaf hij een keuzecollege aan zijn universiteit.

Alfred Fettweis stamde uit het Duitstalige Eupen (België) en studeerde Elektrotechniek in Leuven. Daarna werkte hij als Ingenieur in België en in VS bij de International Telephone and Telegraph Corporation (ITT). In 1963, vlak na zijn benoeming in Eindhoven, promoveerde hij tot doctor in de Technische Wetenschappen. Zijn bijdragen aan de ontwikkeling van de moderne Elektrotechniek zijn indrukwekkend en vonden veel internationale erkenning, onder andere in de vorm van zes eredoctoraten. Hij werd vooral bekend door de door hem ontwikkelde theorie van de 'digital wave filters'. In zijn laatste jaren heeft hij zich nog bezig gehouden met fundamentele vraagstukken uit de theoretische fysica en vraagtekens geplaatst bij onder andere de gangbare algemene relativiteitstheorie.

De Technische Universiteit Eindhoven gedenkt Fettweis als een uitzonderlijke wetenschapper en gewaardeerde collega, die in haar opbouwfase essentieel heeft bijgedragen aan haar ontwikkeling en reputatie. ■

From the President

By: Daan Daverveld

After months of preparation, the moment was finally there: becoming the Board of Thor. With five other enthusiastic young men, we started this Board year on October 2nd at around 02:00h. After two extra days previously, the actual moment came. We got our medals and red ties from the old Board. One by one they were discharged out of the Board, but then we came to the President. She, Birgit van Huijgevoort, had to discharge herself and at the same moment install me into the new Board. That moment was very special. The moment that the old Board is gone and you are the only one installed into the new Board. Because this feeling was a bit strange, I installed the others as quickly as possible. That felt a lot more comfortable. Having everybody by your side felt strong, the first time that we sat next to each other at the Board table, facing all the people in the room. Everyone was congratulating us and was really happy, especially we were. We are pleased that our association gave us their faith and trust to run everything this year.

After becoming the Board of Thor I had to lead the general members meeting (GMM). Every President makes his or her own preparation about what they need to think of or need to do during the GMM. Because there were some changes in schedule, I needed to remake this preparation five times. That made me a bit nervous because everything could change again at the last moment and I would have had to improvise a lot. Luckily this did not happen.

We got the red ties as a present from the old Board. Hidden in a big chocolate lollypop, we had to eat a chuck of almost 1 kg of chocolate before we got to our red ties. These ties are only worn by Board members or former Board members. Our suits, the Thor tablecloth and the floor were one big mess. Everywhere we looked there was chocolate. Besides, it was really delicious and it was going to be a lot of work to clean everything up.

After the meeting ended, we began to get ready to get everybody out and be able to start cleaning. We scrubbed, swept, and mopped everything from the bottom to the top. We had to do the floor like four times before it smelt a bit clean. I remember that I was home and in bed at 07.00h sharp.

Now, there are some challenges for us that we really need to put a lot of energy into. The big growth of the number of students is one of these. Because of the tremendous growth, a lot of services and activities that we organize need to have a revision. To manage that these services are able to take on so many people, changes need to be made. We are looking at different ways to get to this goal.

At the moment of writing, we are working for 1.5 week as the Board of Thor. It is a very busy job, but we love every bit of it. It's the combination of seriousness, relaxation and the joy that comes out of the tasks you complete, and the things you learn that keep you going on. I am excited to see what we will pass through in the coming period. There will be easy things, hard things, small things, and big things, but we will go on until we master every bit of it!

Veel gedonder!

Daan Daverveld ■

Introducing...

Hello everyone.

I am Debashis Dhar from Bangladesh. I started my PhD project in Electrical Engineering in September 2015. At TU/e, I am working in the Mixed Signal Microelectronics (MsM) Group. Prior to that I was in South Korea where I obtained my MSc degree in 2011 and worked in a company for several years. I got my BSc degree in Computer Science and Engineering from Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh. After that I served as a lecturer in City University, Dhaka, Bangladesh for more than one year.

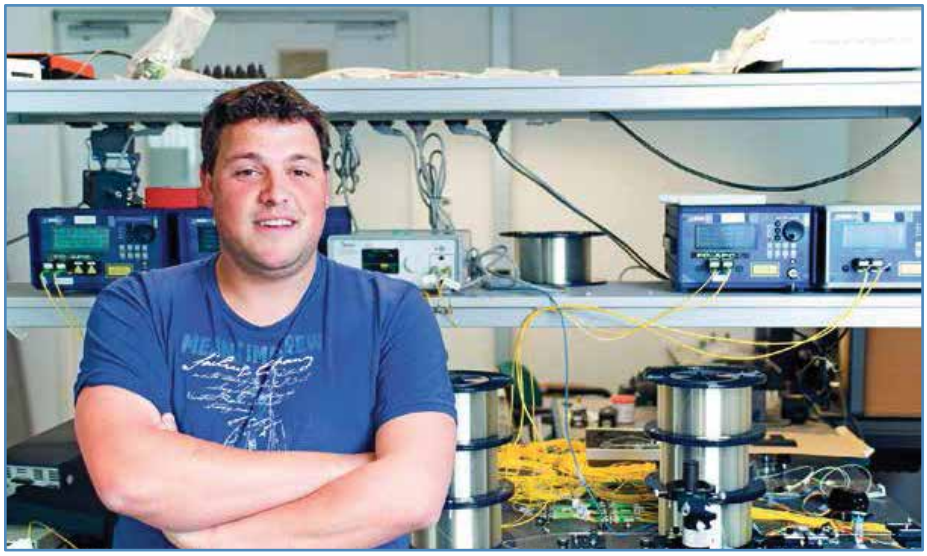
After entering the Netherlands, I realized that I moved to a flat land (the Netherlands) from a land of mountains (Korea). While coming from Amsterdam to Eindhoven on my very first day, I really liked those big green fields which looked like giant football fields from the train.

Apart from study and research, I listen to music whenever I feel bored. Sometimes, I find short comedy dramas quite interesting too. Some of my favorite games are badminton, football and cricket. I also have interest in getting to know new places, people and cultures. ■

Hello everyone. My name is John van Weerdenburg, or – as most students call me – 'Wallie'. For the second time the editorial board requested to introduce myself. The previous introduction I wrote back in 2009 as a Board candidate of Thor. At that time, I promised to gather enough funding to organize lots of successful activities. I think I can say that it was indeed an awesome year. Also, the next years at TU/e I couldn't focus on just studying, and decided to take place in the board of the IEEE Student Branch, organized the SATORI study trip to Japan (2011) and the Advancing Healthcare Symposium (2014). Further, I have spent the 'necessary' time in the Walhalla.

For those of you who don't recognize me from (one of) those activities, here is a brief introduction about myself. I'm John, 28 years old, born and raised in a small town called Wamel (near Tiel). In my free time I try to relax with computer games, brewing and enjoying unique beers, traveling (if my bank account allows it), and music. Lately, only listening to (metal) music, but I would like to play the keyboards, or pick up my guitar again. In 2007, I came to this university to study Electrical Engineering, and finished it last July by earning my MSc degree.

The upcoming years I will spend as a PhD candidate in the ECO group, where I will focus on Spatial Division Multiplexing (SDM) transmission systems. In my graduation project, I have already demonstrated that a tenfold capacity increase over a single fiber is possible by exploiting multiple modes in fibers. As this experiment was a point-to-point transmission over a short length of fiber with offline processing, there are more than enough opportunities and challenges to improve SDM transmission systems over the upcoming years. ■



Jolie Boot appointed director

From November 1, drs. Jolie Boot-Van Wevelingen has been appointed as director of our department of Electrical Engineering, as well as of the department of Applied Physics. We wish Jolie every success in her new position.

Bart Smolders appointed dean

The TU/e Executive Board has appointed prof.dr.ir. A.B. (Bart) Smolders as dean of the department of Electrical Engineering as of 1 January 2016. We wish Bart success in his new position.

Opening Flux

On Monday August 3, 2015, Sander Dekker, State Secretary for Education, Culture and Science opened our Flux building, together with Jo van Ham, Vice-President of the TU/e Executive Board and Véronique Marks, Director Real Estate Management at TU/e. Véronique Marcks stressed during her speech that Flux is extremely energy efficient and heated fully sustainable without any gas, using geothermal heating.

After the stunning opening there was an official reception, as well as guided tours through the labs of Electrical Engineering and Applied Physics.

IEEE SBE received a prestigious award

It was handed over at the IEEE Region 8 meeting in Ljubljana (Slovenia). The award was presented by C. Stasopoulos, director of Region 8 for an "Exemplary Performance as a Student Branch during the 2014-2015 Academic Year". Considering the large geographical size of Region 8 (including Europe, Africa and parts of Asia including Russia), this is an immense accomplishment for the Eindhoven IEEE Student Branch.

In the picture the representatives of the IEEE Student Branch and the Chairman of the IEEE Section Benelux, Prof. A.B. Smolders.

Analysis of 291 first year students

By: Sjoerd Hulshof and Suzanne Kuijlaars

Now that the number of new Bachelor students has increased considerably, it is interesting to know which fields they have chosen and how many foreign students are among them. Out of 291 students, 207 of them have chosen Electrical Engineering as their field, and the remaining 84 students are following the Automotive field. 21% of the first-year students come from abroad. (Fig.1)

This year we welcomed 61 international Bachelor students. 43 chose EE and 18 chose AU. See figure 2 if you are interested to find out their country of origin.

In comparison, last year we started with 110 EE students and 65 AU students. 15% were international students. ■

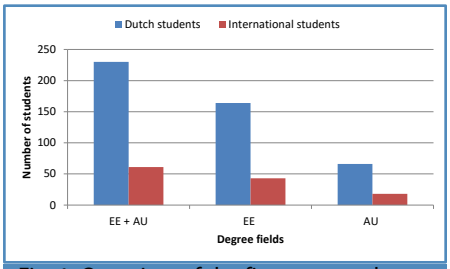


Fig. 1: Overview of the first year students

America	India	Poland
Belgium	Indonesia	Portugal
Bulgaria	Italy	Romania
China	Latvia	Russia
Cyprus	Lietuva	Slovakia
Denmark	Norway	Sudan
Germany	Ukraine	Spain
Greece	Pakistan	Turkey

Fig. 2: Country of origin of the new students

Whose desk is this?

By: Chigo Okonkwo

As an Assistant Professor working on high capacity and long-haul transmission systems, I have a multifaceted job with collaborations with industrial partners and academics. Part of my duties since taking up this position is to build up the in-house laboratory facilities in Flux, develop advanced modulation formats, novel signal coding and the digital signal processing schemes to enable robust signal transmission at high transmission rates over long distances. At the onset of our time in Flux, the majority of my time was in the laboratory 10.061. Now, as we approach the winter months, my activities will be mainly focused on teaching my course 5STA0 on optical communication technologies.

In Potentiaal, my desk was located in one of the corners of the building, hidden from view of visitors and students. In stark contrast to the old location, my new office is located very close to the elevators, with a view right across to one of our neighbours on the other side of the elevators, the Electromagnetics group. To my left, I have a panoramic view of the trees in the area around the "Karpendonkse Plas" and "de IJzeren Man" with a fast changing and dynamic scenery, especially now in autumn.

My room in Flux 9.089 is a calm environment from where I can focus on writing proposals, writing publications, sifting through hundreds of emails, planning future experiments and coordinating the ongoing activities of my PhD and Master students.

Sharing the room with colleagues who have extensive research and teaching experience helps me to learn about the interaction of students with their lecturers and how to make the contact hours more productive. In addition, my office provides easier access for my colleagues and students to 'pop' into my office. Let us not underestimate the power of the discussions in the corridor outside, which I believe eclipses the email conversations. Many deep conversations have been started and many things learnt in a one-minute chat or a "Do you have a second" query from a colleague.

