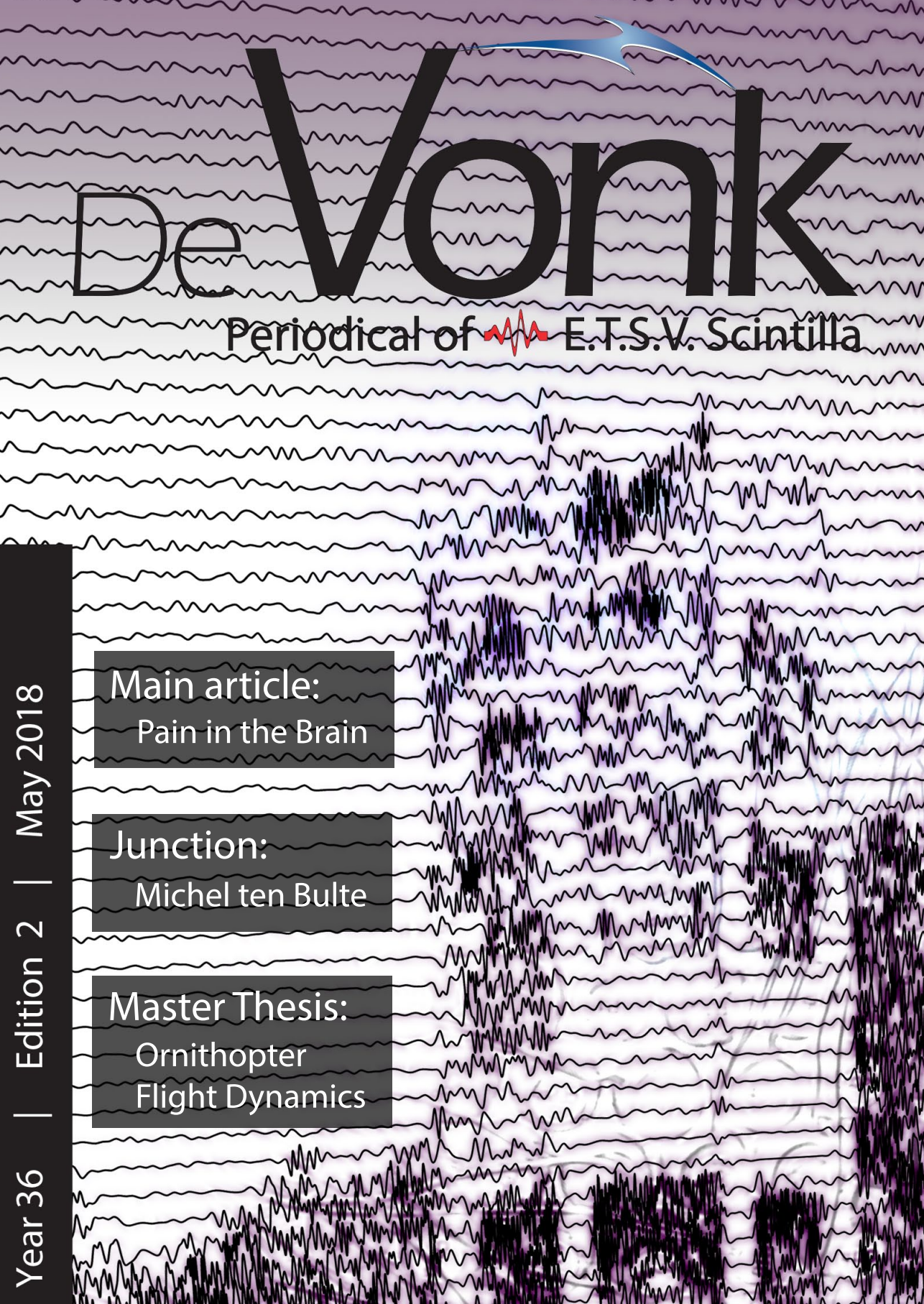
De Vonk

Periodical of E.T.S.V. Scintilla



Main article:
Pain in the Brain

Junction:
Michel ten Bulte

Master Thesis:
Ornithopter Flight Dynamics

Year 36 | Edition 2 | May 2018

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Presidential Note

Author: Koen Raben

Do you ever feel like a plastic bag running in the wind? Only then instead of plastic you feel more like Jabba the Hutt after being strangled. That's how it feels after running the Batavierenrace. Feeling those endorphins running through your body and hearing the loud cheers of the supporters does however give a sensational vibe to this. You always start in a good mood, thinking you can do this! This is what you have trained for that one time, now comes the time to shine! And then you shine! ... For like the first 500 meter. After that, it is just surviving, pulling yourself together and showing everyone that even though you are an electrical engineer, you can do sports!

