MAXWELL

Supporting Air Traffic Control
by separating unmanned aircrafts

Nuon Solar Team
Op zonne-energie Australië doorkruisen

Exploring the EE Groups
Computer Engineering

Byte Me!
Avonturen van de 106de Dies Natalis

Leading in Oil & Gas Technology

Frames defines itself by implementing new technologies in a dynamic market with growing internationalization. In addition, we highly appreciate a good working atmosphere in an informal setting.

Well educated ambitious people are working at Frames. Our terms of employment are correspondingly. Frames tries to stimulate its employees to continue learning, both "on the job" as well as through providing training. Our study costs arrangement allows employees to follow an adequate education in an affordable and easy manner.

Specialized in the design, manufacturing, supply, installation and commissioning of complete systems for oil & gas treatment, separation, heat exchanging, flow control and safeguarding, we constantly expand our technological capabilities as well as our customer base to include virtually all the major oil & gas production companies worldwide.

Opportunities to grow in one of our offices are plentiful. Besides developing opportunities in the Netherlands, we are continuously looking for employees who are willing to help with the growth of our international offices.

In total, Frames has five offices in the Netherlands located in Alphen aan den Rijn, Vollenhove, Woerden and Zoeterwoude. Besides expanding in the Netherlands, more and more Frames offices are opened abroad. Supported by offices in Brazil, Germany, India, Malaysia, Russia, Saudi Arabia, UAE and the USA, Frames has managed to make a name for itself in the global oil & gas industry in the past three decades.

The following technology and product groups are part of the Frames portfolio:

- Flow control & safeguarding
- Gas & liquid treatment
- Separation technologies
- Gas processing
- Biogas processing
- Heat transfer
- Automation
- Field services

Interested?
Please visit www.jobsatframes.com or www.frames-group.com for more information.

From the board
Stories from the previous quarter

Dear reader,

Phew, the fourth quarter was over in a flash. At least it seemed like that from our point of view. As unreal as it may feel, the weird sense of this hectic year coming to an end is more palpable than ever. This quarter was the moment where we as board checked off all the activities we envisioned at the start. I'll come to those important experiences later.

In the meantime, in different parts of the faculty, a lot was happening. First of all, the department of educational affairs struggled to create the new 2013 bachelor curriculum. The entire university is switching to new 'modular curricula'. Because we believe the 2010 Electrical Engineering was pretty good, we tried to change as little in the content of the courses as possible, while fitting in with the new guidelines.

The guys from property management are also doing a good job in renovating the faculty. Finally proper study areas are available in EEMCS. Of course i am talking about 'Study 2.0' on the second floor, packing more than 40 computers and 80 study sites. During the summer FMVG will renovate the three other lecture halls; C, D and E.

Luckily the bulk of our members did not have to worry about these developments too much, and we gave them lots of opportunities to enjoy the fourth quarter.

First turn was claimed by our EESTEC workshop "Tie Before you Die'. I might have written much about this international event already, and the high an-

Sliding downstream in Walibi World!

ticipations were filled as you can read on page 26.

The board had exactly 6 days of rest before we launched our dies weeks. Being the original board, we subtly provoked our Diescommittee to organize as many non-standard activities as possible during these 8 days. Starting with the auction all the way to the excursion to Antwerp, it will be hard for me not to give away everything just yet. We assigned that honor to one of the committee members who wrote all stories down on the go; it is included in this edition.

Furthermore, 8 until the 10th of June was the time to shine for our Sailing weekend committee. To shed every piece of study stress from our bodies, these four freshmen gave us the chance to enjoy the sun, salty winds and Beers in a boat on the Oosterschelde.

During the last month there are these five guys showing up in the boardroom with an ever-increasing frequency. Somehow, through all the annoying questions they have and the amount of time they request from us, it calms me to know they are ready for next year. What's left for you all is to study hard for this years last exams. I hope you can all savor your summer holidays with such a feeling of achievement as we do.

Study hard, ready yourself for next year, and enjoy your holidays!

On behalf of the original board,

Adriaan Taal

Main content

... and more

Editorial

Dear readers,

You are now experiencing the most exciting moment of this quarter, or at least the Maxwell editors are. A brand new and fresh edition of the Maxwell has arrived! For us editors this is always a happy moment where we can look at all the work we have done in order to deliver a new and interesting Maxwell for all the ETV members. As always we have tried to cover a broad range of interests, covering what is new in our engineering field as well as showing the activities that have been there during the past quarter.

In the field of engineering we have articles about mobile data systems, avionics and we explore another EE group, this time we pay a visit to Computer engineering. Also included is an article about the Nuna project. An exciting project in which students build their own solar car, if you are interested in doing a project for a year, the team is still looking for members who want to build the new Nuna.

Besides interesting technical articles, we also take a look back at the quarter and all the cool activities that have been organized. So take a look and bring back the memories for all the things you have taken part in, or get a nice idea of the atmosphere if you were not there.

Since this was the fourth quarter, it is time again to have a summer break. The next edition of Maxwell will be in the first quarter next academic year. The society also teaks a break for a while, there will be no activities and the board will take a well deserved vacation. At the end of august we will welcome the new freshmen in a special weekend and after that the new year can start again.

Wishing you a nice summer break,
Ester Stienstra
Editor

Newsflash
Updates from the Engineering field

AWARE-2: "Off-the-shelf" gigapixel camera

Gigapixel cameras are not unheard of nowadays - although currently they can only be afforded in big projects such as telescope sites. Furthermore, there are some drawbacks: the field of view is typically only a few degrees and the required lens size quickly rises to the order of several meters.

To overcome these problems, engineers from the Duke University in Durham dropped the conventional approach and instead started off with 98 off-the-shelf 14-megapixel imaging sensors. Not only is this relatively cheap, but it also allowed the team to place the sensors around a spherical lens rather than needing a big lens to focus the light on one surface. As if this wasn't enough of an achievement, this setup can take pictures with a 120 degrees wide and 50 degrees tall field of view, by stitching together the separate pictures taken by each of the 98 sensors.

The sensors each run autofocus and exposure algorithms, ensuring that every part of the picture turns out right. The AWARE-2 also has onboard data-processing, which puts all of the separate images together to form a gigapixel image. All of the optics, sensors, data-processing and cooling systems currently fit in a package measuring 75 by 75 by 50 centimeter. The setup can capture three of these gigapixel images every minute.

The team is already working on a more sophisticated version of the camera, which will be able to capture ten images per second and eventually have a resolution of about 50 gigapixel. While relatively cheap, the camera will still have a price tag of about a hundred thousand dollars at first – but the team expects large-scale manufacturing will eventually cut the price to a thousand dollars.

Source: *www.nature.com*

The AWARE-2 camera
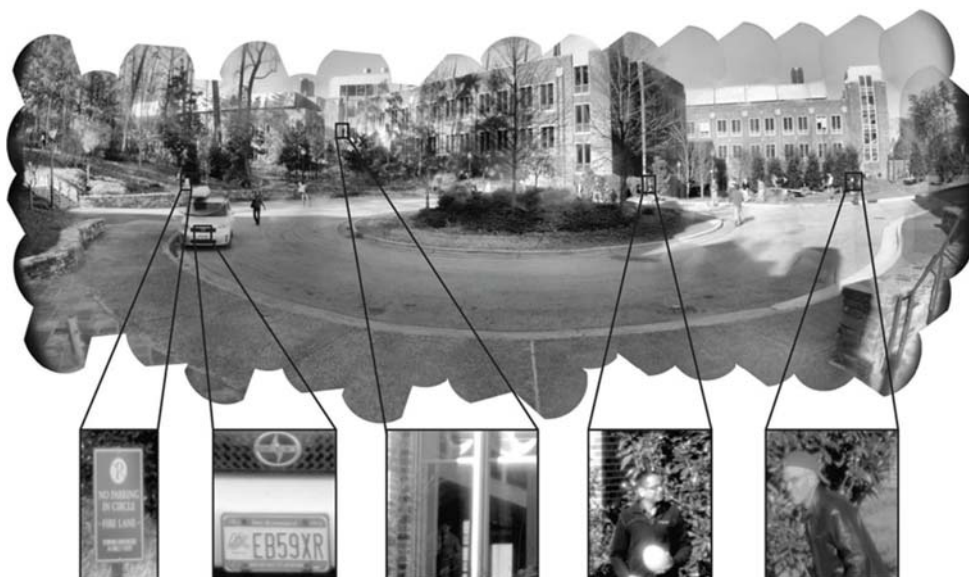
One of AWARE-2's pictures, with some highlighted details

Intel Reveals Neuromorphic Chip Design

The brain is the most extraordinary of computing machines. It carries out tasks as a matter of routine that would fry the circuits of the most powerful supercomputers on the planet: walking, talking, recognising, analysing and so on.

It's no surprise that computer scientists would like to understand the brain and copy its ability. There's a problem, however. The brain is built from neurons and these work in a rather different way from the silicon transistor-based circuits that lie under the bonnet of conventional chips.

Of course, computer scientists can simulate the behaviour of neurons and how they link together on conventional computers. But this is a profoundly wasteful process that is unable to exploit the partallel processing and network effects that the brain clearly makes use of and that eats power in the process.
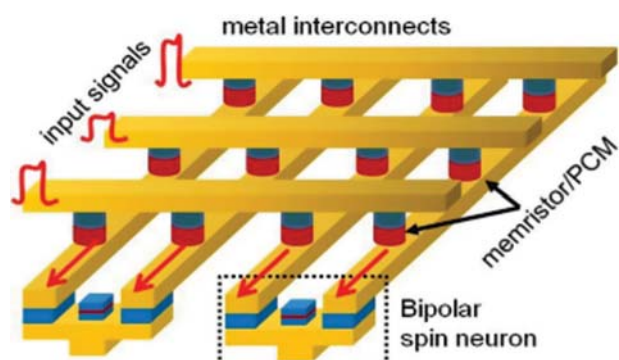
So the race is on to develop a different kind of chip that more accurately mimics the way the brain works. So-called neuromorphic chips must be built from devices that behave like neu-

Schematic of Intels neuromorphic chip

rons - in other words they transmit and respond to information sent in spikes rather than in a continously varying voltage.

On the 18th of June, Charles Augustine at Intel's Circuit Research Laboratory in Hillsboro, Oregon, and a few pals unveiled their design for a neuromorphic chip. They base their design on two technologies: lateral spin valves and memristors. Lateral spin valves are tiny magnets connected via metal wires that can switch orientation depending on the spin of the electrons passing through them, while memristors are fundamental electronic devices that act like resistors with memory. Augustine and co argue that that the architecture they've designed works in a similar way to neurons and can therefore be used to test various ways of reproducing the brain's processing ability. The icing on the cake, they say, is that spin valves operate at terminal voltages measured in milliVolts, that's significantly less than conventional chips.

They claim this translates into a dramatic energy saving. "We show that the spin-based neuromorphic designs can achieve 15X-300X lower computation energy," they say. (What they actually mean is that they 'tell' us that this kind of saving is possible since there is little in the way of a demonstration in their paper.) They also say the new design is ideally suited for the kind of processing tasks that brains do rather well: analog-data-sensing, cognitive-computing, associative memory and so on.