Focusing on my desk, my little daughters have instructed me to pin their paintings on my board. The lovely artworks, pictures and paintings which adorn my board provide a few seconds of escape. The desk itself is relatively organized to allow quick access to my hard copies of draft publications, call for proposals and laboratory notes or meeting minutes. ■

IEEEXtreme

By: Steven Beumer

With all the extreme sports in the world, from extreme ironing to parachuting and so on, there is one extreme sport that is a tradition for us as an IEEE student branch: the IEEEXtreme programming contest. Even the timing of the event, the weekend before the exams, is already tough. Saturday October 24 we started with 7 teams at 02.00h in the night with programming and even the first exercises made our heads hurt.

Most of the teams began promising and with a lot of energy. However, when the sun came up and the normal day started for the rest of the Netherlands, our teams became a little tired and most of them took a break to regain focus. What is a better break than breakfast with hamburgers? Right, breakfast with hamburgers, bapao and chips!

Around dinnertime, some teams had a struggle with their motivation but kept on trying to solve the 20 or more programming exercises that were posted. However, a nice dinner consisting of pizza, fries or shoarma and some really extreme beers kept us going. Around midnight, most of the teams started to give up and succumb to their drowsiness or started watching movies to reach the 02.00h mark to indicate they have been programming/awake for 24 hours.

Since this is not an easy task, I would like to thank Frans Willems and Bart Mesman for supporting us during the extreme and being our proctors. And while every team finished in the top 1000 and did a really good job, I would like to congratulate 'team Bram' with finishing highest of us all, at the 126th place of the world. ■

The oasis of Flux

By: Lisa Teunissen and Linda Janssen

It was around the end of 2013 that we got the news from the faculty that we would get a giant roof terrace with our new bar on the 6th floor of Flux. This news was however accompanied with the announcement that that was all we would be receiving. There was no money available for furniture or decoration of the terrace. Another announcement was that we were going to share the roof terrace with the study association of the Applied Physics department. This all led to the start of a two-year-long working group. The first year we spent by doing nothing. We had a meeting with Van der Waals where we talked about our ideas. Here it became apparent that without actually being able to see the roof terrace itself we couldn't make a decision about what we wanted to put on it. So we decided to meet in the first week after the rehousing.

From that moment on, we had almost weekly meetings spent by debating what furniture we wanted, what material it would be made of, who was going to make it, what is was going to cost, who was going to pay for this, who would be responsible, and what both faculties had to do with it. What furniture we wanted was pretty easy. Who was going to make it was not. We asked several companies for a quotation. We had two groups of quotations. The amateur who could make it really cheap but without any warranties and the specialist who was way too expensive. We searched again and found a company that was a mix between these two extremes and fitted us well. Now that we knew what we wanted and how much it was going to cost we needed someone to pay it. As two study associations we don't have too much money and handmade furniture is expensive. In the end we found a wonderful company who was willing to help us finance the project and realize our vision.

The working group from left to right: Linda Janssen, Sjak Jansen, Roderick van Gils, Lisa Teunissen and Coen Corstjens

We were all done and happy, but then… the department had asked the architect of Flux to make a design with his vision for the roof terrace and wanted us to incorporate his vision in our plans. Our vision was one of maximum potential, meaning lots of seating area without compromising too much of the standing area. The vision of the architect was one of a green oasis, meaning lots of trees and greenery and few seating area. You can see how we butted heads about this and so this was the start of numerous meetings with the faculty and the architect. At last we came to a compromise. We were going to execute our vision of the furniture but with the addition of some trees spread out and high grass along the glass enclosure. We wanted this to be realized before the introduction week of 2015 so all the new students could enjoy a drink on our furnished roof terrace.

We are now at the end of 2015. The furniture was on time for the introduction week and we are still very happy with it. We are however still waiting eagerly for the greenery to finish our vision of the terrace. Seeing different groups of students or faculty members enjoying a drink in the sun makes us very happy. Everybody is also welcome to have a seat during the day or enjoy lunch there. The roof terrace closes when the bar does every day at 7 o'clock. We hope our roof terrace becomes a green oasis at the head of the 'Groene Loper'! ■

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Icons of EE: Michael Faraday

By: Pasquale van Heumen

Introduction

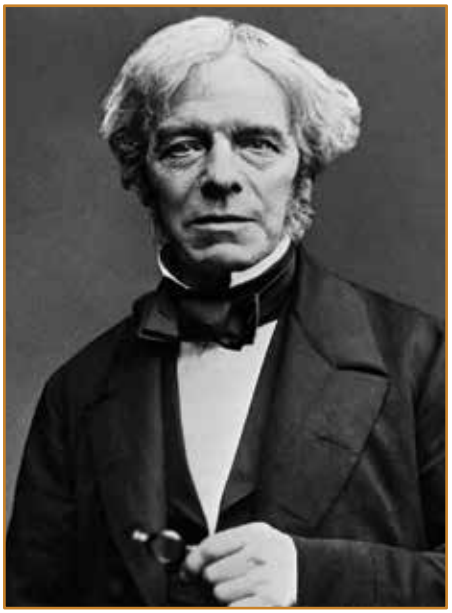
Michael Faraday, born September 22nd, 1791, was an English scientist who contributed to the fields of electromagnetism and electrochemistry. Faraday was born in Newignton Butts, which is now part of London. After having basic school education, he became an apprentice at the local bookbinder and bookseller. During his apprenticeship he read many books and became interested in science, especially electricity.

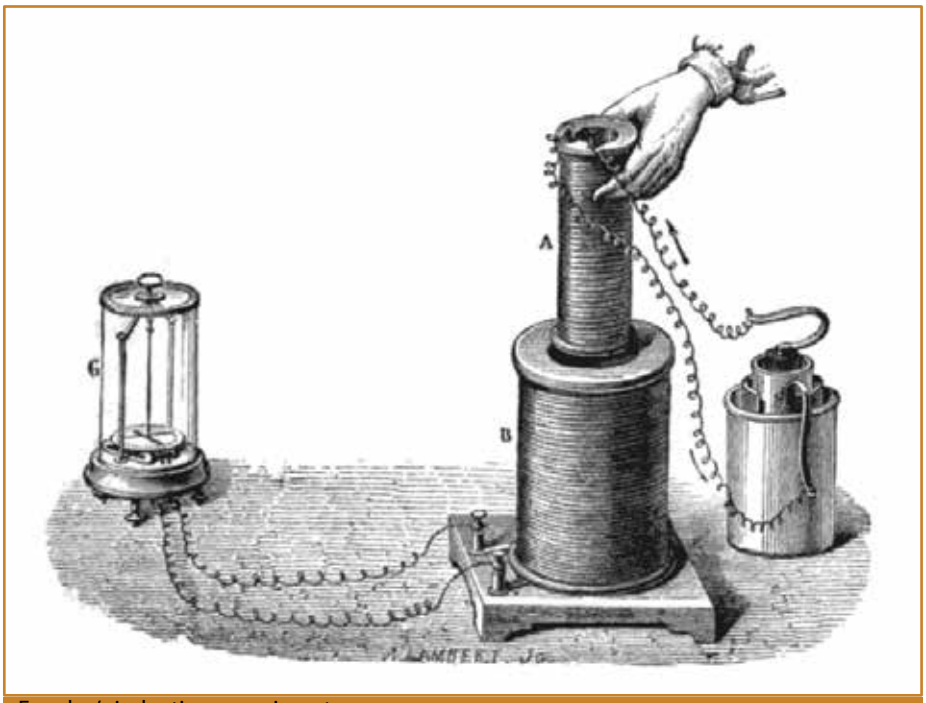
In 1813, he became assistant of chemist Humphrey Davy at the Royal Institution of Great Britain. During and after his assistantship, Faraday worked extensively in the field of chemistry, discovering chemical substances such as benzene and liquefying gases such as chlorine. In 1825 he became the Director of the Laboratory at the Royal Institution until 1867.

Scientific work on electricity and magnetism

In 1821, not long after the discovery of electromagnetism by the Danish physicist Hans Christian Ørsted, Faraday was able to build an electric motor. The first one he built is known as the homopolar motor.

After this achievement, Faraday kept publishing experimental work on electromagnetism, but it took years before he had a breakthrough and discovered the principle of electromagnetic induction in 1831. For his experiment he wrapped two insulated coils of wire around an iron ring. With a battery connected to one coil and a galvanometer connected to the other he discovered that switching on and off the current in the first coil, induced a current in the second coil.





Faraday's induction experiment

Only a few months later, he did an experiment to find out if magnetism and motion also could induce electricity and found out that this was the case. In 1832 the French Hippolyte Pixii built a practical generator based on the principles of Faraday. The experiments showed that a changing magnetic field produces an electric field. This relation was later formulated by James Clerk Maxwell as Faraday's law.

In 1843, Faraday performed an experiment that demonstrated the effect of electrostatic induction. He also showed that charge resides only on the exterior of a charged inductor. This effect is the basic principle of how the Faraday cage is a shielding for static electric fields.

Later, in mid-1840s, Faraday did experimental work on the effect of magnetism on light. He discovered that application of a magnetic field in the direction of propagation of the light rotates the polarization direction. This magneto-optic effect is nowadays referred to as the Faraday Effect. With this experiment he was the first to demonstrate that light was a kind of electromagnetic phenomenon.

Near the end of his career, Faraday proposed that electromagnetic forces extended into the empty space around a conductor. This idea was not accepted by the scientific community at the time and Faraday did not live to see the acceptance of his proposal.

Besides all of Faraday's experimental results, he also invented the concept of flux lines to represent magnetic and electric fields. This model of representing fields was crucial for the successful development of the electromechanical devices that dominated engineering and industry for the remainder of the 19th century.

Faraday was a practical scientist and all his work heavily depended on experimental results. His work revealed a lot of the fundamentals of electricity and gave other scientist a basis to make practical devices based on electricity and magnetism. The work of Faraday made it possible for Electrical Engineering to be the motor of our modern society. Therefore, Michael Faraday is an Icon of Electrical Engineering. ■

The Battle of Finnsburg

By: Fer Radstake

Compared to the wealth of Viking literature, we have relatively little of the continental Germanics. The main exception to this is in the case of the Anglo-Saxons, who left us with such poems as Beowulf, The Wanderer, and The battle of Maldon.

Like other Germanic cultures, the Anglo-Saxons had a mostly oral literary tradition. "Scops" would perform at banquets and sing about the great deeds of the many famous heroes. It was not until the advent of Christianity and monastic life that some stories were written down.

One poem that gives an especially vivid and action-oriented image of Anglo-Saxon warfare, is the Finnsburg Fragment. As its name suggests, we unfortunately only know part of the poem. The end is described in the famous Beowulf though, where a scop narrates the events of the Finnsburg Fragment, although in a very compact way. This compactness suggests that the story was widely known, something corroborated by the fact that in the relatively small corpus of Anglo-Saxon literature there are two poems describing the battle, and that Beowulf describes the poem as "oft recited". Nevertheless, we know only little about the characters in the poem. The only character that we know much more about is Hengest, who, if this identification is correct, is the same Hengest as the commander who conquered much of current England from the Romano-Britons.

Very fitting for the December edition of the Connecthor, the battle of Finnsburg takes place in the beginning of winter, somewhere in Frisia, where a Danish contingent of sixty men under prince Hnæf is staying as guests of the Frisian king Finn. Somehow war breaks out between the two sides, and the Danes take refuge in the, apparently unoccupied, Finnsburg fort. This is where the remaining part of the fragment starts:

[…] | Burning horns[1]?"
The young king | proclaimed then:
"That's not the dawn-red, | nor a dragon,
nor do this hall's | horns1 burn[2].
The birds screech, | startled by soldiers:
those wolfs are marching. | The war-wood[3] clashes,
shield against shaft. | The moon shines
under the clouds, | now killing will come
as is made to happen | by our mutual hate.
Awake, my heroes! | Head for your shields.
Run for your battle-gear | and be courageous
and high of spirit! | Now head for the vanguard!"