And this years edition was a special one! How? I don't know yet, because as of writing this piece, I haven't actually ran it yet. But I'm sure it will be a sight to behold!

Another thing that is special is the way how time has the ability to fly. Because the time between my last presidential note and this one seemed to have gone by like beer during a cantus. And in the meantime we as a board have done our best to keep the association running and thriving. With notable activities as the Skitilla ski trip and the prom as highlights between all the other activities that were held.

And now our time is slowly coming to an end. But in these last months when the weather is getting better and nature is starting to flourish with new life, Scintilla will also be blessed with little lambs called candidate board members. These lambs will happily start jumping around and being cute. Additionally, the Scintilla room has been improved by the coming of various lovely plants. The mood rises like the oxygen in the air. And together with those little lambs and little plants we have the pleasure of seeing our association shine in all kinds of activities that are left this year. Because now comes the times of barbecues and bonfires, when people try to get the last study points of the year while also having more important things to drink. But of course there are also more serious activities that you can join, like the cantus or the annual scrapheap challenge! So I would suggest that you take your time to enjoy yourself and join one of the many festive occasions, because there is only one summer every year!

Dames en heren,

Op de koningin, op Scintilla!

Koen Raben, President of the 88th board of E.T.S.V. Scintilla

Masthead

De Vonk

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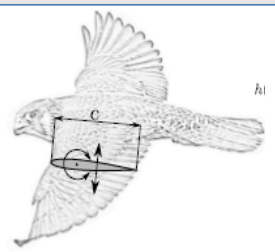
08 Main Article

BSS

BSS wrote a article about pain. We know you might have some headache now from al the studying, so quickly go to page 8 to find out more on pain diagnostic tools.

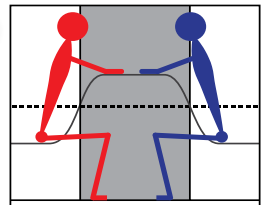
23 Master



Steven Gies did his master thesis with Clear Flight Solutions. Here he did measurements and analysis of the Robird's Flapping Wing. More about this can be found on page 23.

Junction 20

This time we have the amazing Michel ten Bulte in our junction! Go quickly to page 20 to find out more about the life of Michel.



Education 36

Stef will tell you more on how to get your opinion heard in the UT councling. Also more information on the higher hierachy is given. Learn more and go to page 37.

Editorial

So it is Wednesday evening and I am in the Scintilla Room once again. After some refreshing drinks and some warm food, I got the honour to write the Editorial.

So I started this evening with some spellchecking so other could do the layouting. I hate layouting, so I just will not do that. After spellchecking I got to do something fun! Go through all the photo's of the last activities and see whether there are some beautiful pictures of members. I always have a nice time picking photo's. However, Lynn also hates layouting so she started putting the photo's in InDesign.

And that is why I am writing this. Because everyone else is busy. Mark is layouting the Scintilla activities; Wim is layouting News and Jippe is Jippe so probably he is doing something useful.

You might think, I miss some people.. That is true.. Guus is at home relaxing because he does not love us. We did however some voting, and Guus will bake a pie for the next Vonk meeting. So maybe is looking for recipes. Maarten is trying to not look like an EE person and is being social with the hockey people. Edwin (Nahuel, but this is to difficult for me) is doing..? We do not really know, but I saw him walking today! Almost the same is true for Rik. No clue what he is doing, but he voted in favour of Guus baking a pie. For Marissa, I also do not know where she is.

So now you know enough about our layout evening to start reading the Vonk. We tried to fill it with some lovely articles you can all relate to.