Intel's new chip design certainly looks to be an improvement over existing ones but it is still orders of magnitude away from the computational efficiency that real neurons achieve.

Source: *www.technologyreview.com*

Phone speaker 2.0

Kyocera – a Japanese company mainly known for manufacturing printers – has found a new way to transmit sound from a smartphone to your ear. Instead of using a regular speaker, Kyocera's design is based on a ceramic transducer, which generates vibrations on the entire phone. These can be heard 'through the air' but the phone is meant to touch your ear – sending the vibrations straight through your ear tissue, then reaching your eardrum.

Especially when the direct path to your ear is blocked (by, in this case, the smartphone itself), Kyocera claims the sound is very clear and hard to interfere. The used technology was originally intended for hearing aides, but the costs have gotten low enough for use in mobile phones.

While an exact date is unknown, Kyocera says a new line of smartphones employing this new technology will be released in Japan very shortly.

Source: *www.gigaom.com*

Nuon Solar Team
Op zonne-energie Australië doorkruisen

Auteur: Technolution in interview met Willem Zwetsloot

Delftse studenten doen al twaalf jaar mee aan de World Solar Challenge. Dit is een tweejaarlijkse race door Australië voor auto's die op zonne-energie rijden. Voor elke race bouwt een nieuw team een nieuwe auto, om te voldoen aan de laatste eisen van de organisatie, maar vooral om de modernste technieken te kunnen gebruiken. Het projectbureau Technolution sponsort het team en geeft technische ondersteuning. "Met de energie van een stofzuiger kunnen wij 140 km/h rijden."

Willem Zwetsloot nam na zijn bachelor elektrotechniek deel aan het Nuon Solar Team. Met twaalf collega studenten bouwde hij de zesde zonne-auto: Nuna6. Willem is bevlogen van elektrotechniek. "Ik heb altijd graag met elektronica geklust en gebouwd. Bij mijn studie vond ik dat de praktische kant onderbelicht bleef. Nuon Solar Team is voor mij de uitgelezen kans om de theorie van je studie toe te passen in de praktijk. Iets bouwen dat het ook echt doet."

Regeltechniek

Willem heeft de accu en alle regel-techniek voor de auto ontworpen, gebouwd en getest. Een collega elektrotechniekstudent heeft de motor en het zonnepaneel verzorgd. "Maar daarnaast werk je heel nauw samen met de anderen om die hele auto tot stand te brengen. Het moet elektronisch werken, maar ook mechanisch functioneren."

Ervaring

Hoewel elke auto opnieuw wordt gebouwd, hoeven de studenten niet zelf het wiel opnieuw uit te vinden. Het oude team kent de sterke en zwakke punten en geeft die door. "In Nuna5 was de software en vooral de hardware van de regelelektronica niet betrouwbaar, waardoor de auto veel heeft stil gestaan tijdens de race," vertelt Willem. "Die is daarom geheel op de schop gegaan. In de Nuna5 was de regeltechniek verdeeld over meerdere platformen in de auto, wat de zaak complex en foutgevoelig maakt. Dat wilden we centraal organiseren op een boordcomputer."

Boordcomputer: MobiBoxx

Het vorige team had voor de elektronische problemen aangeklopt bij het Goudse Projectbureau Technolution, en dit contact is gebleven. Inmiddels sponsort Technolution het team en geeft het technische ondersteuning. Zo bood het bedrijf

Het team met de Nuna

aan om zijn boordcomputer te gebruiken: de MobiBoxx. "Dit is een zelf ontwikkeld platform voor in-car automatiseren," legt Principal Consultant Rob Siegerist uit. "Een klein, zuinig maar krachtig systeem waar Linux op draait en dat via CAN-bussen met alle onderdelen van de auto communiceert: pedalen, stuur, motor-controler, accu, etc. Tevens bevat het een GPS unit en communiceert het via WiFi met de volgauto." Een van de teamleden kreeg een werkplek en ondersteuning bij Technolution, voor een spoedcursus MobiBoxx programmeren. "Vervolgens konden we met programmeertaal C de hele auto modelleren," vertelt Willem. "Alle parameters kun je beïnvloeden. We maken een energieplanning voor een hele dag, om panelen en accu optimaal te benutten. De MobiBoxx is een bewezen platform voor auto's. Het is getest, het is betrouwbaar. Het doet wat het moet doen, de hele race. En dat werkte: we hebben nul minuten stil gestaan; een primeur in de Nunageschiedenis."

Design Reviews

Willem: "Wij hebben als studenten drie jaar studie-ervaring. Dus in de gesprekken met sponsor-bedrijven probeer je zo veel mogelijk samenwerking te bewerkstelligen. Bijvoorbeeld met design reviews. De

kennis die ik had kon ik wel toepassen, maar er was geen professor of docent die dat kwam toetsen. Dus hebben we Technolution gevraagd om met ons naar het ontwerp te kijken. Zij hebben veel ervaringskennis en kunnen tips geven om het net even anders te doen, bijvoorbeeld om statische elektriciteit te voorkomen. Dat vond ik erg handig. Oplossingen kunnen soms uit onverwachte hoek komen. Daarom is het belangrijk om met zoveel verschillende mensen contact te hebben." Rob: "In samenspraak en samenwerking ontstaan de mooiste dingen. Die ontstaan niet als je achter je bureau blijft zitten. Ik ben ook blij dat wij daar een positieve bijdrage hebben kunnen leveren."

Veranderende rollen

Het bouwen van de auto duurt ongeveer een half jaar. Daarna, in aanloop naar de race in Australië, veranderen de functies in het team. Willem nam de rol van race operations op zich. "Ik heb bijvoorbeeld uitgezocht hoe je zo snel mogelijk een band kan verwisselen. Bij pech moeten we zelf een "pit stop" opbouwen langs de weg, met een goed getraind team dat snel samen een wiel kan vervangen. Ik heb bekeken hoe je dat zo efficiënt mogelijk kan doen en ik heb de mensen getraind. Tijdens de race heb ik problemen opge-

lost. Dat trekt me ook het meest: het totaaloverzicht hebben, en de organisatie er omheen."

Konvooi

Om veiligheidsreden eist de organisatie dat voor en achter elke zonne-auto een gewone auto rijdt. De auto die een paar minuten voor de Nuna rijdt, heeft de "pit stop" aan boord. Een uur verder vooruit rijdt een tweede auto. Dit is de meteo-wagen, die het lokale weerbericht een beetje nauwkeuriger maakt en het parcours verkent. De auto achter de Nuna is het con-

Cijfertjes

- Paneel-opbrengst, gemiddeld: 1 kW
- Paneel-opbrengst, maximum gemeten: 1400 W)
- Accu capaciteit: 5 kWh
- Energiebudget voor totale race: 30-35 kWh
- Actieradius puur op accu: 460 km Ter vergelijking: Nissan Leaf heeft een accu van 25 kWh en kan daarmee 160 km afleggen.
- Gewicht carrosserie en chassis: 35 kg
- Gewicht accu: 25 kg
- Gewicht wielen en motor: 40 kg
- Gewicht coureur: 'aangevuld' tot 80 kg

Het team

De Nuna in actie

trolecentrum. "De MobiBoxx in de Nuna doet het elementaire regelwerk, en hij communiceert met de volgwagen. Daar gebeurt het zware rekenwerk op laptops: de strategische berekeningen, met het weerbericht en de gegevens van de Nuna en de meteo-wagen. Daarmee rekenen we de optimale snelheid uit, en die sturen we weer naar de MobiBoxx. De hele logistiek met ons konvooi vind ik subliem. De voorkennis van de meteo-wagen heeft ons echt geholpen."

Tactiek en strategie, energieplanning

Zoals in elke race zijn tactiek en strategie heel belangrijk. Maar anders dan in formule 1 races kan te hard rijden je de overwinning kosten. Als je te snel rijdt in een energie-race, trek je de accu leeg. Dan moet je gas terug nemen. "Praktisch gezien rijdt de auto op de zonnepanelen, en is de accu maar een buffertje, voor bewolking, hellingen of tegenwind," vertelt Willem. "De panelen kunnen tot 1400 W leveren. Gemiddeld in de race trekken we 1 kW en krijgen we via de panelen 1 kW binnen. Daarmee kunnen we 90 km/h rijden. 's Ochtends leveren de panelen wat minder en gebruiken we de accu, midden op de dag leveren de panelen meer en stoppen we wat terug in de accu. Dat zit verwerkt in onze energieplanning."

Wie zich nu aanmeldt kan zeker meedoen

Willem ziet dat mensen aarzelen om deel te nemen aan het Nuon Solar Team om financiële redenen. "Dat merken we sterk in het aantal belangstellenden. Zeker vanuit elektrotechniek, daar hebben we nog niemand. Wie zich nu aanmeldt kan zeker meedoen." Om aan die aarzelende studenten tegemoet te komen, is er nu een minor Nuna, vertelt Willem. "Een half jaar, van september tot januari ben je teamlid, en doe je nog twee vakken ernaast. Dat levert dertig studiepunten op."

Toekomst: zonnepanelen optimaliseren

De zonne-auto is met zes generaties behoorlijk ver uitontwikkeld. Maar de zonnepanelen kunnen nog verder worden geoptimaliseerd, zegt Willem. "Wij zoeken de uitersten op qua efficiëntie en specificaties. We kopen de cellen los, ontwerpen er een geïntegreerd paneel voor en dat wordt gelamineerd, in een flexibel substraat dat op de auto past. Daar zitten een aantal stappen in die we nog niet helemaal snappen en daarom is het zo belangrijk om elektrotechnici te hebben. Dat zonnepaneel is bepalend in de race. Met een procent verbetering zijn we een uur eerder bij de finish!" Verbeteringen waarbij Technolution graag weer een ondersteunende rol speelt, zegt Rob.

Willem sluit af met een oproep. "We zijn hard op zoek naar elektrotechniek studenten! Schroom niet om contact op te nemen met Willem Zwetsloot (mail: *willem.nuna6@gmail.com* of telefoon: 06-83606685)."


Klaar om te racen!