The gold-laden thegns | girded their swords,
then neared the door, | those noble champions.
Sigeferð and Éaha | drew their swords.
At the other gate | were Ordláf and Gúþláf,
behind them stood | Hengest himself.

Gárulf told Gúðere | not to give away his life[4],
which he so savoured, | by storming as first
to the doors of the hall, although he was armoured,
since someone much loathed | would like to slay him.
The brave hero | boldly asked,
for all to hear, | who held the door.
"Sigeferþ's my name, | of the Sedgean[5] am I.
A well-known foreigner, | I fought many wars
and have known much grief. | But now, against me,
you will attain | triumph or death."

Then resounded | the sound of slaughter
- brave heroes | bashing their bucklers,
creaking floorboards | and cracking skulls -
till in battle fell | the brave Gárulf.
First among all | of the Frisian folk,
Gúðláf's lad | now lay amongst many
dead bodies. | The dark-brown, black
raven[6] soared. Swords sparked
as if all of Finnsburg | was filled with flames.

A replica of the helmet found near the area of Sutton Hoo in East Anglia.

I've never heard | of heroes braver
than those sixty | daring soldiers,
nor of men who for mead | gave more in return[7]
than these heroes | did to Hnæf.
None of them fell | as for five days they fought.
They held the doors, | those dauntless Danes!

Then the warrior[8] was wounded. | As he went from this life
he told that his byrnie[9] | had broken in two;
his helmet was weak, his war-garb as well.
The people's protector[10] | bade him to tell
if the warriors survived | their wounds well
or which of the lads …

Sadly, the Finnsburg Fragment breaks off here. The ending of the story is described in the famous Beowulf epic. Hnæf was eventually killed, but Finn's armies were too weakened to defeat the Danes, or force them out of the hall. Thus, the two sides were forced to make peace. Meanwhile winter had properly begun:

The ship couldn't | sail the seas:
the wavy sea | was stirred by a storm.
It fought the wind | while the winter locked
the waves
in bonds of frost | till finally another
year started | as it still does now.

With Hnæf dead, Hengest took over command as the Frisians welcomed them to their halls to spend the winter. However, the peace turned out to be only temporary. As soon as the weather cleared enough for the Danes to return to their homeland, Hengest and his men killed Finn and all of his retainers present in the hall[11]. ■

The pristine condition of these shoulder clasps makes it hard to believe they had been buried for more than 1300 years.

A reconstruction of the shield found at the Anglo-Saxon Sutton Hoo ship burial.

1. Probably the gables, as horn-shaped projections were often attached to the ends of the roof.
2. So the lights outside must be the torches of the oncoming attackers.
3. Spears.
4. The poem suddenly switches to the Frisian point of view, later to return to the Danish side and finally to the Frisians again.
5. Another tribe. How a Sedgean warrior would end up in Danish service is not mentioned.
6. Perhaps alluding to Odin, the god who rules half of dead heroes and who's associated with ravens. Alternatively it could be a raven banner, known to be flown by the Danes, or simply be put here to emphasize the carnage, as ravens are known to feed on carrion.
7. The drinking of mead was part of an oath-swearing ritual.
8. Either a wounded Frisian, or a Dane questioned by the Frisians.
9. A short mailcoat.
10. Probably Finn.
11. The reasons for this are not entirely clear, often mentioned are to avenge Hnæf, and that Danish reinforcements arrive, eager to pillage the now disadvantaged Frisians.

Team Blue Jay

By: Tessie Hartjes

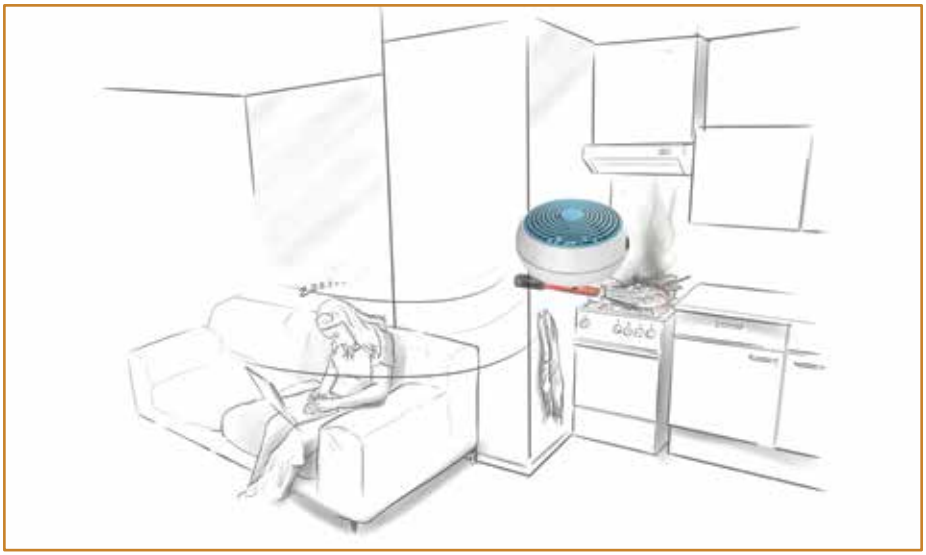
Hi! We are Team Blue Jay. A new student team that originates from the TU/e Lustrum committee. In 2016 the TU/e will celebrate its 60th anniversary and the two students currently taking place in this committee – Lex Hoefsloot & Tessie Hartjes – have initiated Blue Jay.

The idea started with a question: what should the university do during a Lustrum year? Answer: show the world what we are capable of. By combining current research into an innovative project we want to give the 'outside' world a glance into the future.

We chose drones as a platform for this. Drones are either known from warfare or seen as a gimmick, while their potential is much bigger. A drone equipped with a gripper literally gives you an extra pair of eyes and hands with motion in six degrees of freedom. They are smaller, quicker and more agile compared to riding robots.

Over a period of a couple of months the team started to fill and from September 1st we have officially started with 12 full-time and 6 part-time students. One third of the students are from Electrical Engineering, next to that we have students from Software Science, Physics, Mechanical Engineering, Industrial Design, Sustainable Energy Technology and Industrial Engineering.

Our goal is to create a drone that will serve as a 'buddy' inside your home. You should be able to give it a command in order to, for example, let it get your phone. It will therefore need a sense of location, a navigation system, understand your commands, know and recognize your phone, and of course be able to fly towards it, pick it up and return without harming anyone or anything. In order to prevent possible injuries we will design our own frame around the rotors to bring the rotors out of reach and sight. Our project is therefore divided in the following parts: 1. Object avoidance system, 2. Object detection and recognition, 3. Localization and indoor navigation, 4. Control and path planning, 5. Powertrain optimization, 6. Gripper System, and 7. Social Interaction.



We are currently testing a lot and integrating various sensors into the subparts. Of course we have also had our first crash with our very first wooden-frame prototype. The next step is to use a lightweight composite frame. Furthermore, every peripheral sensor communicates according to a standardized protocol with our Blue Jay Operating System (BJOS). This way a modular framework is ensured, the basis for a platform that can be adjusted to many different applications.

In terms of applications you can think about a flying care robot for elderly people or an interactive playful toy for children. Currently we are collaborating with the fire safety department to design the drone in a useful way to either pro-actively prevent or repress a starting fire. On the other hand, it can inform the owner, check the status of the fire, and possibly guide the owner safely out of his home.

We will demonstrate our drone during the Dream & Dare Lustrum festival on April 22nd, 23rd, and 24th, 2016. There we will create a Drone Café in which the first drone will take your orders and the second will bring it to your table. Can we invite you all for a beer?

Cheers! ■

bluejay

Thales excursion

By: Valerie Tjin-A-Djie

Driving up the parking lot in Hengelo you could instantly see the huge Thales buildings and we could only wonder what we would find inside. We were greeted by Wendy and after receiving badges we walked to their new building where we had some coffee. Then we sat down in a room for two presentations. The first was about what Thales actually is and what they do. It was a very exciting presentation because the presenter was very passionate and he used amazing illustrations. The second presentation was also very interesting and more technical. After a nice lunch there was time for a casus. Three groups had to brainstorm about possible solutions to a problem and present their ideas afterwards. The last major (and probably most exciting) part of the day was the tour through the factory. Like most of the people we met that day, our guide had also studied Electrical Engineering. He showed us a lot of their radars and the labs where they were making prototypes, but also production rooms. Everything looked really high-tech and interesting. The day at Thales ended with some drinks and an evaluation for Thales so they could have an idea of how our experience was. The group had a nice dinner in Hengelo before driving back to Eindhoven. It was a long but really fun and instructive day. ■

Excursion to Prodrive

By: Quinty Peters

Thanks to our amazing study association Thor we, first year students, could bring a visit to Prodrive. Prodrive is a company that is specialized in many different kinds of technical developments. In the morning we had classes as usual and after that all participants went to the company by bike. What we discovered was that there were two separate buildings and we first arrived at the wrong one of course. Fortunately we got at the right place just in time.

We got a warm welcome by the Prodrive employees and we also got some drinks. The whole group of students was divided in smaller groups for a tour through the building. It is built very systematically: the lower the floor, the closer you get to the final product. Unfortunately, we weren't allowed to go to the lowest floor. However, we were allowed to go into the 'practical rooms', in which you could see what the people there were working on up close. You had to put on a lab coat and a kind of tape that goes from underneath your shoe into your sock to make sure you were not electrically charged.

The employees didn't work in desolated rooms as they do in a call center. Instead, their working places were quite big and the walls were made of glass.

After the tour, there was a presentation held by the company. They told us about their goals and how they plan to achieve them. It was all very interesting and we could talk about it in the end with a drink. It was also possible to ask the employees some questions. At the end, a group picture was taken and everyone could decide on their own when they wanted to leave.

Even though it was planned as a serious excursion, it was really fun. Everything was organized well and it was quite interesting to see how a company like Prodrive works, because there is absolutely a chance for an EE student that you will work in a place like that later on in your life. ■


16


19
THALES


3


4


6


10


14


12


20


8


9

1. Borrel lecture AME
2 & 3. Excursion Prodrive
4 & 5. kandi-af borrel
6 & 7. Lunch lecture Omron
8 - 11. Constitutional drink
12. Excursion Kautex
13 & 14. OkThorberfest
15. Lunch lecture Sioux
16 - 18. Soldering workshop
19 - 20. Excursion Thales

Technisch trainee Alliander

Wie ben je en wat is jouw studie-achtergrond?
Zes jaar geleden verruilde ik mijn middelbare school in Leiden voor de Universiteit Twente in Enschede. Daar ben ik begonnen aan de bachelor Advanced Technology en daarna heb ik de master Electrical Engineering gekozen. In de tussentijd heb ik een tijdje op Groenland en Spitsbergen gestudeerd en stage gelopen op de University of Michigan. In 2014 ben ik afgestudeerd in de micro- en nano sensortechnologie.

Wat was voor jou de reden om voor het Alliander traineeship te kiezen?

Toen ik afgestudeerd was, vond ik dat ik nog niet klaar was met leren en ontwikkelen. Ook wilde ik de organisatie waar ik zou gaan werken graag goed leren kennen. Het technisch traineeship van Alliander bood mij precies waar ik naar op zoek was. Ik vond het fijn dat Alliander een technische omgeving is, die belangrijk werk doet voor de maatschappij.

Aan welke projecten heb je tot nu toe meegewerkt?
Mijn eerste opdracht heb ik gedaan bij het bedrijfsonderdeel strategie. Hier heb ik gewerkt aan een project waarin (historische) binnensteden worden verduurzaamd. Daarna ben ik bij productontwikkeling en –management aan de slag gegaan. Hier ontwikkelen we een nieuw type aansluiting waarmee collectieven, die duurzame energie op willen wekken, goedkoper uit zijn.