With love,
Céline

News for the Electrical Engineer

Author: Maarten Thoonen

It is now practical to refuel electric vehicles through thin air

At this time, there are still a lot of practical problems with recharging electrical cars, charging stations are not that ubiquitous yet. Would they be there, they lead to street clutter and the copper makes them a target for thieves. The charging cables are also a tripping hazard. Therefore, engineers are looking for a way to wirelessly charge cars. At this point you can buy a wireless charging kit for $2500 to $4000, but it is a bit of a DIY solution and involves a loss of input power of 11%. But as of 2018, electric cars are starting to have induction pickup loops preinstalled. Toyota, Audi, BMW, Daimler, Ford, Jaguar, Mercedes-Benz and Volvo are likely to launch remote-charging-ready vehicles soon.

Not only electrical cars will start to be wirelessly chargeable. A firm plans to install a wireless charging system for container stackers in the port of Los Angeles. At this point, the charging cables may only be plugged in by electricians, which makes the vehicles expensive to operate. Another promising type of vehicle is buses. Now, electrical buses are impractical due to the long charging times. If buses can recharge at certain stops, they become a lot more feasible. At this point, wirelessly charged buses run in Mannheim, Utrecht, Genoa, Turin, Salt Lake City and a number of cities in California. More cities are expected to follow in the future, including Los Angeles. Future research is now directed at charging vehicles while moving.

https://www.economist.com/news/science-and-technology/21730623-electromagnetic-induction-gets-rid-cables-it-now-practical-refuel?zid=291&ah=906e69ad01d2ee51960100b7fa502595

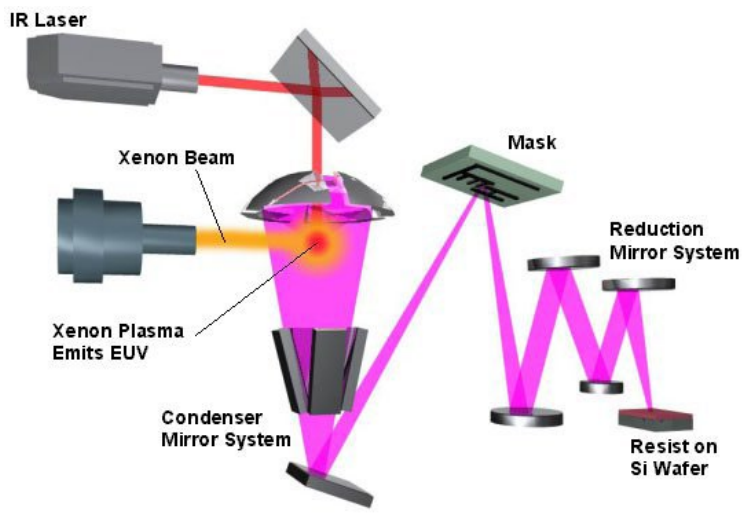


Figure 1. Setup used for 3nm lithography

The World's First 3nm Tapeout: Cadence and Imec Demonstrate Novel Lithography Techniques

Cadence Design Systems and Imec have announced the first 3nm tapeout. This allows even more FinFET transistor nodes to be implemented on one chip.

In 2015, the two companies produced a 5nm tapeout. The test chip produced is a 64-bit MCU, using a 3nm standard cell library, TRIM metal flow, and a routing pitch of 21nm. This is a big step, as making smaller transistors is a major challenge.