De MobiBoxx

Feest bij aankomst

Exploring the EE Groups
Computer Engineering

Author: Ester Stienstra

To visit the group of this edition we step in the elevator of the high rise building. The group is situated on the 15th and 16th floor. Computer engineering is a large group with about 10 post docs and 40 PhD students. The research area of computer engineering can be described as the link between micro-electronics and software technology. Work is done on hardware design, mostly not at transistor level, but with predefined blocks like memory blocks, registers and buffers. The group is mainly designing processors for varying applications but other research activities range from system level design, runtime support, compilers to computer arithmetic. In essence, Computer Engineering looks at both hardware and software aspects when designing a system. This is called hardware/software co-design. The group has a lot of projects, often in cooperation with industry or in a network of different universities.
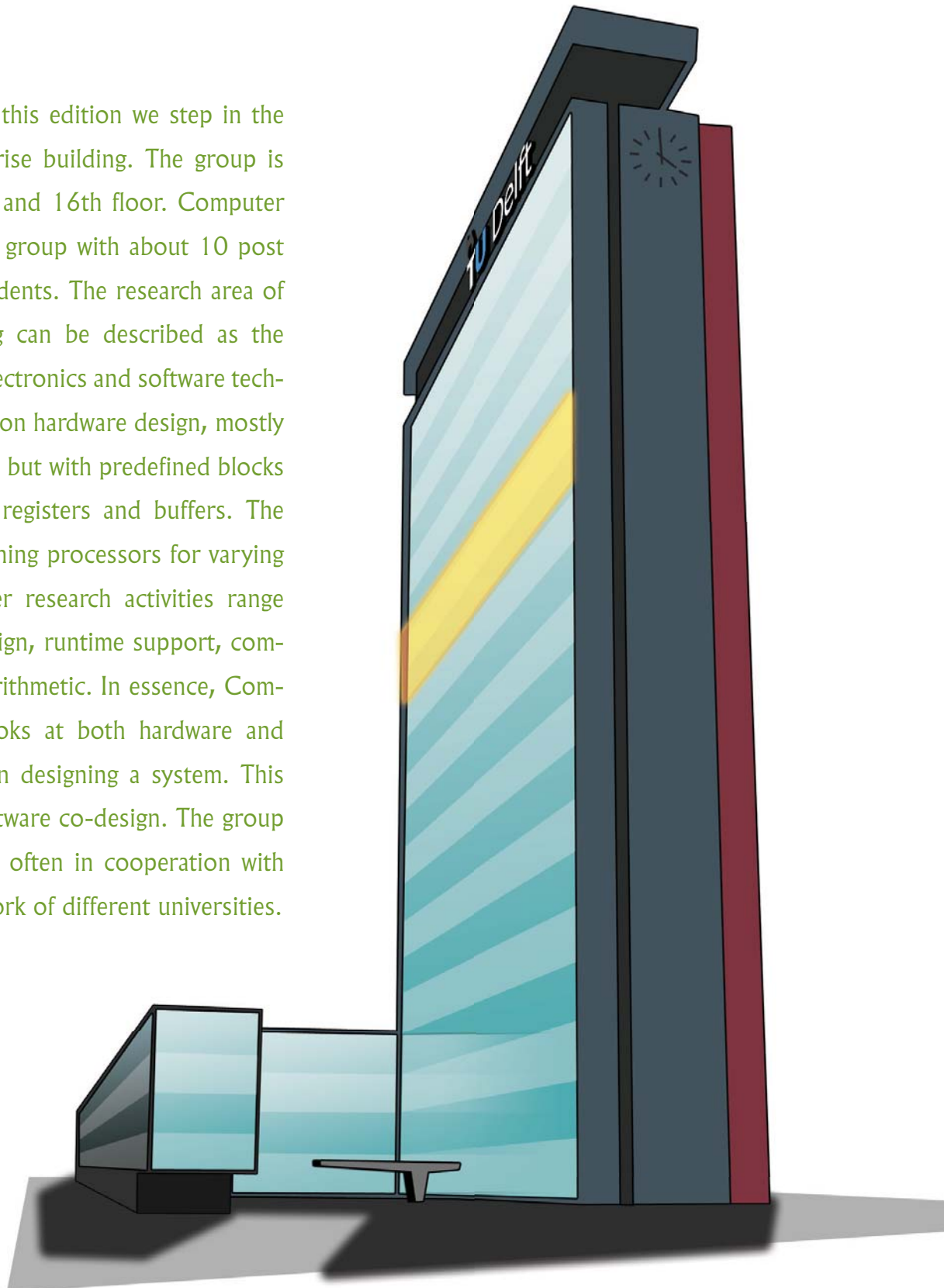
The field of computer engineering is a challenging research field. In 1965 Gordon Moore stated that every eighteen months the number of transistors on a chip will double, so far this law has been followed by the technology, but the end of scaling down is nearer than ever. Also because of this constant downscaling the reliability of transistors is not longer a 100%, so when doing calculations with that type of hardware the outcome may not be the correct one every time. At the same time the requirements for computational systems get more and more complex, as people expect smaller hardware that does computations faster with less energy. The research done at the Computer Engineering group is grouped in three pillars, but projects can be in more than one of those areas. The three pillars are dependable nana computing, electronic system level design and multi/many core architectures.

" It is expected that the number of cores on a chip will start to follow Moore's law "

Dependable nano computing

Because of the downscaling of transistors, the differences that occur during fabrication of IC's are more and more of influence on how the final circuit will perform. Since the errors do not scale down, the same error makes relatively seen bigger changes in variables. This means that is it getting harder to predict how a circuit will work by just running simulations, because the effects of fabrication are hard to predict. In order to solve these issues the group is doing research in order to develop new design methodologies and simulation algorithms. Also new w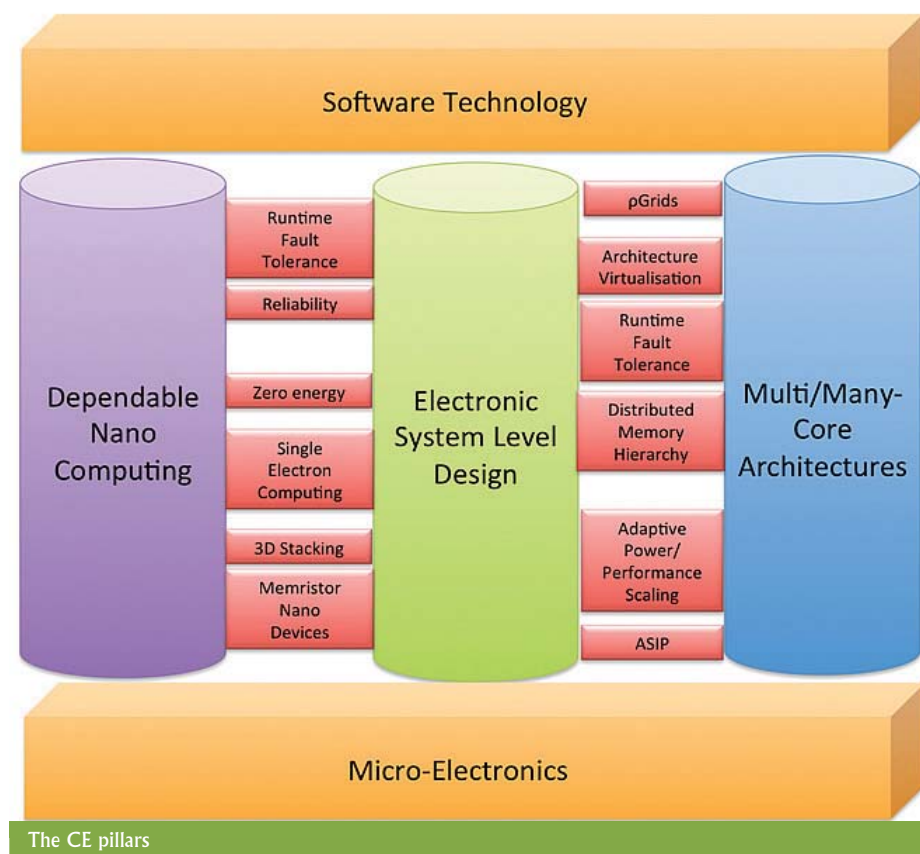ays of constructing computational systems are developed, using other devices than is now happening in conventional electronics. Among the topics are single electron computing, zero-energy computing and systems with different structure than the now used CMOS.
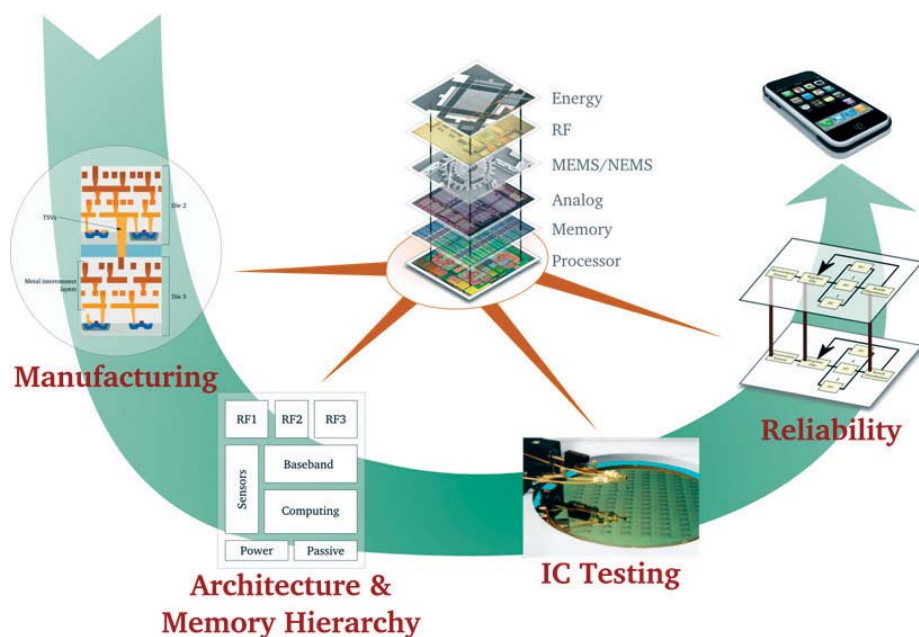
Electronic system level design

Changes in technology are coming at the market faster and faster. One of the consequences of this is that if you design something that is state of the art, but because of delays you deliver it late to the market (say a couple of months) your design is worthless, because your competitor is already selling it. This means that the software used to design systems needs to be very accurate in predicting al the effects that can occur on a chip. In the field of electronic system level design, research is done on how to make better simulation software and how to test chips faster and more cost effectively. Also the simulation tools should be able to keep up with the increasing complexity of systems, since systems are getting bigger and reconfigurable.

Multi/many core architectures

It is expected that the number of cores on a chip will start to follow Moore's law, that is to double every eighteen months. If this happens, the complexity of systems will increase rapidly. Multi/many core designs mostly contain one general-purpose processor and a couple of custom computing elements. This way the processor can be specially designed for a specific application. Besides the design of the different cores, it is also necessary to look

The CE pillars

Manufacturing

Architecture & Memory Hierarchy

IC Testing

Reliability

Energy
RF
MEMS/NEMS
Analog
Memory
Processor

RF1 RF2 RF3
Baseband
Sensors Computing
Power Passive

3DIM3

The soccer team

Coffee break

at how these cores can communicate with each other. One of the bottlenecks here is the communication between the computational elements and the memory of the system. Another issue in making bigger processors if of course power. The market is more and more focusing on low power appliances, for mobility and environmental reasons. Since the systems are getting bigger, the power that can be used per core is therefore decreasing rapidly.

Research projects

One of the projects that the CE group is participating in is the European 3DIM3 project. In this project a design methodology is developed for stacked chips. By stacking chips more functionality can be packed in the same amount of area. There are a lot of things to take into account when you want to stack chips. Especially the order in which the different components are stacked is important. Because of the heat that is produced by the different components some should not be stacked directly on top of each other. Also new ways of handling defects should be invented.

In another project the group has developed its own platform with processor cores called the molen (Dutch for windmill) processor. This processor consists of one general-purpose processor and several reconfigurable cores. The reconfigurable cores can be adapted to the application for which a system is designed. The molen processor is even designed in such a way that the reconfigurable cores can be adapted on the fly. This way the processor can be constantly adapted for the running application. This line of research is continued in other EU projects such as the ERA-project where this concept is pushed even further.