Hoe kan je jouw kennis en ervaring in het traineeship inzetten?
Ik had na mijn studie weinig kennis over elektriciteits- en gasnetten. Tijdens mij afstuderen waren microvolts en nanowatts de eenheden, terwijl bij Alliander spanning onder een kilovolt 'laag'spanning wordt genoemd. Hele specifieke kennis over de netten is niet het allerbelangrijkste. Ik merk dat mijn technische achtergrond mij helpt om snel te begrijpen waar processen in hoofdlijnen over gaan.

Wat betekent persoonlijke ontwikkeling voor jou en hoe kan jij je in het Alliander traineeship ontwikkelen?

Voor mij betekent de persoonlijke ontwikkeling binnen het Alliander traineeship dat ik vrijgelaten wordt om te ontdekken hoe ik tot de beste resultaten kan komen, uitgedaagd wordt om nieuwe dingen op te pakken en verantwoordelijkheid te nemen en continu in de gelegenheid wordt gesteld om te reflecteren op de competenties waar ik aan gewerkt heb.

Hoe ervaar je het om trainee te zijn binnen Alliander?
De werksfeer vind ik heel bijzonder. Je begint met vijftien medetrainees, allemaal net klaar met studeren, geen werkervaring en allemaal nieuw binnen Alliander. De introductieperiode zorgt ervoor dat je een hele hechte band krijgt. Nog steeds ga ik heel regelmatig lunchen of 'een koffietje doen' met medetrainees. We gaan regelmatig borrelen, zijn een paar keer uit eten geweest en ik heb met mijn traineegroep meegedaan aan het zaalvoetbaaltoernooi van onze jongerenorganisatie Tension. ■

Naam: Joël van Tiem

Leeftijd: 23

Functie: Technisch trainee

Woonplaats: Enschede

Studie: MSc Electrical Engineering (Universiteit Twente)

Peer Review Anton de Kom University

By: Jan Vleeshouwers

Cornel Wijngaarde, program coordinator, and Diny Peters, manager quality assurance, invited our Faculty to take part in a peer review of the bachelor program of Electrical Engineering at AdeKUS, in February 2015. We, Bart Smolders and Jan Vleeshouwers, accepted the invitation.

The invitation originated from the Twinning program (Twinningfaciliteit Suriname-Nederland, http://www.utsn.nl), which was initiated in 2008 to facilitate new cooperation projects between Surinam and Dutch organizations. One of these projects is the 'Peer Review' project between the VSNU (Vereniging van Samenwerkende Nederlandse Universiteiten) and the Anton de Kom University of Surinam (AdeKUS).

Our mobile office in our hotel beat Flux by a mile

The peer review consisted of a thorough scan of documents presented by the AdeKUS Electrical Engineering program staff and a three-day visit to AdeKUS, which included discussions with staff, board, students, alumni, and two relevant companies (the Surinam telecommunication company Telesur and EBS, Energie Bedrijf Suriname), who take up about half of the EE-graduates. The visit (June 23-26, 2015) included a feedback session and discussion on the third day. When we were back in Eindhoven, we wrote a small report summarizing our findings.

The EE bachelor program at AdeKUS can be considered equivalent to our Eindhoven program (or to the Dutch Bachelor programs in general), but there is an educational dilemma. The program aims for a direct employability in the Surinam industry (Telesur, Energiebedrijven Suriname) as well as for scientific education. The program has accents on practical experience and has teachers from industry, but the program also stresses a solid mathematical and physical basis, scientific methods, and independent thinking. Both targets are difficult to achieve within one 3-year program. The staff was interested in the OGO projects we have developed in Eindhoven to integrate theory and practice, and we have promised to help them design these projects at AdeKUS.

Diploma ceremony at AdeKUS

In our opinion, the weakest aspect of the program is the scientific level. For a program to achieve a scientific level, it must be nourished with input from scientific activities from the teaching staff, and the teaching staff must have the background and the opportunity to perform relevant research. But the staff is short on members with a MSc or PhD degree. Currently, one staff member is completing a PhD in Leuven, and as a result of our visit, we shall have a second staff member from AdeKUS in our faculty for a PhD-studies, probably related to smart grids.

During our visit to Paramaribo, the technical faculties of AdeKUS had a diploma ceremony which we were invited to attend. Quite remarkably, as you can see from the picture, the male-female ratio in Surinam is practically the reverse from what we are used to in Eindhoven. And as in Eindhoven, it has got nothing to do with talent. In Surinam, girls are not biased to avoid technical studies, and in addition, boys discontinue their studies much more easily than girls. ■

Efficient modeling of fields

By: Jean-Pierre Vaessen

Let me briefly introduce myself. My name is Jean-Pierre Vaessen and I did my PhD in the Electromagnetics group of professor Anton Tijhuis. Some of you may still know me as a teacher of some Electromagnetics courses in the period that I was a PhD student at TU/e. When I was asked to write a small article about my PhD investigation I started wondering how to write the article in such a way that most of you would read it to the end. Chances are of course that I already lost some of you after reading the words 'electromagnetic fields'. I know from my time as a student that the EM courses were generally considered as (very) tough and believe it or not, I was one of them. Yet with hard work, good supervision and perseverance, I managed to do an internship, Master thesis and now a PhD thesis in the area of electromagnetics. Enough small-talk, let's get to the details of my PhD thesis.

In a modern household, the number of electronic devices has increased enormously. Flat-screen TVs, personal computers, laptops, mobile phones, tablets, (wireless) routers, baby monitors, microwaves, etc., are by now common. All of these devices emit and receive electromagnetic energy. Due to this capability of receiving and emitting electromagnetic energy, these devices can also interfere with each other. This type of interference is known in the literature as electromagnetic interference (EMI). EMI can degrade the performance

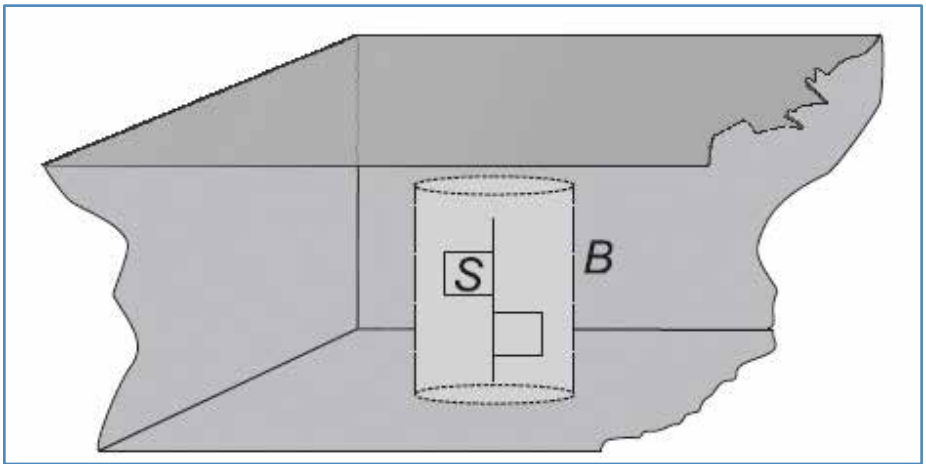
of the devices or can even lead to complete malfunctioning of these devices. The electromagnetic compatibility (EMC) of a product is defined as the capability of the product to work correctly in its electromagnetic environment without introducing unacceptable disturbances to anything in that environment. For manufacturers of electronic products it is often difficult to exactly know the layout of the device, think e.g. of cabling in a car or an airplane, or the electromagnetic environment in which the product has to operate.

The objective of my thesis was to create the capability to analyze complex electromagnetic situations with a wildly varying electromagnetic field in which the involved computations are designed in such a way that acceptable computation times can be achieved. In fact, the fluctuations in the field are so strong that this deterministic field can even be analyzed with stochastic methods. In the thesis I focused on two situations that are common in the EMC community, namely a transmission line above a ground plane and the field distribution in a so-called Mode-Stirred Chamber (MSC). In both cases, we organize the modeling approach such that the stochastic or deterministic variations in the geometry can be accounted for with an acceptable numerical effort. Although in this article I will mainly consider the second situation, I will briefly mention something about the first situation.

In the first situation, we considered a transmission line, of which the geometry was partially stochastic, above a ground plane. We developed a model to investigate the effect of a change in the geometry of the transmission line on the induced voltage at the end of the line. You can think of this situation as a first-order model to investigate the coupling between an electromagnetic field to the cabling inside a car or an airplane. The exact layout of the cabling is not clear upfront and we are interested in the effect of a change in the layout of the cabling on the corresponding electromagnetic fields. To investigate if the used model has predictive capabilities for a practical configuration, TNO Defence, Safety and Security in The Hague developed a real measurement setup in which a thin wire could 'almost randomly' vary over time. The setup was excited by an electromagnetic field and we could measure the induced voltages in the structure given the randomly varying wire. We managed to get good agreement between the distributions of the voltages predicted by our numerical model and the measured voltages.

In the second situation, we developed a model to investigate the electromagnetic fields inside a Mode-Stirred Chamber (MSC). An example of a MSC is shown in Figure 1. A MSC is for instance used to test the immunity of an electronic product towards electromagnetic fields by creating a large ensemble of electromagnetic fields impinging on the device under test. In short, the operating principle of a MSC is as follows. A MSC is a room of which all walls are made of metal. In this room a source is placed to generate an electromagnetic field. This electromagnetic field is continuously reflected due to the presence of the metallic walls. As you still might recall from your EM classes, the electromagnetic

field in such a closed cavity is strongly inhomogeneous. This means that there are certain areas that have high field strengths and others that have field strengths almost zero. To ensure that the field is homogeneously distributed throughout the MSC a so called stirrer, i.e. a revolving metal paddle wheel, is introduced that stirs the electromagnetic field. This paddle wheel effectively changes the boundary conditions inside the room. Note that this concept is very similar to that of a microwave. In a microwave the same hot spots and cold spots occur (that's why your food is often unevenly heated). In a microwave a turntable is used to prevent that part of the food stays at this cold spot.

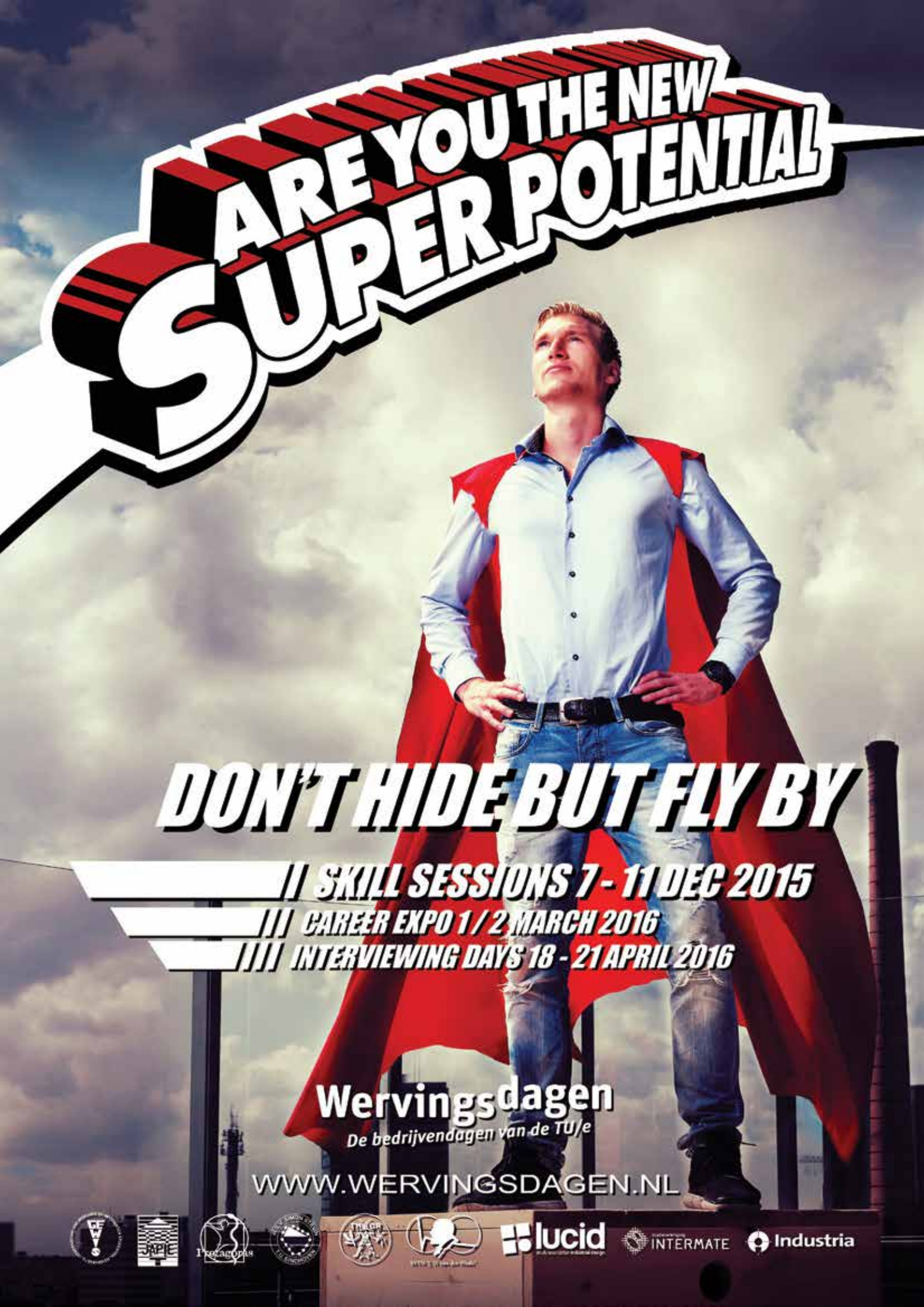


Artificial surface B that separates the stirrer S from the rest of the room.

We are interested in the electromagnetic fields inside the MSC since this helps us in designing a better MSC. We could then use the model to optimize e.g. the size, shape, and position of the stirrer. In the literature an efficient way to compute the fields in such a chamber is lacking. With commercially available tools it takes weeks to characterize the room for a few frequencies. To significantly speed up the computations we employed the equivalence principle to separate the region close to the stirrer from the rest of the room. To this end, we enclosed the stirrer by an imaginary rotationally symmetric surface, see Figure 2. In the literature this rotationally symmetric surface is known as a Body of Revolution (BOR). On this surface we define sources and we compute the reaction of both the stirrer and the room for all possible sources. Since the region outside the artificial surface does not change when the orientation of the stirrer changes, we only have to compute the reaction of the chamber once. This amounts to a significant reduction in computation time. The reaction of the stirrer on the presence of the sources has to be computed for every orientation of the stirrer. However, since we chose a rotationally symmetric surface, this rotational movement can be simply accounted for by a phase shift in the source distribution on the surface. With the presented method we can now characterize the fields inside the room within hours instead of weeks.

Although the proposed method is conceptually straightforward, the devil is, as usual, in the details. As mentioned before, the most important step of our approach is to enclose the stirrer with the artificial BOR. Luckily, an extensive body of literature is available that deals with electromagnetic scattering by a BOR. I still remember the words of my supervisor when I started to implement a numerical method for the BOR: 'Here are some papers about the BOR. I expect that you can have this running in about 2-3 months.' How different did it go in practice… After carefully analyzing the papers, it turned out that there was a severe problem in the existing numerical methods for obtaining a stable and numerical scheme for a BOR. Solving these issues turned out to be an extremely difficult task. It took me months to find a solution. As you can imagine, at times I was completely desperate. It happened to me several times that I left the Potentiaal building after yet another miserable day being completely disillusioned by this BOR problem. The first thing I saw when leaving the building was a German car of which the license plates started with 'BOR'…… When does the hurting stop?? Luckily, with never-ending enthusiasm I managed to find a solution that in the end turned out to be very elegant and very simple. Well, simple… If you know what you need to do everything is simple, but in 40 years of research on the BOR no-one else had a better idea.

Since I ran out of time due to the analysis of the BOR, I didn't have the time to compute the fields in a truly closed chamber. To give proof of principle, we computed the fields near a corner reflector, which can be seen as the first building block of a true MSC. We demonstrated that we can compute the fields inside this simplified chamber in about 1 hour for all possible orientations of the stirrer. This gives us confidence that we can compute the fields inside a true chamber much faster than the several weeks that are currently needed when using commercially available tools. Hopefully, I will manage to model the complete chamber next to my busy daily work and private life. Looking back at my PhD period I must say that I really enjoyed it and I can really recommend it to everyone who wants to get the best out of himself. One piece of advice: completely finish your thesis before you start working for a new employer. I can tell you from first hand that it is extremely challenging to finish your PhD next to your working life. I was lucky to have much support from my family and supervisors to finish it. My PhD period was an exciting time and I will miss the research for sure, but I'm glad I managed to finish the thesis after all. ■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CWTe Labs boost wireless research

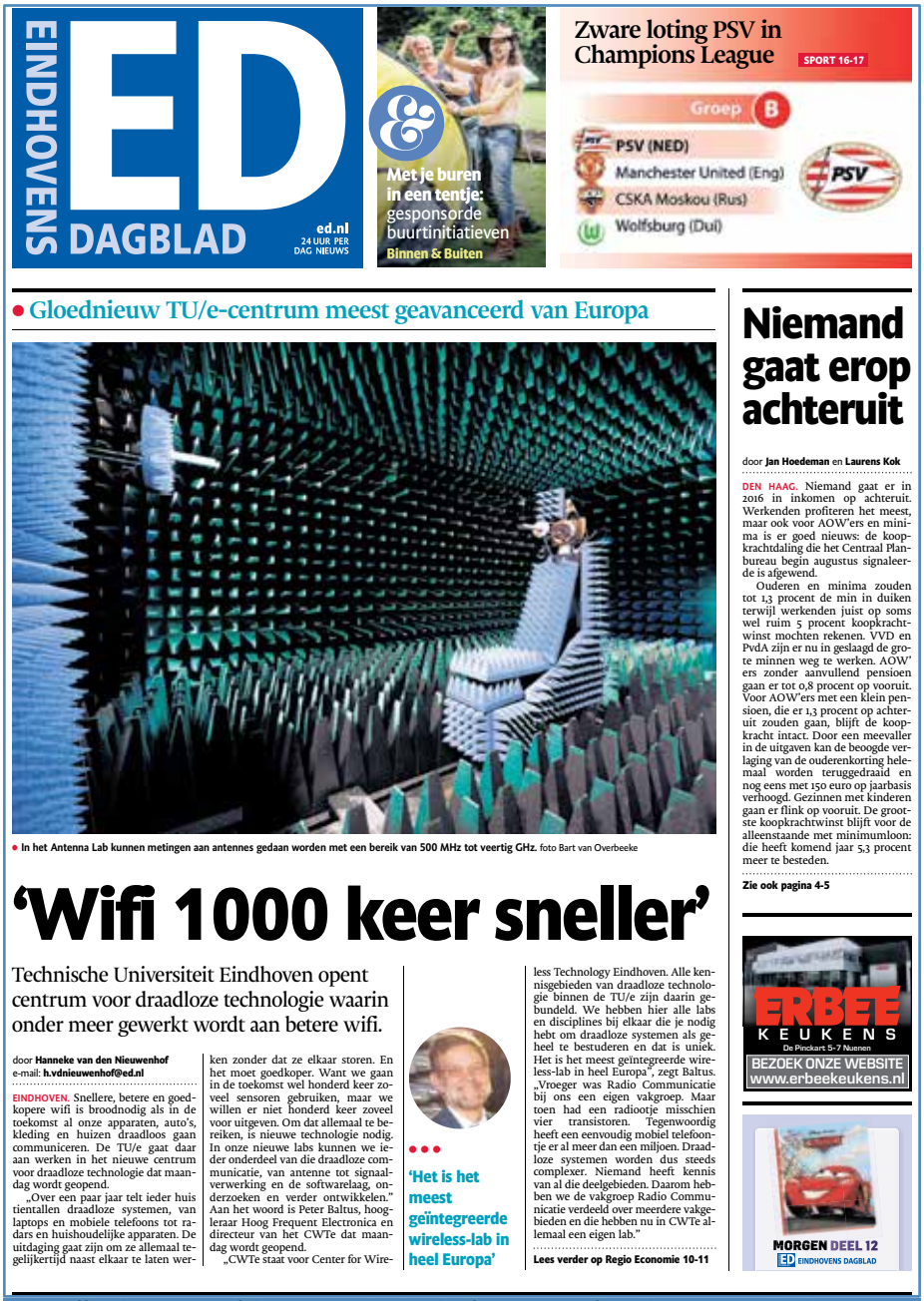
By: Jan Haagh

On August 28 we were front-page news in Eindhovens Dagblad! In that week we were having the official opening of the Centre for Wireless Technology Eindhoven (CWTe) Labs in the new Flux building. Our opening had caught the attention of many on-line news sites but also the traditional papers. Especially the research line to achieve higher wireless data speeds triggers the interest and the newly opened labs make this possible. These labs, which we proudly presented during our official opening, are really unique. In the old Potentiaal building the labs that are required for wireless research were scattered throughout the building: antenna research on the 13th floor, micro-electronics on the 5th floor, etc. In the new Flux building all these labs have been brought together on the 8th floor. The Faraday cages, with an attenuation of at least 60 dB for frequencies up to 80 GHz, and their ESD floors and temperature regulation, create the ideal interference-free, reproducible environment for wireless research. The specially designed windows, which do not jeopardize the Faraday cage functionality, make the CWTe Labs also a nice environment to work in, even with measurements that take multiple days.

The CWTe Labs consist of multiple specialized labs that are adjacent to each other, so that where applicable e.g. an on-wafer circuit in the Electronics Lab can be connected to a prototype antenna in the Antenna Lab via a feed-through patch panel. Propagation tests in a reproducible environment and system integration can be done in the Propagation and System Integration Lab. Besides these labs we have the Extension Lab and the Radio over Fiber Lab. The Extension Lab is specifically for joint projects with the industry or for measurements by external parties themselves, where, e.g. due to IP reasons, a separation of the test environment with limited access has to be created. Furthermore, the CWTe Labs include two smaller Faraday cages: one for EMC measurements and one for ultra-low interference measurements.

In the CWTe Labs, CWTe wireless research will take place that is jointly performed by the five participating groups of Electrical Engineering: Electromagnetics (EM), Mixed-signal Microelectronics (MsM), Electronics Systems (ES), Signal Processing Systems (SPS) and Electro-Optical Communications (ECO). Since its establishment in 2007, CWTe, under leadership of its director Prof. Peter Baltus, focusses on application-oriented research in three research lines: Ultra High Data Rate, Ultra Low Power, and Short Range Terahertz Observation. In this article a few example projects will be discussed.

In the STW Decafe project the radio co-existence issue was investigated. Many multi-mode transceivers suffer from co-existence problems that result in reduced performance when more than one transmitter and/or receiver is active at the same time. Especially when a receiver is trying to receive a weak signal and at the same time at least one other transmitter is active, this can result in high linearity requirements to prevent desensitization through blocking. Solving this problem would make a full duplex single frequency band system possible that in point-to-point connections would double the capacity. In this work, where SPS and MsM jointly ▶



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• In het Antenna Lab kunnen metingen aan antennes gedaan worden met een bereik van 500 MHz tot veertig GHz. foto Bart van Overbeeke

'Wifi 1000 keer sneller'

Technische Universiteit Eindhoven opent centrum voor draadloze technologie waarin onder meer gewerkt wordt aan betere wifi.

door Hanneke van den Nieuwenhof
e-mail: h.vdnieuwenhof@ed.nl

EINDHOVEN. Snellere, betere en goedkopere wifi is broodnodig als in de toekomst al onze apparaten, auto's, kleding en huizen draadloos gaan communiceren. De TU/e gaat daar aan werken in het nieuwe centrum voor draadloze technologie dat maandag wordt geopend.