The CE lab values very highly the transfer to industry. Many results of the CE research are used by industry and have found their way into commercial products. This ranges from memory testing at Intel to graphics rendering in the iPhone. Many companies were started by their alumni and a more recent spin off is BlueBee which focuses on multicore computing platforms.
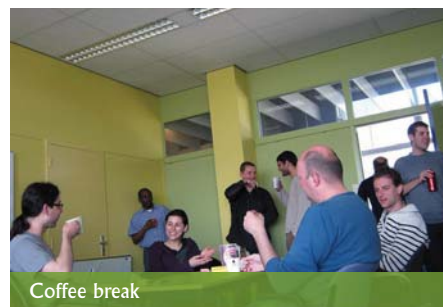
Social activities

The group has a lot of foreign students and employees. Because of this fact a lot of social activities are organized, so that people far away from home can start new friendships. One of the simple things that is done is a joint coffee breaks. Every day, there are two coffee breaks were everyone gets together to enjoy a cup of coffee and chat about work and other thinks. Besides this also other events are organized. The group has its own soccer team and activities like barbeques, movie nights and diners are organized. And the Xmas party is a long standing tradition where everybody brings some dishes from their home country to share with each other. Because there are so many events, the bond between the people on the group is generally fairly strong.

LTE
The new generation mobile data systems

**Author: Arie Verschoor (Network Architect KPN)**

LTE (Long Term Evolution) is the successor of mobile network technology UMTS. Currently KPN is preparing the introduction of LTE. It helps KPN to keep pace with the expected explosive demand for mobile data services and to offer subscribers the best quality experience: higher data throughputs and lower latency.

In May 2010, spectrum in the 2600 MHz band, suitable for LTE was auctioned in The Netherlands. Existing mobile operators were allowed to buy only 10 MHz of paired spectrum, whereas Ziggo-UPC and Tele2 each bought 20 MHz. KPN executed a successful trial with LTE in the period May 2011 – January 2012.

What is LTE?

LTE has been standardised by 3GPP. Operators have joined forces in NGMN (Next Generation Mobile Networks). In this organisation operator requirements are specified and contributions to standardisation are coordinated. KPN and many other operators globally are members of NGMN. Release 8, the first LTE release, became available in 2008. Releases 9 and 10 contain enhancements, like LTE Advanced (higher bandwidth, higher data throughput).

Compared with UMTS, LTE has a completely new architecture, given in figure 1. The main difference is the absence of an RNC (Radio Network Controller) that provides interconnection between a number of base stations (called eNodeB) and between the eNodeBs and the core network. Instead, in LTE each eNodeB has its own interface to the core network (S1-interface). Furthermore each eNodeB is directly connected to all other eNodeBs in its neighbourhood by means of the X2-interface.
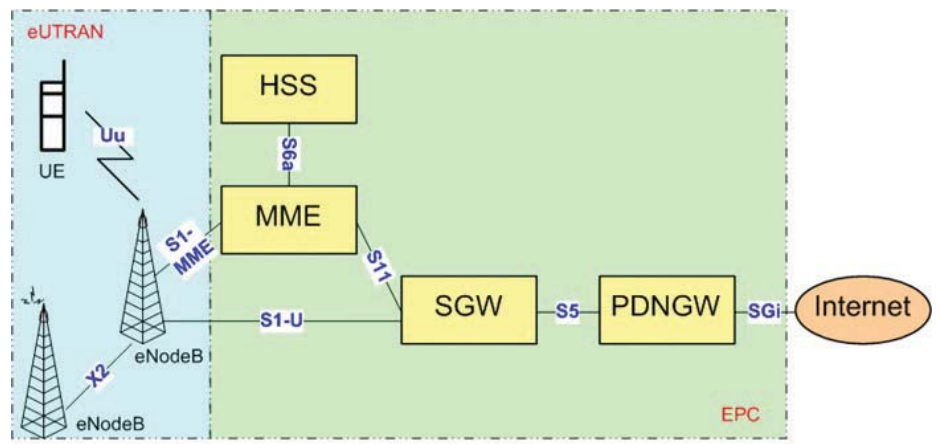
eUTRAN	evolved Universal Terrestial Radio Access Network
UE	User Equipment
EPC	Evolved Packet Core
MME	Mobility Management Entity
SGW	Serving Gateway
PDNGW	Packet Data Network Gateway
HSS	Home Subscription Server

Figure 1: LTE Network Architecture

LTE also uses a new radio technology. In LTE a data stream is split into different parallel streams that are transmitted over different sub-carriers (15 kHz spacing). One Resource Block (180 kHz) consists of 12 sub-carriers.

LTE uses OFDMA (Orthogonal Frequency Division Multiple Access) as a multiple access method for the downlink. In this method, one or more Resource Blocks are assigned to a user for a time period of at least 1 ms (see figure 2). This method is very flexible in allocating Resource Blocks; a user can use all Resource Blocks for a short period. A subset of the Resource Blocks can also be used for a longer period. SC-FDMA (Single-Carrier Frequency Division Multiple Access) is used for the uplink. The difference with OFDMA is that all allocated Resource Blocks have to be contiguous, leading to a lower peak-to-average ratio of the signal (cheaper power amplifiers in terminals).

LTE can operate in a variety of bandwidths, ranging from only 1.4 MHz to as much as 20 MHz. This allows an operator to gradually re-farm spectrum from, for example, GSM to LTE. LTE can opera-
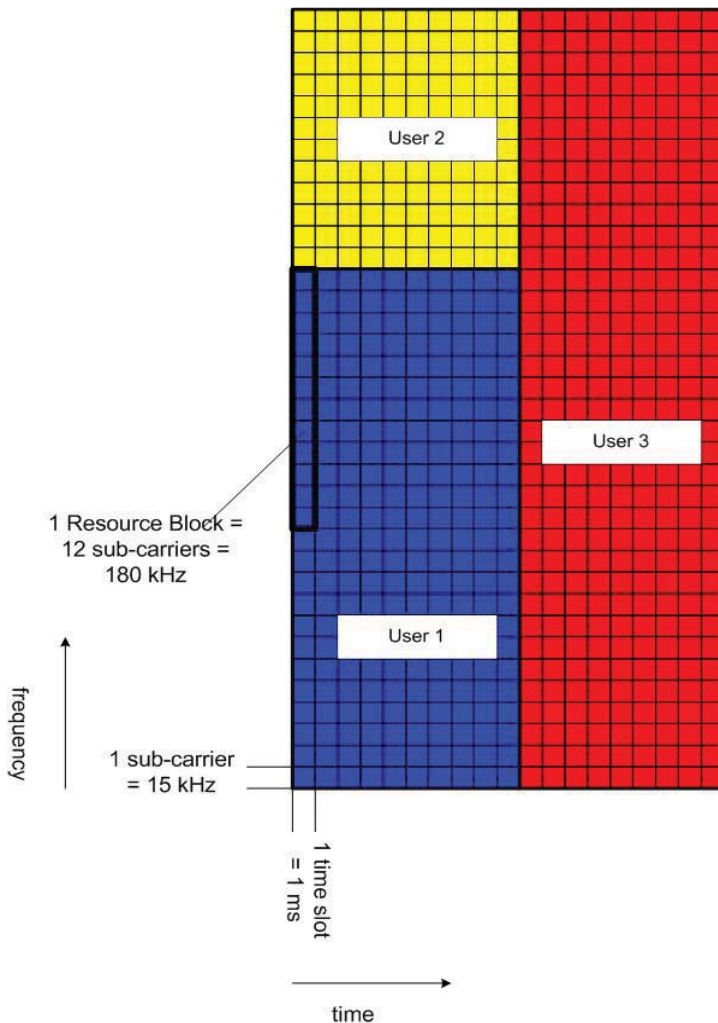
1 Resource Block =
12 sub-carriers =
180 kHz

frequency

1 sub-carrier
= 15 kHz

1 time slot
= 1 ms

time

User 2

User 3

User 1

Figure 2: Multiple Access in LTE: OFDMA

Figure 3: Example of an LTE site

LTE includes several functions that make installation and configuration of eNodeBs easier. This functionality is indicated as "Self Organising Networks". During the trial it was shown that operators can profit highly from this.

The trial showed that LTE can offer much higher data throughput than UMTS; a maximum throughput of 54 Mbit/s was measured on the downlink. 24 Mbit/s was measured on the uplink. Furthermore the claim of low latency, important for interactive services, was confirmed. An end-to-end latency of only 15 ms was measured.

te on many frequencies: 800 (Digital Dividend), 900, 1800, 2100 and 2600 MHz.

eNodeBs are able to transmit at two antennas simultaneously. This technique is called MIMO (Multiple Input Multiple Output). It can either be utilised to increase the throughput or to increase the reliability of the data transfer.

LTE has been designed as a packet data network. Speech service is either offered as Voice over IP or as a circuit-switched connection via UMTS (Circuit Switched Fall Back).

KPN's LTE trial

KPN executed a trial in an area on the municipal boundary of The Hague and Voorburg. In this area six eNodeBs have

been built. Furthermore, one eNodeB has been installed at the test centre of KPN for laboratory tests. The trial equipment was supplied by Nokia Siemens Networks. TNO and TU Eindhoven contributed to the tests of the trial.

KPN's aims for the trial were to gain experience with planning, building and operating an LTE network and to assess the quality experience of future subscribers.

During the trial the adapted models used for radio planning could be verified. Different site concepts have been tried: conventional and feeder less sites, combined (LTE-UMTS) or separate antennas, different MIMO deployments (space and cross-polarisation MIMO).