„Over een paar jaar telt ieder huis tientallen draadloze systemen, van laptops en mobiele telefoons tot radars en huishoudelijke apparaten. De uitdaging gaat zijn om ze allemaal tegelijkertijd naast elkaar te laten werken zonder dat ze elkaar storen. En het moet goedkoper. Want we gaan in de toekomst wel honderd keer zoveel sensoren gebruiken, maar we willen er niet honderd keer zoveel voor uitgeven. Om dat allemaal te bereiken, is nieuwe technologie nodig. In onze nieuwe labs kunnen we ieder onderdeel van die draadloze communicatie, van antenne tot signaalverwerking en de softwarelaag, onderzoeken en verder ontwikkelen." Aan het woord is Peter Baltus, hoogleraar Hoog Frequent Electronica en directeur van het CWTe dat maandag wordt geopend.

„CWTe staat voor Center for Wireless Technology Eindhoven. Alle kennisgebieden van draadloze technologie binnen de TU/e zijn daarin gebundeld. We hebben hier alle labs en disciplines bij elkaar die je nodig hebt om draadloze systemen als geheel te bestuderen en dat is uniek. Het is het meest geïntegreerde wireless-lab in heel Europa", zegt Baltus. „Vroeger was Radio Communicatie bij ons een eigen vakgroep. Maar toen had een radiootje misschien vier transistoren. Tegenwoordig heeft een eenvoudig mobiel telefoontje er al meer dan een miljoen. Draadloze systemen worden dus steeds complexer. Niemand heeft kennis van al die deelgebieden. Daarom hebben we de vakgroep Radio Communicatie verdeeld over meerdere vakgebieden en die hebben nu in CWTe allemaal een eigen lab."

Lees verder op Regio Economie 10-11

'Het is het meest geïntegreerde wireless-lab in heel Europa'

Niemand gaat erop achteruit

door Jan Hoedeman en Laurens Kok

DEN HAAG. Niemand gaat er in 2016 in inkomen op achteruit. Werkenden profiteren het meest, maar ook voor AOW'ers en minima is er goed nieuws: de koopkrachtdaling die het Centraal Planbureau begin augustus signaleerde is afgewend.

Ouderen en minima zouden tot 1,3 procent de min in duiken terwijl werkenden juist op soms wel ruim 5 procent koopkrachtwinst mochten rekenen. VVD en PvdA zijn er nu in geslaagd de grote minnen weg te werken. AOW'ers zonder aanvullend pensioen gaan er tot 0,8 procent op vooruit. Voor AOW'ers met een klein pensioen, die er 1,3 procent op achteruit zouden gaan, blijft de koopkracht intact. Door een meevaller in de uitgaven kan de beoogde verlaging van de ouderenkorting helemaal worden teruggedraaid en nog eens met 150 euro op jaarbasis verhoogd. Gezinnen met kinderen gaan er flink op vooruit. De grootste koopkrachtwinst blijft voor de alleenstaande met minimumloon: die heeft komend jaar 5,3 procent meer te besteden.

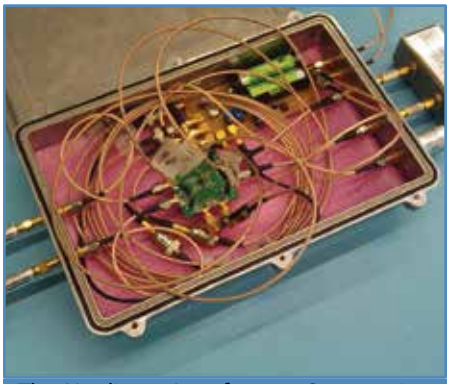
Zie ook pagina 4-5

The official opening of the CWTe Labs hit the front page of Eindhovens Dagblad.

CWTe Labs.

participated with also the industrial partners NXP and Catena, a Nonlinear Interference Suppression (NIS) technique was investigated. With this method amplitude based, rather than frequency based, filtering would be possible. A strong interferer that in frequency is almost on top of a much weaker wanted signal can be attenuated to an acceptable level with NIS. Prerequisite here is that the interferer is known, which is the case in the situation that the interference is cause by the own transmitter. A short movie of the results can be found on YouTube (https://youtu.be/tf598ZI4kdI). Further work, where the focus is on the situation where the interferer is not known, is now being done in the context of the Catrene project CORTIF.

In the recently finalized Catrene project RF2THz, EM and MsM worked together on research in the 20/30 GHz band for satellite communication. RF2THz is a large and relatively broad EU project that aims to develop silicon technology platforms for emerging RF, mm-wave, and THz consumer applications such as 77/120 GHz automotive radars, mm-wave imaging and sensing, fast measurement equipment, 60 GHz wireless networking and fast downloading systems, 400 Gbit/s fibre optics data communications systems, 4G photonic mobile communications and high performance RF wireless communication systems as well as two-way satellite communications



The Nonlinear Interference Suppression prototype.

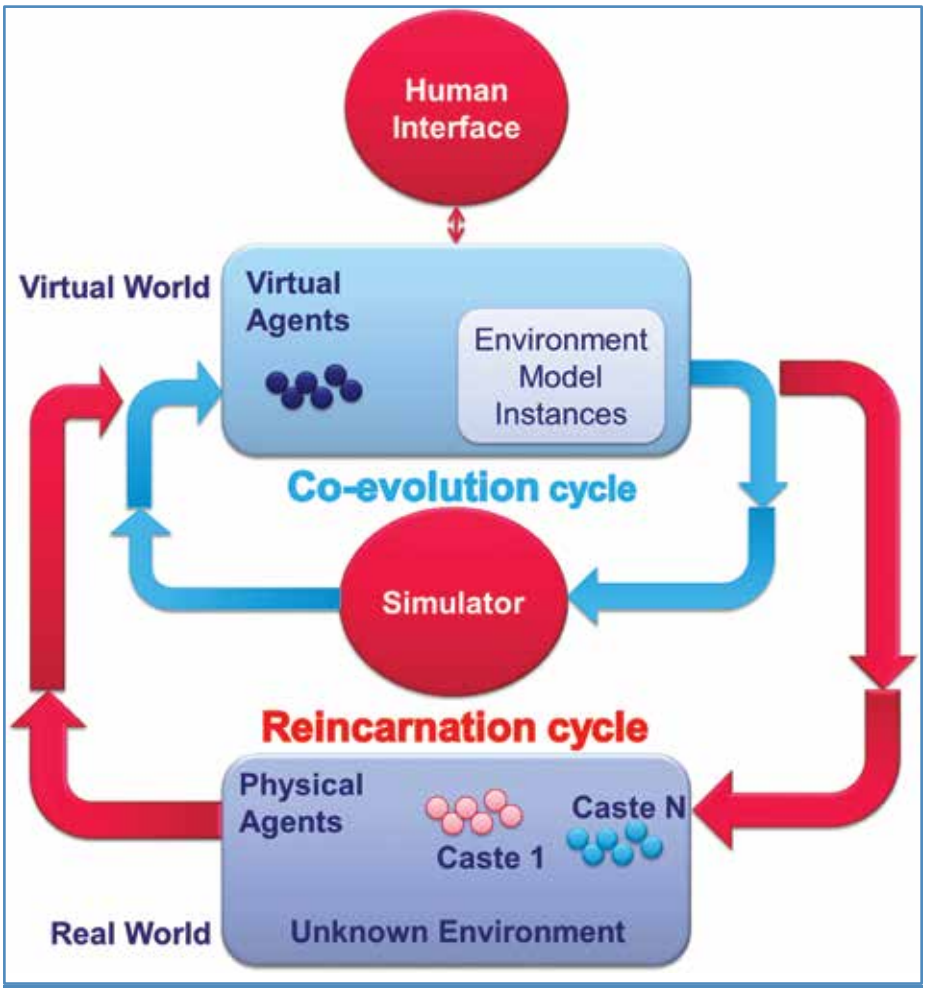
systems. On that latter part we focused together with NXP and other industrial and academic partners. We developed the Focal Plane Antenna and the front-end, with optimized separation between the transmitter and receiver side.

A new project that started this summers is the ECSEL project 3CCar (Integrated Components for Complexity Control in affordable electrified cars). In this European project the EPE group of Prof. Elena Lomonova focuses on energy harvesting from the electro-mechanical autonomous shock absorbers, while CWTe focusses on the low-latency wireless communications between the four corners and a central control unit. Autonomous shock absorbers can recover the energy for their operation from the movement of the shock absorber. The control algorithms of the shock absorber can also be implemented locally with the shock absorber, eliminating the need for energy or information exchange between the shock absorber and the car itself. However, there is still a need to align the settings of the individual shock absorbers, so a communication path needs to be established. To ensure flexibility and reduce cost, this communication should preferably be wireless. This imposes some inherent limitations and trade-offs, like power dissipation, reliability and error correction, but also that the properties and parameters of such wireless links, and especially the transmitters in such links, need to stay within regulatory limits, which can change from country to country as well as over time.

Traditional digital wireless communication distributes the symbols constituting the message sequentially. Most wireless links achieve high reliability by using block (error correction) coding. This introduces significant latency because the correction can only be applied once all symbols from a block have been received. The only way to reduce latency while maintaining reliability using this approach would be to increase the raw data rate. However, that only works if channel impairments are not correlated in the time domain. However, in car environments, burst errors are likely to occur.

Our recent research into reliable low-latency wireless connections have resulted in the insight that such connections can be achieved through exploitation of other ways of distributing the information, thus eliminating the trade-off between latency and reliability.

Another new project that just started in October is PHOENIX, of which we are the coordinator. PHOENIX is a European H2020 project in FET Open, a scheme for Future Emerging Technologies and cooperation projects for advanced and paradigm-changing innovation. PHOENIX, which we do jointly with INCAS3, RWTH and KU Leuven, focusses on ultra-low power wireless sensor networks. PHOENIX will develop a novel method to efficiently explore unknown, inaccessible environments where a priori information is limited or even absent. Given the constraints posed by such environments, PHOENIX will accomplish the exploration with a swarm of small sensors (also called physical agents) that are extremely limited in size and internal resources and can operate autonomously. The PHOENIX method starts processing a user question (an information request about an unknown environment), then assesses available knowledge and initiates an evolutionary loop: In this loop, PHOENIX deploys and retrieves data from tiny physical agents capable of penetrating the environment and gathering information. Based on this knowledge, a model of the unknown environment is developed and evaluated. This obtained environmental knowledge is subsequently used to train a next, improved, generation of

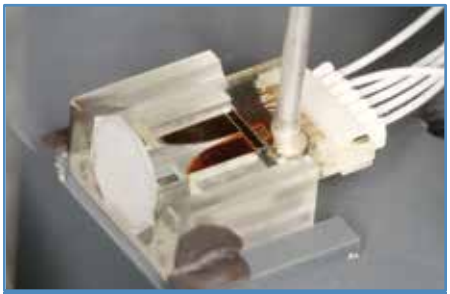


The PHOENIX project structure.

physical agents, ready for deployment. The goal of this co-evolution is to maximize the information captured about the unknown environment by progressively optimized agents. As such, PHOENIX consists of three components: (i) a human-interface layer, (ii) a co-evolutionary framework, and (iii) versatile agent technology.

In this project, TU/e and KU Leuven are jointly responsible for the design of the versatile agents, which can be optimized for a task that is unknown at design time. These agents survive in unknown, often hostile, environments and can evolve to maximize knowledge gathering for scientists, technicians and researchers. They are driven by an evolvable instinct, implemented through embedded inference hardware (via machine learning in the environmental model). These agents hence contain a multi-modal actuator/sensing arrays that support active and passive sensing, communication and localization functions, and IP for hardware-mapped configurable instincts for behavioral and sensorial control.