LTE roll-out

The experienced gained during the trial period helps KPN to build an LTE network that guarantees the best quality experience to the customers. Since May 2012 the first subscribers in limited areas in The Hague and Utrecht can profit from the high performance of LTE. In the coming years LTE will gradually be introduced in more regions of The Netherlands.
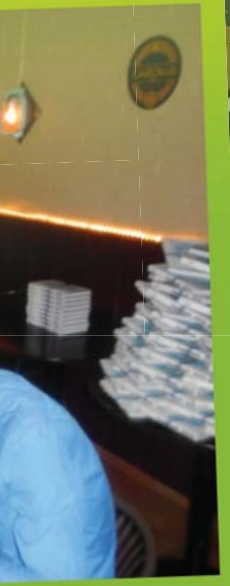
For more information or publication, please contact Arie Verschoor, email: *arie.verschoor@kpn.com*

DANGER

106e Die
BYTE
Electrotechnisc

LASER D
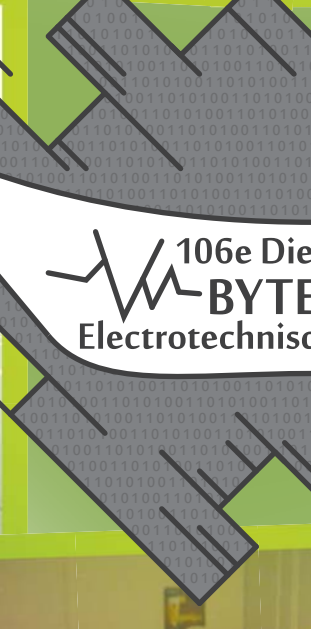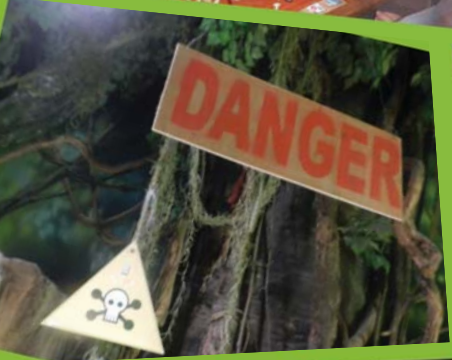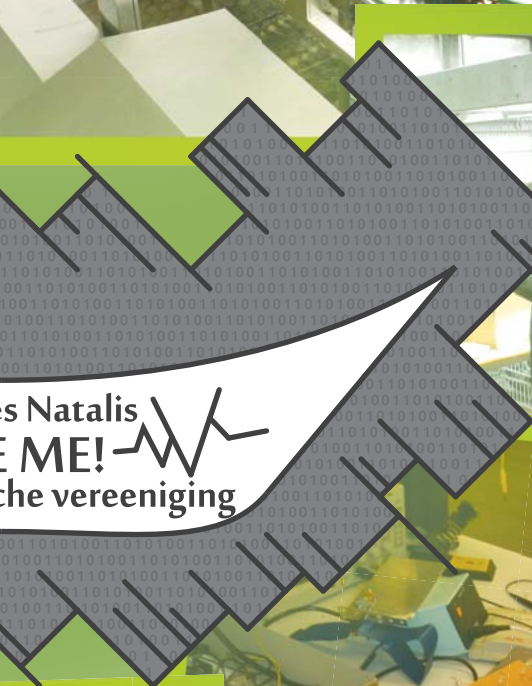
Circuit Bodging
Amplifiers with a twist

Author: Ben Allen

Generally when designing or building an amplifier the goal is to amplify a signal without distorting it. We wish to amplify a signal from a sensor or audio source as accurately as possible to provide accurate measurements or high fidelity reproductions of sound recordings. But in the 1950s, electric guitar players noticed that when their low-quality amplifiers got damaged or otherwise failed, the resulting sound was 'warm' and pleasant...

A short history lesson

Early guitar amplifiers were low-quality, and had a tendency to produce distortion if they were damaged or their gain was increased beyond their designed limits. Later, guitarists would remove or dislodge valves to create the dirty, distorted sound. Some even went as far as poking holes in speaker cones or otherwise damaging the speakers to add further distortion.

As the demand for this unique sound rose, electronic methods of introducing this distortion were developed. While guitarists were becoming increasingly creative in how they caused their amplifiers to distort, the sound was permanently coupled to a specific amplifier and could not easily be transported. In 1962, the first commercial distortion circuit was released. Called the Maestro Fuzz Tone, it found its roots in the early 1960s during a recording session. With a bass guitar plugged directly in to a recording console, bass player Grady Martin accidentaly hit the strings while the recording engineer was still making adjustments. The unattenuated signal saturated the console's input transformer, causing it to distort. Session engineer Glenn Snoddy soon saw the sound's potential and started work. In an interview, he recalls:

"Later when I found out what it was, I set about trying to develop that sound using transistors. [...] We fooled around with it and got the sound like we wanted. I drove up to Chicago and presented it to Mr. Berlin, the boss at the Gibson company, and he heard that it was something different. So they agreed to take it and put it out as a commercial product."

The use of distortion as an effect was born.

Design constraints

Since the 1960s, a lot has changed, and guitarists have become accustomed to certain controls being on distortion effects. These are generally a gain control, which adjusts how badly the signal is distorted, some form of filtering to adjust the sound, and a level control to keep the volume at the output managable. And ultimately, our goal is to make the guitar signal clip.

R = 80, f ~200Hz
R = 1080, f ~15Hz
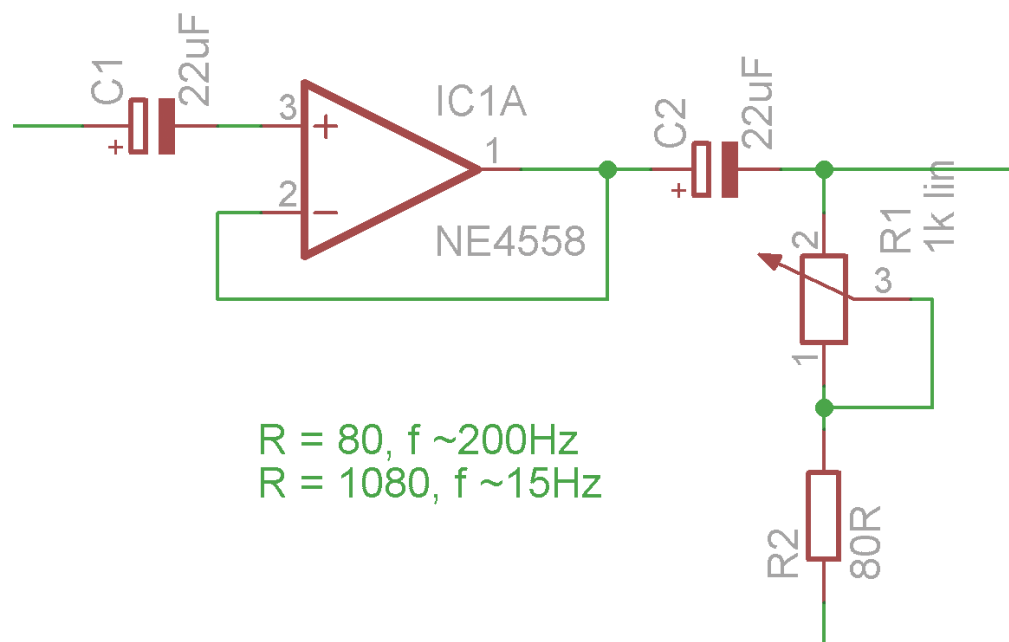
Choosing an amplifier

Firstly we need to consider how to artificially reduce headroom so our signal clips in a controlled and predictable manner. One way to do this is choose a low supply voltage, but this reduces the amount of room we have to play with the 'clean'' or undistorted signal. Guitarists like a dynamic response where when they play harder, the signal distorts more. For this to happen, we need at least some headroom to work with. A better solution is to amplify the sound reasonably accurately, and then use some form of network that will introduce the clipping. Note that this is not always how distortions are built, but in our case it makes the circuit much easier to understand.

An operational amplifier is an ideal choice for simple amplification, and in the guitar effects world, the NE4558 carries a fair amount of weight. For modern standards, it's pretty low-quality, but thankfully, we're designing a circuit for the electric guitar, which is a black art at the best of times. The signal being fed to the circuit, by itself, sounds bad to human ears anyway, and any loss of quality is as good

as unnoticable and adds character to the effect we're building. Remember, we're intentionally trying to sculpt the guitar sound, so we can be fairly sloppy in our design. We will use one of the NE4558s amplifiers to make a gain stage. Because the NE4558 is a dual op-amp, we have one amplifer left, which can be left alone, or in this case be used to buffer the input as in IC1A. Guitars have an output impedance of around 15kΩ, but musicians are unpredicatble.

Setting the Gain

The gain stage is built around IC1B, is non-inverting, and has a gain G:

$$G = 1 + \frac{R4}{R3}$$

Where R4 varies from 0 to 1kΩ and R3 = 120Ω, therefore the voltage gain varies between 1 and 9,33. Guitars have a nominal output voltage of 0,1 to 1V RMS, so with a supply of ±10V, this should be enough. The network of diodes D1 and D2 clips the signal, as they conduct and short when the output of IC1B goes be-

yond ±0,7V. This introduces the clipping we want.

Tone

Whenever you talk to a guitarists about effects, the word you'll hear a lot is 'tone'. This is a vague, intangible concept used to describe the guitar sound, and guitarists will always want control over it. What this means for us is that we need to add a filter to modify the sound. A simple high pass filter as implemented with C2, R1 and R2 will do. This is a simple first-order filter with a -3dB frequency at

$$f = \frac{1}{2\pi C(R1 + R2)}$$

This allows the user to filter out bass from approximately 15Hz to 200Hz before the clipping stage.

And finally

Finally, R5 adds a level control. Add C1 and C3 for DC decoupling, and the rudimentary circuit is complete. This platform serves as a basis for a simple beginning. As always, we encourage you to experiment.
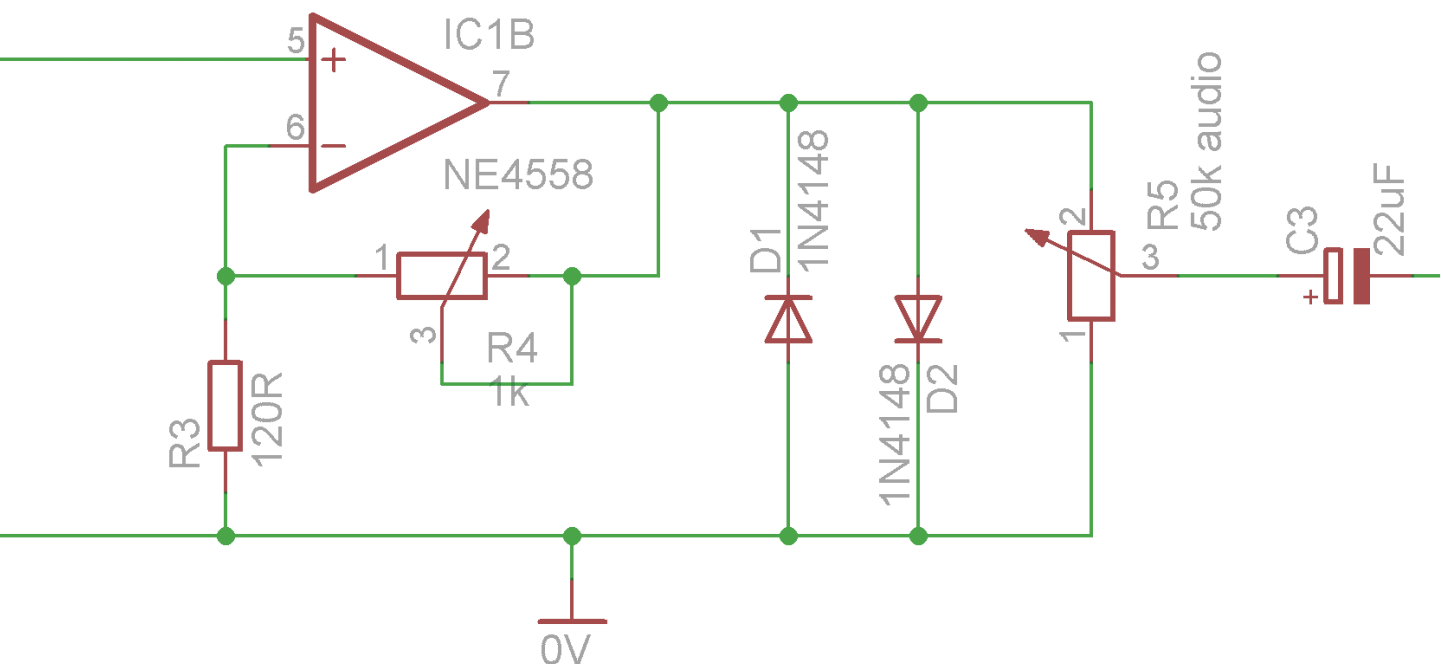
Supporting Air Traffic Control
..by separating unmanned aircraft

Author: Electronic Navigation Systems Group

In our faculty, important societal challenges are being addressed by the different research groups. A commonality between many of these challenges is that the enablers to address them are in the domain of Electrical Engineering. One type of challenge is the continuous quest for 'new' sensors, with 'new' not only being used for new ways to measure a certain property or signal, but also for significant advances in terms of size, power consumption and performance. This research is typically driven by a rather fundamental approach. Examples comprise radars that operate at much higher frequencies and sensors that can detect even minute changes in the environment.