At the very high frequency end (100 GHz to 3 THz), the CWTe is working on imaging and spectroscopy in the Short Range Terahertz Observation program. While this frequency range was only accessible for laboratory-scale equipment for decades, since a couple of years miniaturized systems are explored to enable applications outside the lab. Industrial and agriculture/food process control as well as medical three-dimensional scanners for tumor margin detection targeted. Technology-wise these extremely high frequencies are very challenging, as high-end CMOS technologies are at and beyond their frequency limits of amplification. Research is performed to overcome these limits and the terahertz program of the CWTe is targeting innovations in terahertz sources, receivers, and system integration. Free-space setups in the frequency range up to 370 GHz and in collaboration with the FOM institute DIFFER an optical THz spectroscopy setup up to 3 THz are operational already and can be used for material and application research. In collaboration with Philips Research, a highly miniaturized CMOS integrated setup for broadband spectroscopy is used for further research. More integrated setups are being developed at the moment for various research projects. Collaboration with research groups and industrial partners is actively pursued to grow the market opportunities for the new technology solutions. ■



Highly miniaturized broadband receiver for the frequency range up to 300 GHz. The device measures 1 cm in length.

Free-space spectroscopy setup for the frequency range between 80 GHz and 120 GHz.

Memorable ASML Internships

Nowadays, you can find 16 GB USB sticks on supermarket shelves for as little as €10. This probably isn't something you think about much, but it actually represents quite a significant milestone. One of the high tech players who is working on these kind of milestones every day, is ASML, a manufacturer of lithography systems for producing computer chips.

ASML supplies equipment to all the world's major chip manufacturers including Samsung, Intel and TSMC. There are dozens of steps along the path to producing a chip. ASML helps manufacturers take just one of these steps, but it's a very crucial step. Lithography involves exposing and chemically etching the wafers used to 'print' a chip's components. The degree of miniaturization achievable is fully dependent on the accuracy of the lithography process.

With ASML's latest generation of machines, it's possible to print lines on chips measuring only about 20 nm in thickness. To put this into perspective... that's like printing the contents of a 500-page novel onto a centimetre-long strand of human hair!

You probably think ASML's machines are incredibly complex. You'd be right. Every day, thousands of engineers and researchers dedicate themselves to refining its machines still further. And we are always looking for interns or graduates that want to join them.

Internships

If you are a technical student, you can apply for an ASML internship – and if we can find the right assignment for you, you'll get a memorable experience in cutting-edge technology and teamwork. As long as you are bright, eager to learn, and can work in a team, we will be pleased to consider placing you in our technologically diverse organization. What's more, your technical skills will be strengthened, enriched and stretched – whatever your specialty is. That's because we build machines that are amongst the most complex systems ever conceived. And machines like these require an extremely wide variety of technologies.

As an intern, you are part of this cutting-edge technology and work in a multidisciplinary team. You will also experience an international environment and have the opportunity to learn from many different technical specialists. It can therefore be the starting point for building your own professional network.

We offer a wide range of internships and graduation projects, but you can also work with an ASML engineer and formulate your own unique assignment. One that is built around your area of expertise and interest. We have found that a little creative thinking and a touch of flexibility goes a long way in making an internship rewarding, relevant and enjoyable – for both sides.

How to apply for an internship

Simply visit www.asml.com/students and check out the current opportunities. If you see one that interests you, upload your CV and motivation letter via the website. If you do not find an assignment that matches your interest, then feel free to send an open application. There is always an opportunity to formulate one based on your background and/or interests. We appreciate initiative and support innovative plans and ideas! ■

Niels Hooger, Electrical Engineering, did a Board Diagnostics intern project: "When applying for an internship at ASML I noted my interests and skills and the assignment I received fitted my wishes. During my work, the assignment changed, but I was able to retain focus on the parts that interested me most. My best memory of ASML will be the people I met and all the things they taught me. I have never before been surrounded by so much knowledge and experience as I was at ASML."

ASML

The Viking "Christmas"

By: Fer Radstake

Why the Christian festival of Christmas is celebrated on December 25 is not clear. One theory is that this was done in an attempt to Christianise the main festival of the Roman cult of Sol Invictus, which was celebrated at that date. Whatever the reason, there are many ancient European religions having an important festival on or around December 25. So did Germanic/Norse Paganism, and its Viking worshippers.

The festival of Yule was the Viking "equivalent" of Christmas. Although the festival was eventually oppressed by Christian rulers, a number of traditions currently associated with Christmas possibly stem from the pre-Christian Germanic peoples, including[1]:

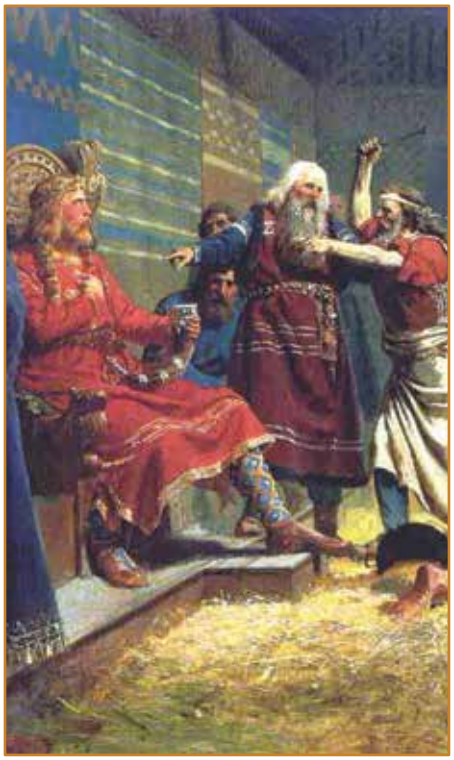
- Christmas trees are sometimes associated with the Germanic worship of certain trees.
- Mistletoe was seen as a magical herb by the Germanics. Interestingly, we find the plant in the magical inscription "þmk:iii:sss:ttt:iii:lll" found on several rune stones. This can be read as "þistil mistil kistil", meaning "thistle, mistletoe, casket".
- Christmas elves may be connected to ancestor worship, besides elves directly stemming from Norse mythology.
- Santa Claus comes from the Dutch Sinterklaas, who in turn could be a Christian continuation of the Norse God Odin, one of the Gods Yule is mainly associated with. Some interesting similarities between them:
    - Sinterklaas is, like Odin, described as an old, long-bearded, hooded man.
    - Sinterklaas carries a staff, Odin a spear.
    - Sinterklaas rides the roofs on his grey horse, Odin's grey horse is capable of flight.
    - Gift giving by a "rider in the sky" may be connected to the Wild Hunt, a mythological event often connected to both Odin and Yule.
    - Odin has two black ravens, Sinterklaas black helpers ("Zwarte Pieten")[2].
    - Children leave a carrot for Sinterklaas's horse in a shoe to get some candy in return, in Pagan times people would offer things to Odin and expect good fortune in return.

Although it's likely that at least some of the Yule tradition lives on in today's Christmas celebrations, we know only little of how the Vikings themselves celebrated it. We do have an account of a large festival that may well be Yule though, in the Saga of Haakon the Good by the 13th century historian Snorri Sturluson:

It was an old custom, that when there was to be a sacrificial feast all the people came to the temple and carried there all that they'd need while the feast lasted. All men would bring their own ale to the festival.

There were also small cattle and horses to slaughter, and all their blood was called "hlaut", and "hlaut-bowls" were the vessels that kept the blood. "Hlaut-twigs" were made like aspergils, and used to redden all the altars and both the outside and inside of the temple, and sprinkle the people as well. The meat though would be cooked for the banquet.

The fire would be in the middle of the temple's floor, and over it the kettles. Drinking goblets were handed out all around the fire, and the chieftain who organised the feast blessed the goblets and all the sacrificial meat. He first emptied Odin's goblet for victory and the glory of his king, and then Njörd's and Freyr's goblets for fertile seasons and peace. Then it was customary for many men to empty the braga-goblet[The cup over which vows were made.]. They also drank a goblet to their departed friends, and that was called the memorial toast.



Whatever the Yule festivities looked like, we can be sure of one thing. Like many Viking festivities, it must have gone with lots of eating and, especially, drinking and feasting. In that light, it's only fitting that an association named after the Norse God Thor continues that tradition with the annual "Kerstborrel". So if you want to experience what the Viking Yule festival must have been like, I heartily invite you to the Walhalla on December 10. Merry Yule! ■

1. Due to the lack of primary sources about pre-Christian rituals, any comparison between the two festivals is highly speculative.
2. Similar black helpers of Saint Nicholas in other countries without a history of slavery indicate that the black colour of Zwarte Piet has most likely nothing to do with racism, although this of course doesn't say anything about the validity of the raven theory. Cf. the Swiss Schmutzli and the Austrian Krampus.

Experiences at Thales

Judie Ibrahim, Aviation Studies Student, Amsterdam University of Professional Education, aged 23

When I was looking for an internship I wrote to many companies, three of which presented me with an offer. I chose Thales because it is a company with an international focus, exporting more than 85%. During my internship at Thales I was involved in analysing the process costing method, looking for ways to improve this. Since I am mainly involved with technology at Aviation Studies, I particularly wanted an internship that gave me the opportunity to work with management processes. The subject of the assignment with Thales was unknown to me, but that was exactly why I was keen to start and I saw it as a challenge.

I believe that with genuine interest you can master the theory. When I started work at Thales I was surprised by the open corporate culture. You can talk to anyone and they make time for you to give you support. If you take the initiative, there are many opportunities. After having implemented my recommendation, I intend to start with a Master of Business Administration at the University of Amsterdam in September. I think that the combination of a Bachelor's degree in engineering and a Master's degree in Business helps you to find solutions looking through two different spectacles. I stay in touch with my supervisor and I hope that I will be able to work at Thales once I have my Master's degree. ■

As a student your biggest fear is that your graduation research ends up somewhere in a drawer. At Thales you are truly taken seriously and they have confidence in you. Thus, my recommendation regarding a new method for process costing will be implemented in 2016.

When I was still studying, I was already seeking employment. I was looking for a technical company with an interesting product where I could make use of my physics background. At the Beta Business Fair [BètaBedrijvenBeurs] in Nijmegen I had a conversation with a recruiter from Thales. She invited me to their head office to discuss the opportunities at Thales. One of the vacancies stood out right away, namely the position of Trial Conductor. I applied for this position and after a few interviews they hired me. Meanwhile, I have been working at Thales for a few months and am enjoying it very much. As the Trial Conductor I constantly build on the knowledge gained during my studies. I will regularly go abroad as part of a team to test our naval radar systems. At sea we show the client that our system is indeed as good as promised in the contract. We do this through various scenarios. For example, we have an F-16 fly in to see when the radar detects it first. While I was applying for jobs I also received an offer from another technical company, but the good atmosphere at Thales was decisive for me. People here are very helpful and take the time to explain something. Thales certainly lives up to the image I had of it: a high-tech company with a pleasant working environment. ■

THALES
Together • Safer • Everywhere

As the Trial Conductor I constantly build on the knowledge gained during my studies. I will regularly go abroad as part of a team to test our naval radar systems.

Annelot Schuring, Graduated in Physics, Radboud University Nijmegen, aged 24

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Turning an internship into an adventure!

By: Teun van den Biggelaar

Just like a lot of other students decide to do, I also decided to do my internship abroad. I wanted to know what it feels like to just 'start over' with your social life in an unfamiliar environment. To get out of my comfort zone, get to know a different culture, and above all, have a lot of fun!

The destination of my internship was Campinas, Brazil. During the Prosperando Study Tour, which was organized by Thor, we visited a lot of companies in Brazil. One of those companies was CPqD. CPqD is a non-profit government-funded research and development company, which is specialized in telecommunications. During the visit I liked the company and the working atmosphere. Besides that, I also really liked the Brazilian culture, so I decided to return to CPqD for my internship.