Another type of challenge (that is characteristic for the research project described in the main part of this article) is to provide information that meets a specific set of performance requirements which cannot be met by a single sensor. Addressing such a challenge requires an approach in which knowledge about the potentially available sensors and their properties is combined with an intimate understanding of the possibilities and limitations of data integration.

In contrast to the more fundamental research, this is research at the systems level. Furthermore, if the goal is to use the resulting data to provide operationally relevant information, additional challenges comprise the design of the data presentation concept and the algorithms needed to realize it. The multi-disciplinary nature of these challenges characterizes the research that is performed within the Electronic Navigation Systems group of our Faculty. Before a recent M.Sc. research project is provided as an example, some background information about the overall challenge being addressed in the area of unmanned systems is provided.

Unmanned Aircraft

For the past 10 years, there has been an enormous increase in the use of unmanned aircraft. In terms of airframe design, propulsion and aerodynamics, the state-of-the-art is such that it is possible to construct air-vehicles that fly at altitudes even above 40.000 ft, can stay in the air up to 48 hours without refueling, and carry a significant amount of payload. With the tremendous increase in overall flying hours, there is sufficient statistical data available to support the claim that the reliability of several types of unmanned aircraft has caught-up with other military aircraft. From this perspective, it should become possible to fly unmanned aircraft above populated areas (i.e. we shouldn't be overly concerned that due to some failure they suddenly fall out of the sky).
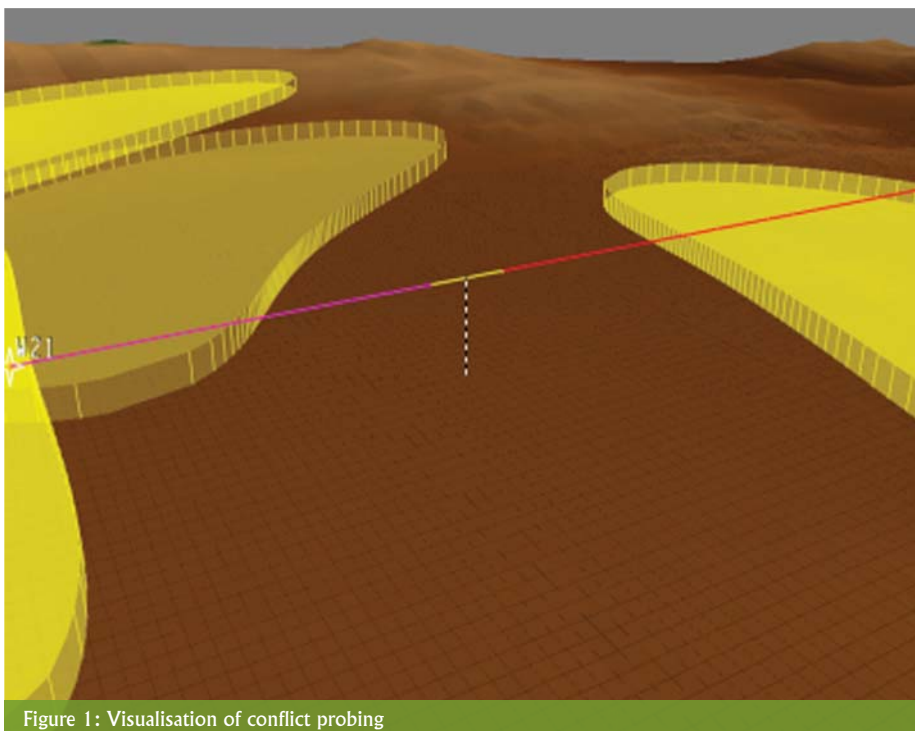

Figure 1: Visualisation of conflict probing

Although by far the largest amount of missions is flown in the context of military operations, other types of applications have been and are being introduced. Examples comprise border patrol and surveillance of areas that suffered from a disaster such as an earthquake, forest fires or a tsunami. Operators such as UPS are investigating the possibilities for unmanned cargo aircraft in the intermediate future.

However, at present the biggest constraint to the operation of unmanned aircraft is that they are not allowed to share the controlled airspace used by commercial aviation. To fly an unmanned aircraft through this airspace, it must be closed to other air-traffic. As long as this limitation exists, the use of unmanned aircraft will remain impractical for all applications that require regular access to the controlled airspace.

A (R)evolutionary change?

This situation will not change until it has been proven that (properly designed and equipped) unmanned aircraft can safely share the airspace with manned aircraft. Clearly, such a transition will not happen overnight. It will have to be preceded by carefully designed and executed demonstrations and evaluations in which one or a few unmanned aircraft will be allowed to share the controlled airspace with other traffic. It is expected that in the beginning, as an additional safety precaution, air traffic control will require an extra large buffer (referred to as a separation) between unmanned aircraft and manned aircraft.

Whereas the development of reliable, high performance airframes for unmanned operations is a typical challenge for the domain of Aerospace Engineering, the challenges associated with airspace integration are mainly in the domain of data acquisition and integration, data distribution and data presentation. These lat-

Figure 2: Jack de Vries maneuvering a simulated UAV along other traffic using the EWI designed conflict probes

ter challenges can be far more effectively addressed if the results of innovative research in these areas are already exposed to future end-users in an explorative phase. Both the challenge and the opportunity to cooperate with the future end-users were recognized several years ago. In 2009, the dean of our Faculty together with the dean of the Netherlands Defense Academy and the Commander of the Air-Operations Control Station in Nieuw Milligen (AOCS-NM) signed a covenant to emphasize and further strengthen the ongoing cooperation in the area of UAV airspace integration research.

Figure 3: Tom Verboon giving his thesis presentation

During the past years, both researchers and students from our faculty have explored and implemented new concepts to support the (ground-based) pilots of unmanned aircraft and air traffic control. As a result of the cooperation, it has been possible to demonstrate and test these concepts at the AOCS-NM in a very realistic environment. Several international 'best paper' awards were received for this research, among which 'best of conference'. The most recent innovation is the result of the research performed by EWI student Tom Verboon, who in the context of the Interfaculty Specialization Profile Avionics investigated, implemented and demonstrated a new concept to support air traffic control. This work was particularly focused on enabling an evolutionary transition to the integration of unmanned aircraft into controlled airspace.

Innovation@EWI

Based on results of research performed by previous Avionics students, Tom investigated whether it is possible to integrate the so-called conflict probing concept into an existing traffic and fighter control system used at the Air Operations Control Station in Nieuw Milligen. A multidimensional (spatial) conflict probe yields a specification of the volumes that, if intersected, will result in a loss of separation. The direct visualization of the airspace that must be avoided makes it intuitively apparent what the options are to remain safe (figure 1). The computation of the conflict space requires a conflict prediction for the current path of a vehicle and also for changes to the current path, i.e. turning left or right and in case of an aircraft also climbing or descending.

Although the idea was already proposed in 1971 in the context of a new nautical navigation display, the available computer performance was prohibitive at that time. In 2004, researchers from Rockwell Collins speculated that it would become feasible with the next generation of Avi-

onics. In 2008, Jochum Tadema, a PhD student from our faculty, realized and evaluated a first prototype concept and demonstrated its superiority relative to existing displays that support the pilot in maintaining separation.

After the successful demonstrations to experts and interested parties, including the former Staatssecretaris of Defense Jack de Vries (figure 2), we started to hypothesize that the concept also may have merit for the support of air traffic controllers, which led to the question whether it would be possible to realize a prototype to evaluate this. Several good arguments were provided why it wouldn't work.

The most obvious one was that the concept was designed for the task of maintaining separation between one particular vehicle (the UAV under control) and the other traffic. In contrast, the job of an air traffic control is to maintain separation between all traffic, hence using conflict probes would lead to a severely cluttered air traffic control display. Another relevant argument was that in order to evaluate the concept, we would need to implement it on a system that the air traffic controllers are used to work with.

Given the legacy systems in use at the AOCS-NM and the fact that only with a certain NATO clearance it is allowed to work on the software of these systems, adding a conflict probing function to the existing software was deemed infeasible with the available resources. Finally, even if it would have been possible to modify the existing software, it was highly questionable whether the systems would have sufficient spare computing power to deal with the computationally intensive probing calculations. A good property of EWI students obviously is to never believe something cannot be done and go beyond what others think is possible. Hence, given all these excellent reasons why not to pursue this any further, we were especially motivated to demonstrate the feasibility and potential advantages of conflict probing on a legacy system.

Approach & Results

Rather than pursuing an integration of the probing functions into the existing system, the idea to independently compute the conflict space, and digitally combine the resulting image with the air traffic control display was proposed. Challenges comprised the realization of an interface to obtain the data from the

Figure 4: The AOCS system, enhanced with Tom Verboon's ATC conflict probes

radar trackers, the realization of a conflict probing function that uses the data from the radar tracking system, and the generation of a probe image that is conformal to the map projection used on the existing ATC system. Specific questions concerned the amount of uncertainty in the position and velocity data from the radar tracker and its impact. These questions were addressed using a rigorous analysis of over 2.5 million track updates from the radars, and solutions based on dynamic thresholds were designed to mitigate effects of too large uncertainty.

The initial plan to realize the envisioned demonstrator was briefed to the Knowledge and Innovation Center (KIC) at the AOCS-NM in June 2011. After this briefing everyone involved agreed that the idea seemed both feasible and promising enough to pursue. With the excellent support from the KIC, every hurdle was tackled. On March 16, 2012, the first tests were performed in which the conflict space was computed using actual (recorded) radar and tracker data and a simulated UAV. After the successful completion of this test, the concept was later demonstrated using live traffic data and a simulated UAV.

Demonstration

On April 26 this year Tom Verboon presented his M.Sc. research. Given the relevance of the innovation and the fruitful cooperation, it was deemed more than appropriate to do this at the AOCS-NM. At this location it would be possible to demonstrate the results in the real environment, using live traffic data. Many students, relatives and friends had to rise very early in order to arrive at 9:30h AM at the base in Nieuw Milligen. After the successful presentation and demonstration, the committee had a final discussion with Tom about his research in the office of the commander of the base.

Next steps

Now that the feasibility of the concept has been demonstrated in a near-operational environment, the next step is the systematic evaluation of the concept in order to determine both advantages and the existence of drawbacks. Such an evaluation goes beyond the mere man-machine aspects and will comprise an analysis of the potential trade-offs between look-ahead time and sensor uncertainties in relation to false alarms (i.e. unnecessarily commanded maneuvers to prevent loss of separation). Students who are interested

in such a topic are welcome to stop by the ENS group to learn more about possibilities in this area. The abstract that Tom has submitted about his M.Sc. research to the IEEE / AIAA Digital Avionics Systems Conference has recently been accepted and in October this year Tom will travel to Williamsburg in Virginia to present his work to an international audience.

Another Avionics student, Maarten Kastelein, is currently investigating how an extension of the probing concept, so-called implicit maneuver coordination, performs in case of multiple intruders and what the requirements in terms of data are. If successful, this will allow a specification of a conflict prevention strategy that yields complementary maneuvers without requiring communication between the different aircraft involved in the conflict, thus eliminating a critical failure mode.

Conclusion

Challenges such as the safe integration of unmanned aircraft in controlled airspace require innovative approaches, many of which find their enablers in the EE domain. Key ingredients to solutions in this context are both national and international cooperation, and students who see impossible as a challenge instead of a limitation. In our faculty we are fortunate to have these students since they enable us to obtain and maintain an international recognition of excellence, as evidenced by the many awards for both student papers and papers from faculty members.

Acknowledgements

For more information on the joint EWI-NLDA-AOCS UAV research see: *www.uav.nl*

Figure 5: The final thesis discussion in the airbase commander's office

Activities of the ETV
## Excursions and lectures

Trip to KEMA
Author: Imke Zimmerling

After a journey to the city of Arnhem we had to do some searching for the right place to be on the site of KEMA. Finally we could directly have some lunch, together with a group of students from "Gezelschap Leeghwater", who also wanted to take a look at KEMA. We were accompanied by some old friends, who recently left our university and now work at KEMA and some other staff. The first interesting conversations arose. When everybody had finished lunch we first heard some talks about the different working fields of the consulting part of KEMA. These include in the field of electrical engineering among others High-Voltage DC transmission, EMC calculation, the construction and planning of energy grids and components and advising companies in all questions around energy distribution, transmission and sustainability. Most students knew KEMA from its famous "KEMA keurmerk". But as we learned, KEMA has recently sold this part of the company to the German DEKRA company.

The next part of the visit was a tour to the laboratories of KEMA. This part of the company, located at the other side of the road, mainly tests high voltage components for external costumers. Companies from all over the world come to the laboratories in Arnhem to let the engineers test their equipment and get the certificate that says "tested by KEMA". We are allowed to take a look in the High Power Laboratory, which is the biggest of this kind in the world. There is also a modern High Voltage Laboratory that has been opened just some years ago. The newest laboratory is the Smart Grids laboratory, here the grid is going to be simulated, especially the impact of new technologies on the grid. As we know the energy grid is about to change and get smarter and more intelligent. This includes the introduction of more power electronics into the system. The consequences of these changes are discovered in this new laboratory.
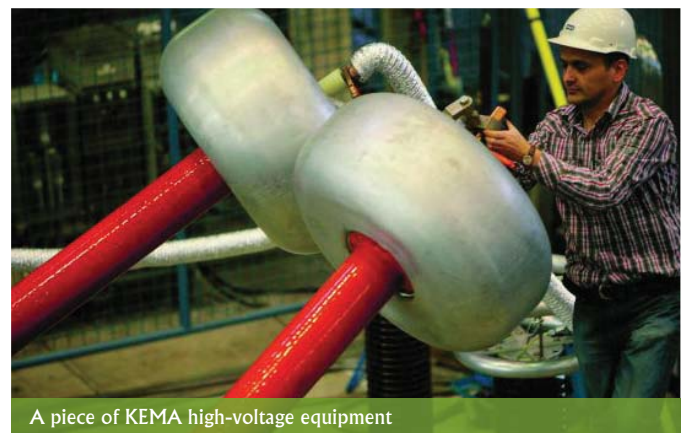
A piece of KEMA high-voltage equipment

On the site we also see an impressive truck, used for onsite testing, another service KEMA offers. The testing area is located directly at the waterside. This is for practical reasons: Transformers, one of the main components that is tested in the High Power Laboratory, often are transported on ships because they are very heavy. In Arnhem it is even possible to test the transformer while it remains on the ship on the water.
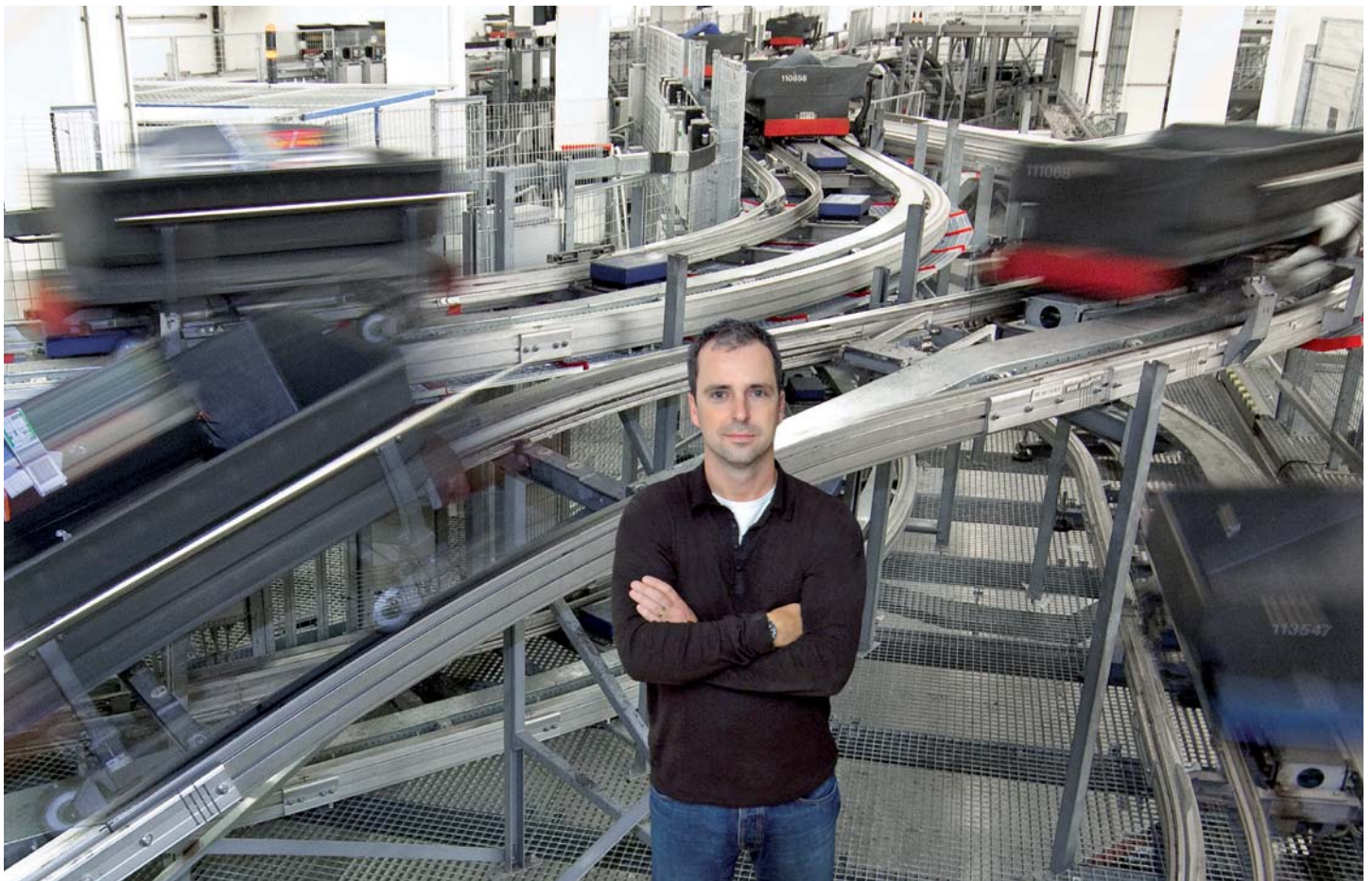
After the tour we joined the mechanical engineers again and talked over some drinks and snacks.

Lunchlezing Movares
Auteurs: Nina Beschoor Plug en Kevin van der Mark

Ook een gefrustreede student die zich afvraagt waarom onze winterregeling zo slecht is? Dan was afgelopen lezing van Movares iets voor jou! Tijdens deze lezing, gegeven door Harm van Dijk, werd uitgelegd dat Movares een advies- en ingenieursbureau is. Zij hebben in Nederland meer dan 1400 werknemers en werken samen met Duitsland en Polen. Movares is voor het spoor in Nederland heel erg belangrijk voor de detectie van treinen. Voorbeelden van verschillende manieren ervan zijn block detection, passage detection, electromagnetic, mechani-cal, etc. Ook verhelpen zij problemen die daarin voorkomen en verzorgen interfaces zoals ERTMS (European Rail Traffic Management System). Harm van Dijk, die zelf een bachelor elektrotechniek heeft gedaan, werkt al bij Movares sinds 1993. Hij is hierbij onder andere gespecialiseerd in veiligheid van het spoor en alle systemen, detectie van treinen, en interfacing technology. Heb jij interesse in het engineeren aan het spoor? Zoek het dan maar snel op!

Tie before you Die
Technology in Dutch culture

Author: Paul Marcelis

EESTEC is an organization of and for Electrical Engineering and Computer Science students in Europe. The aim is to promote and develop international contacts and the exchange of ideas among students of EECS. The association achieves its aim through organizing workshops, introducing them to the industry and the educational system of other countries, but above all to each other.

Delft was already present in 1963 when Eurielec, the predecessor of EESTEC, was founded. Eurielec also organised exchanges and workshops. The first Eurielec congress was held in Delft and the first chairman of Eurielec was also from Delft. Unfortunately contact faded during the 70's and 80's. This was the reason the Eurielec project was ended and EESTEC was founded in 1986.

Nowadays EESTEC International is seated in Delft. While a long time ago the Dutch were really active in EESTEC, the involvement of LC Delft has been quite to a minimum the last years. For Local Committees it's obligatory to organize one workshop every two years, and that's what Delft did.

Since this year however the added value of EESTEC to the ETV has been rediscovered and the mentality has changed. This year's board wants more participants from Delft to events and wants Delft to organize an event every year!

The first aim has already been achieved. This year, five members of the ETV has been to an international event of EESTEC, where last year there were practically none. But that's not important right now, because we also organized our first workshop in two years: Tie before you Die!

Since Delft is very renowned in EESTEC, our workshop was looked forward to. In de end, only 12 participants were selected for our workshop. These participants

Everyone say TIE!

where European students, member of another Local Committee. It would be an event with both educational and cultural activities.

The workshop started at April 22th, when all the participants arrived by plane or car from all the corners of Europe. After they arrived, they were introduced to their host or brought to the host with the Board's limousine. In the evening the ate with the host and after, all the participants gathered to have a drink in the Kobus Kuch.

After the arrival day, the workshop really started. It wouldn't be interesting for you to read a list of all the activities, so I'll only highlight a few. On Monday we only had some introduction to the faculty and Delft, but Tuesday we went to Amsterdam. Here we saw the highlights of the city, ate herring and experienced what the city had to offer.