Campinas is a big city with approximately 1 million inhabitants. I lived in a district named Barão Geraldo, which was in the north of Campinas. One of the best and biggest universities in Brazil is located there, making Barão Geraldo really a student district and a nice environment to live. When I arrived in the residence where I would live for the coming six months, I actually didn't really know what to do. I hardly knew anyone and the environment was totally unknown. However, I immediately remembered what I liked so much about the Brazilian culture. The Brazilians are very friendly and open towards strangers; during my first day in Brazil I got invited for a typical Brazilian barbecue, and on the second day some newly made friends showed me around in the neighborhood. Next to that, I immediately got invited to a lot of student parties in the district, so I could easily meet new people. It was only a matter of days before I felt at home in Campinas.

At CPqD I worked on antenna arrays. An antenna array simply consists of multiple individual antenna elements. If you excite these individual antenna elements in a smart way you can shape the radiation pattern, which simply means you can focus the transmitted signal towards the user. I developed a flexible algorithm in order to calculate these excitations very fast and accurately. Next to that, I verified the algorithm by designing an antenna array in a 3D simulation software package called CST. The project was very challenging, but eventually everything went well and I gained a lot of knowledge.

But next to the technical skills I gained, I saw a lot of differences between the Dutch and the Brazilian way of working. If I have to summarize the Brazilian mindset in a few words, I would say 'take it easy.' At CPqD it was allowed to start the morning in the restaurant with breakfast. And with breakfast I don't mean to quickly eat some bread and drink a coffee, but more like mainly chatting the first working hour. Also the lunch took mostly more than an hour. Next to these long breaks, it also regularly occurred that you got invited by colleagues to drink a coffee and have a half-hour chat. Some people on the other hand had a busy schedule and didn't have too much time for questions or chit-chat. However, having a busy schedule apparently doesn't apply when you talk about vacations. Then also these busy people are happy to show 'some' vacation pictures, taking approximately two hours of their expensive time. On top of that, the employees of CPqD were allowed to take a nap during working hours. There were even hammocks on the campus of CPqD to facilitate this.

This Brazilian mindset can also be found in regular life. When I went to the supermarket for some groceries, I knew I was always gone for more than an hour; the lines are long and the cashiers are working very slowly. But apparently the Brazilians don't mind waiting, so I started to accept this as well. Also, when you would meet some friends at a specific time, 9 out of 10 times they will be at least

30 minutes late. One time some friends didn't even show up without any notification. I was very surprised about this, but according to other Brazilian friends this happens regularly.

As for traveling, unfortunately around Campinas there aren't a lot nice places to visit. But if you are willing to spend some hours in the bus you can easily reach beautiful places on the coast and spend the weekend there. The large amount of national holidays in Brazil also positively contributed to the ability to travel during my internship. My first trip was to Ilhabela, a beautiful island with nice hiking trails, beautiful beaches, and a great nightlife. I also met some new friends over there, and I even met some Dutch guys which were living in São Paulo. The next stop was to Florianopolis, which is a touristic island famous for its beaches and delicious fish. In June, three Dutch friends traveled to Brazil to visit me. We spent about a week together, in which we relaxed and made some dives in the sea around Paraty. Next to that I showed them the awesome Brazilian nightlife, and they definitely enjoyed it. The last trip during my internship was to Bonito. The highlight in Bonito was definitely Rio da Prata; a river where you can swim and snorkel between literally thousands of exotic colorful fish.

When I finished my internship at CPqD, I still had about one month to travel in Brazil. First, I visited Chapada Diamantina; a huge national park in the northeast of Brazil. In this park there are a lot of trails where one can find a lot of big waterfalls, caves, and mountains with a spectacular view. To visit the most impressive

parts of the park, I had to hike for a few days in a row, and had to sleep in a tent, or search for a house of a native family. Sometimes the trails were rather hard, but it was definitely worth the effort!

After spending two weeks in Chapada Diamantina, I traveled to Manaus to spend a week in the Amazon jungle. This was also quite an adventure; we had to build our own camp and mainly find our own food. This often resulted in eating exotic fruits (which I didn't even knew they existed) and delicious piranhas. I've also eaten some larvae, and I can tell you that they tasted surprisingly well! Next to that, we spotted a lot of animals like birds, monkeys, big lizards, armadillos, sloths, caimans, (pink) dolphins, snakes, and (big) spiders.

When my adventure in the jungle ended, I returned to Campinas to have one last drink with my friends and colleagues. Unfortunately, every good moment comes to an end and I had to say goodbye to my new Brazilian friends.

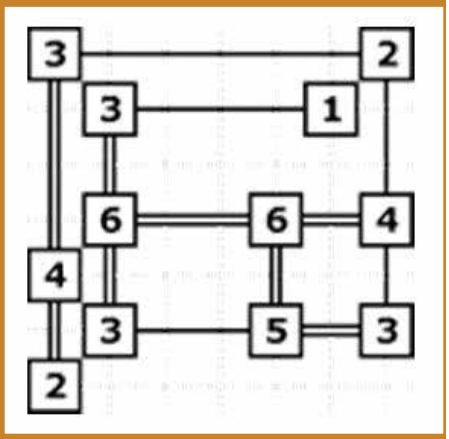
I can definitely say that I had a fantastic time in Brazil. I made a lot of friends, learned a lot about the Brazilian culture and traveled to a few fantastic places. Although I'm happy to be back in Eindhoven again, I do not have a single regret about spending six months in Brazil. For those who still are in doubt of doing an internship abroad; do it! It is really an once-in-a-lifetime experience! ■

Puzzle

Objective / Rules

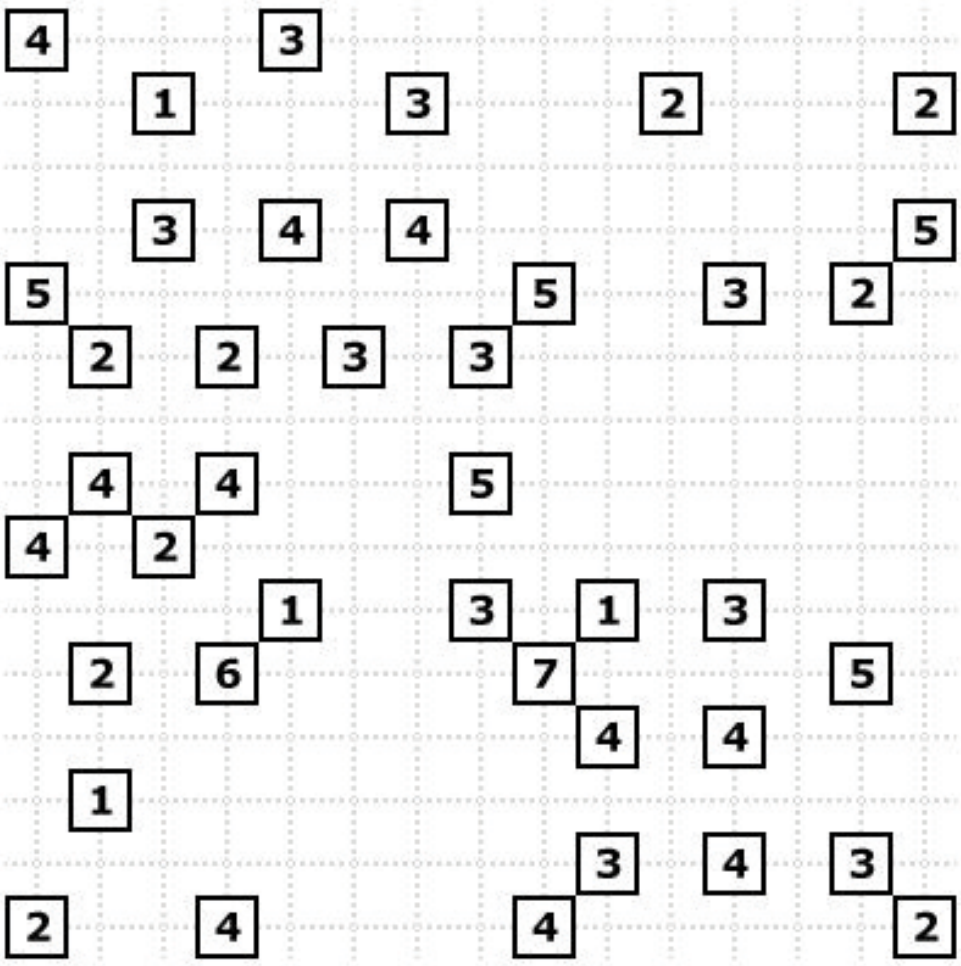
- Connect every island, such that any island can be reached from any other.
- Each island contains a number that shows you how many bridges leave that island.
- Up to two bridges can connect the same two islands.
- Bridges can only go horizontally or vertically and they may not cross each other.

Please send your answer to connecthor@thor.edu before 8 January.



Previous puzzle

The winner of the previous puzzle is Jari van Ewijk



Elevator pitch

By: Tom van Nunen

Technology is our way of living. In our case particularly, technology really is what we do for a living, but more generally it offers us a lot of convenience and influences our everyday lives in many ways. Sometimes, however, I wonder whether we let our lives depend on technology too much.

For quite a while now, I try to avoid the elevators in Flux as much as possible. Even when I have to be on the 10th floor, I prefer to take the stairs. I think that the main cause for this is the fact that I recently got trapped inside the elevator in Flux, and that I certainly didn't enjoy that. The fact that technology had taken over the situation and I couldn't do anything about it made me feel powerless and uncomfortable. But besides that, there are several other reasons to critically think about your elevator use and maybe take the stairs more often.

First of all, it's just healthier to do so, everybody understands that. Second, the stairs might very well be faster than the elevator; today it took me less time to reach the 6th floor by stairs than it took some others to reach it by elevator. The third reason is linked to the previous reason, and it's the most important reason for me to avoid the elevator: every time I stand in the elevator, I get sick and tired of people using the elevator for only one or two floors.

Granted, if you have a trolley with you, you have bad legs or you have to move five floors or so, the elevator is a brilliant invention. But if you're just too lazy to take the stairs for one or two floors, you're just being rude, especially if you realize that everybody in the elevator has to stay in there longer and people waiting for the elevator have to wait longer, just because of your laziness. Next time you plan on taking the elevator, I want you to think again: are the stairs a valid alternative for this trip?

Taking the stairs has quite some advantages. As said before, it's healthy, it doesn't have to be slower and you're not being rude to people who do have good reason to use the elevator. But there is more. By using the stairs, you implicitly make use of one of the key features of our new Flux building: it enables you to meet people and start conversations with them. Of course, you can also start a conversation while waiting for the elevator, but you'll

be forced to abruptly stop the conversation as soon as the elevator arrives or when you reach your floor.

A lot of people have opinions about the new building and in my opinion this is one of the most important properties of Flux. The open character of the building noticeably brings people together and invites them to discussions or just chit chat. You run into each other more often and you can peek into the offices, instead of just spending the whole day in your office with the door closed. Sometimes it would be nicer if all equipment and such are in one place, or at least close to each other, and of course I can't disagree. I just hope that you can also see the possibilities that are enabled by the new design.

So from now on, when you are required to move from your current position A to a given position B, enjoy your trip. Don't look at it only as a necessity, but enjoy the trip, the view, the fact that you can stretch your legs and the company, and try not to be so rude and lazy to take the elevator for just one or two floors. ■

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AME is an independent developer and manufacturer of high quality electronic products located in the top technological region of the world (Brainport Eindhoven). Our goal is to create innovative products that exceed customer expectations. We accomplish this by integrating product development and manufacturing and keeping a clear focus on the product and its function. Driven by technology, we strive for the best solution combining the disciplines of electrical, mechanical, software and industrial engineering. Through creativity, passion, ambition, motivation and a highly educated level of our employees AME secures its goal of being a profitable company.

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Internships

AME is the ideal work environment to develop hands-on experience while completing your studies. You will be involved in challenging real-world projects and work with experts from a multitude of technological disciplines. We invite you to get in touch with us to discuss any internship openings.

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