The main activity on Wednesday was a case study at Omron. They showed two ways of project and team management, Agile Scrum and Lean. Applying these ways of project management would improve project efficiency a lot. In the evening we went to the party 'Boer zoekt Hoer' in Leiden.

Thursday was a cultural day to get the participants familiar with Dutch culture. This was done by visiting a farm, going to the Keukenhof and having a barbecue in the evening. After diner we went to a party at the DSB, where all the participants could enjoy the sounds produced by the Als Je Maar Kaal Band.

To conclude the workshop, we organized a day of Dutch technology on Friday. We visited two delta works: the Maeslantkering and the Haringvlietdam. While some

The colourful keukenhof

Fierljeppen

Menno and Maja in the Keukenhof

At Omron we played with LEGO to learn about the LEAN manufacturing progress

participants were still tired of the rest of the week, most of them were dazzled by the vastness of the delta works. In the afternoon, Rotterdam was visited and to conclude the workshop we had prepared an international night at one of the organizers house, where all participants brought their country's specialties. At 6:00 AM, the last participant finally left the party and thereby closed the workshop officially.

Luckily, ETV members do not have to wait another year to relive EESTEC. Of course Delft is not the only Local Committee to have an event for students from all over Europe. Almost every week an event takes place in cities like Athens, Belgrade, Riga or even Istanbul. The magic behind EESTEC is, visiting a workshop abroad is totally free! If you'd like to know more about having fun all across Europe, drop by the ETV!

Byte Me!
Avonturen van de 106ᵉ Dies Natalis

Een aantal weken geleden (van 7 t/m 16 mei) zijn de Diesweken van 2012 geweest. Dit waren geslaagde weken met veel leuke activiteiten waar leden aan mee hebben gedaan. Hier lees je een verslag van de Dies 2012 met als thema 'Byte Me'.

Maandag 7 mei

waren de veiling, de receptie en het dies-etentje. Tijdens de veiling hebben veel leden en niet-leden leuke gadgets gekocht. Ook dit jaar zijn er weer veel oscilloscopen verkocht tegen mooie prijzen. De receptie heeft gezorgd voor hilarische taferelen met een immer kaal bestuur, deze gezelligheid ging door tijdens het diesetentje met als enige minpuntje dat een deel van het bestuur hier schitterde in afwezigheid.

Dinsdag 8 mei

was het tijd om lekker bij te komen van de receptie in het tikibad. Twee uur later dan gepland door de just-in-time trainingen voor de eerstejaars kwam een delegatie ETV'ers het tikibad onveilig maken. Na eerst elke glijbaan geturfd te hebben was het tijd voor de groepsfoto. De foto moest en zou natuurlijk een onderwaterfoto worden, dit heeft naast allesbehalve een groepsfoto toch geweldige foto's opgeleverd.

Woensdag 9 mei

werd er gesport door Delft met de ETVenture en werd er lekker genoten van vlees en pils tijdens de altijd gezellige barbecue. Een lage opkomst op de ETVenture heeft dit geen minder mooie activiteit gemaakt. Met bikkelen op een "stormbaan" en een heuse speurtocht door Delft zijn de deelnemers tot het uiterste gegaan. Zij kwamen bezweet maar voldaan aan op de barbecue waar velen hun buik rond gegeten,

en gedronken hadden. Uiteraard werd de avond afgesloten met nog meer bier in de /Pub.

Donderdag 10 mei

was het de eer aan de Jaarboekcommissie om een mooi jaarboek uit te reiken, en werd er mooi en minder mooi meegezongen met de beste meezingers in de karaoke. De jaarboekuitreiking werd zoals altijd geopend met mooie worden van de President der Electrotechnische Vereeniging. Later op de avond, terwijl elk lid van de jaarboekcommissie nog leuke serieuze verhalen aan het schrijven was in de jaarboeken ,werd de karaoke geopend door de Diescommissie. Hierna was het de beurt aan de rest, de

hele avond is er dan ook onophoudelijk 'gezongen'. Van Blof tot Guus Meeuwis en van de 'Bohemian Rhapsody' tot 'Ring of fire', zo'n beetje elk lied kon gekozen worden. De karaokeavond ging dan ook tot de late uurtjes door met de nodige weggeslagen biertjes als gevolg.

Vrijdag 11 mei

was het lekker genieten van een lekkere lunch tijdens de picnic, door het minder mooie weer was het echter noodzakelijk om de picnic te degraderen tot een ondergrondse /Pubpicnic. Dit heeft er echter niet voor gezorgd dat het eten minder lekker was, er werden dan ook de nodige broodjes ETV en kroketten gege-

De Diescommissie bijt de spits af

ten. Het was de ideale afsluiten van een zeer geslaagde eerste week van de Dies.

Maandag 14 mei

werd er rondgescheurd door de Uithof met het karten. Waar het voor sommigen moeilijk was om recht op de baan te blijven, was het voor anderen een battle om de snelste tijd neer te zetten. Uiteindelijk is de snelste tijd gereden door Lennart Boeke. Ook werd van een aantal hun gevaarlijke rijstijl duidelijk door glijdend door de bochten te gaan en elk gaatje in te duiken. Natuurlijk werd er na het karten een biertje gedaan bij de uithof.

Dinsdag 15 mei

was de tijd daar voor ETV'ers om te laten zien hoe goed zij kunnen klussen in de klusstrijd. De opdracht van dit toernooi hield in om iets te bouwen met LEDjes.

Deze bouwwerken zijn na een dag klussen bekeken door een vakjury met onder andere ons eigen erelid Lou van der Sluis. Uiteindelijk zijn hier 3 compleet verschillende gadgets uit voort gekomen. Een supermooie 'renewable energy' project met een zonnepaneeltje en een windmolentje welke er met de eerste prijs vandoor ging, een fantastische grote wisselbeker. Op de tweede plaats was geëindigd een doosje met 3 ledjes en 3 switches waarmee een uitdagende puzzel gespeeld kan worden. Als derde eindigde het bestuur met een originele windblazer. Tenslotte waren er ook 2 projecten die op het laatste moment net niet hebben kunnen opbrengen om iets in te leveren. De klusstrijd gaat zeker een terugkerende activiteit worden!

Woensdag 16 mei

brachten we een bezoekje aan aquatopia, Antwerpen en de Duvelbrouwerij met het buitenlanduitje. Wat ook niet verge-

ten mag worden is dat we ook een lange tijd hebben doorgebracht in de Kwibus wat het buitenlanduitje nog leuker en bijzonderder maakte. Bij aankomst in Antwerpen zijn we als eerste aquatopia binnen gegaan en hier direct de wc bezocht. Aquatopia was verassend leuk en dit komt niet op de laatste plaats door de alcohol die door ons bloed stroomden. Na de aquatopia was het tijd om een rondje Antwerpen te doen, als echte elektroërs zijn we uiteraard allemaal beland bij de mediamarkt dan wel saturn. Als leuke afsluiter van een zeer geslaagde dies zijn we bij de Duvelbrouwerij langsgegaan. Hier hebben we een bijzonder leuke rondleiding gehad van een zeer gepassioneerde brouwer die wist waar hij over sprak. Tenslotte hebben we de mogelijkheid gehad om lekkere speciaalbiertjes te proeven die bij duvel gebrouwen zijn.

Onderwijsupdate
Het nieuwe curriculum per 2013

Auteur: Bas van Wee, Commissaris Onderwijs ETV

Nog geen twee jaar geleden is de nieuwe Bachelor voor Electrical Engineering ingevoerd. Nu wordt er weer druk gesleuteld aan een nieuw curriculum dat ingevoerd zal worden in 2013. Als je de bachelor voor 2013 niet hebt afgerond krijg je te maken met het nieuwe curriculum. Dit geld zelfs voor de nominaal studerende studenten.

Zoals je wel weet is er in 2011 vanuit de overheid de Halbe-heffing ingevoerd. Dit is een boete voor studenten die langer studeren dan nominaal plus één jaar. Om te zorgen dat het onderwijsprogramma studeerbaarder wordt is er in hetzelfde jaar vanuit het College van Bestuur een rapport opgesteld. Dit rapport, Koersen op Studiesucces, bevat een aantal verplichtingen en adviezen waaraan een studieprogramma moet voldoen in 2013.

Om aan dit rapport te voldoen zal er een nieuw curriculum ingevoerd moeten worden. Aan het begin van het collegejaar zijn er daarom op de faculteit EWI vier werkgroepen opgericht om advies uit te brengen om het rapport Koers op Studiesucces zo goed mogelijk te implementeren. Het voornaamste wat hier naar voren kwam is dat er meer persoonlijke begeleiding moet komen, meer formatieve toetsen, minder herkansingsmogelijkheden en een variatie aan werkvormen. Deze adviezen worden verder meegenomen in de drie curriculumcommissies. In de curriculumcommissies word er per studie een nieuw programma ontworpen dat voldoet aan de eisen van het rapport en gebruik maakt van de adviezen.

Bij Electrical Engineering wordt er zoveel mogelijk getracht om het programma dat twee jaar geleden ingevoerd is om te vormen naar de eisen van het CvB. Op dit moment ligt er een concept voor de nieuwe modulekaart ter goedkeuring bij het centrale bureau voor Onderwijs en Studentenzaken. Om deze reden kan ik nu ook nog geen concept laten zien van het curriculum. Er zijn namelijk enkele punten waardoor het concept niet goedgekeurd kan worden. Op de modulekaart staan vakken kleiner dan 5EC (volgens het rapport moeten vakken/modules minimaal een grootte hebben van 5EC) en worden er meer dan 3 vakken parallel aangeboden - iets wat volgens het rapport ook niet mag. Er is voor gekozen om niet aan de richtlijnen te voldoen omdat we de EPO-projecten willen behouden in zijn huidige vorm, met als argument dat het project de theoriekennis gebruikt en verbreed. Anders zou het EPO-project verdeeld worden over de theorievakken en dit maakt het curriculum erg onoverzichtelijk.

Wat verandert er voor jou? In 2013 wordt het nieuwe curriculum in alle drie jaren tegelijk ingevoerd. Begin van het volgende jaar worden de overgangsregelingen gepubliceerd. Zorg dat je op tijd gaat kijken naar welke vakken je mee kan nemen in het nieuwe curriculum en ga eventueel langs de studieadviseur. Zorg dat je niet voor verrassingen komt te staan!

How do you create a logic gate using just 24 silicon atoms?

Join ASML as an Electronics Engineer and help push the boundaries of technology.

As one of the world's leading providers of lithography systems for the semiconductor industry, we bring together the most creative minds in science and technology to help produce increasingly cheaper, faster and more energy-efficient microchips.

For the past 25 years, we've been helping to realize Moore's law. Now we want to go even further: to enable the tripling, or even the quadrupling of chip-feature density every two years. That's why we need talented Electronics Engineers. People who can, for example, increase the speed and the precision of our systems integration, and thereby enable future logic gates no bigger than a few silicon atoms. It's just one of the many electronics challenges at ASML. And there are countless more – all targeted at achieving more than Moore's prediction.

If you're up for these challenges, we'll put you in a multidisciplinary team and give you plenty of freedom to experiment and learn new skills. What Moore could you want?

www.asml.com/careers

ASML

For students who think ahead