In other news

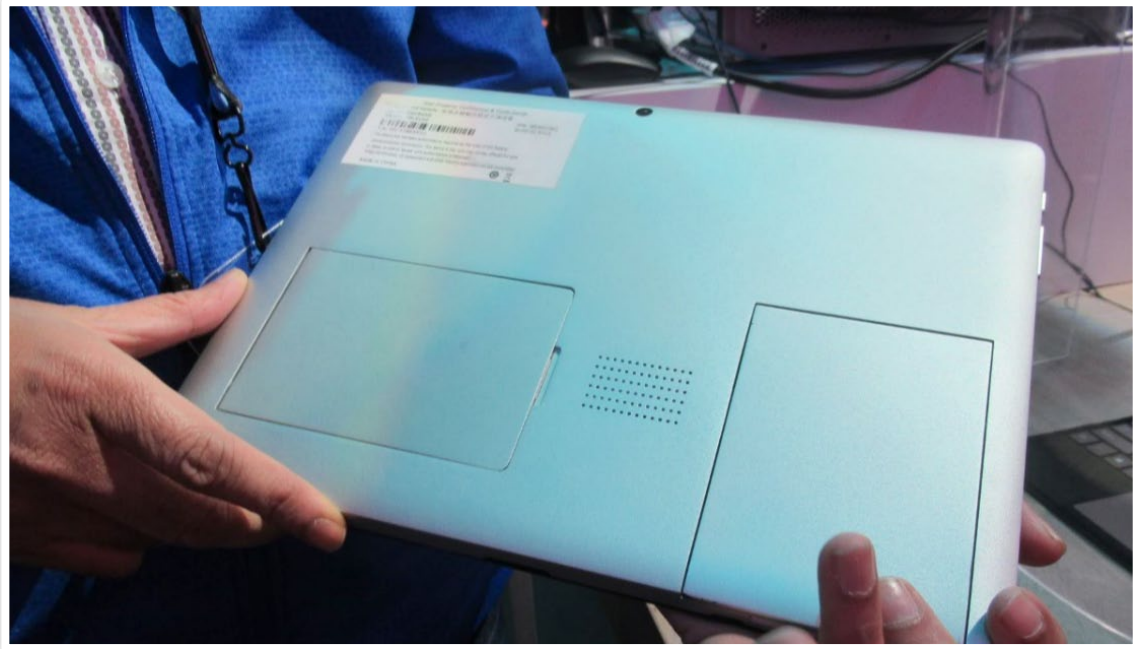


Figure 2. laptop with 2 4x4 element antennas.

Extreme Ultra-Violet Lithography is used for the tapeout. This is a lithography technique using a ultra-violet wavelength of only 13.5nm. The process still suffers from some precision problems, due to the highly specialized mirrors needed to reflect the UV light. Still, high-volume is expected by 2020. Major semiconductor companies have allotted resources to developing the method, as it is one of the more promising ways to shrink transistor sizes.

Another technique used is 193 Immersion Lithography. This means a liquid medium instead of an air gap is used between the optics and the wafer stage. Because this fluid has a refractive index greater than 1, higher resolutions are possible. The 193 in the name comes from the wavelength of the light used in the etching process, 193nm.

https://www.allaboutcircuits.com/news/world-first-3nm-tapeout-lithography-Cadence-Design-Systems-Imec/

MWC: Are Your 5 Fingers Blocking Your 5G?

At the Mobile World Congress, a lot of chips, antennas and other developments for 5G were announced. The mobile industry plans to have a network up and running by 2019. However, there are a lot of problems still.
With wavelengths in the millimeter range, there are new challenges. Not only is the strength of the signal important, the positioning is too. 5G signals are a lot more directional and suffer from much higher losses. Therefore, multi-pronged antennas have to be designed. Intel showcased a PC with 5G with two large 4x4 element antennas on the back, as can be seen in the picture. Software regulates signal reception handoff if one of the arrays is blocked. There is still a lot of research to be done regarding the best antenna configurations. They will inevitably have to compete for space with batteries.

https://www.eetimes.com/document.asp?doc_id=1333026

Pain in the Brain

Developing Diagnostic Tools for the Human Pain System

Author: Boudwijn van den Berg, Biomedical Signals and Systems

BSS

Pain affects the life of large amount of people. Almost everybody has had a period in their life in which they suffered from a lot of pain, by injuries, illnesses, surgeries or just spontaneously. Pain is not only a major physical and psychological burden for patients, but also has big economic and social impact on society. In Europe, it was found that over the range of one month 20.2% of all people suffer a form of pain. There is a big group among those people that experiences chronic pain which was shown to have a prevalence of up to 30%. Forty percent of those people indicate to receive inadequate treatment for their pain [1]. Even though it is already bad to have pain due to an injury, chronic pain is completely different in the sense that it can occur without a reason and keeps coming back. People with chronic pain often receive an inadequate treatment because it is very difficult to determine the reason of the chronic pain and which treatment could help to ease the pain. Therefore, there is a need for improved and new diagnostics of pain. To do so, we need to discover why, where and how our pain system is generating this spontaneous pain.

You might wonder what the connection is between pain and electrical engineering. Even though mental pain is one of the side-effects of studying electrical engineering, this is not the reason for writing this article. Diagnosing pain is very complicated and we need engineers to develop smart tools to make smart measurements. Challenges in our field include the development of specialized stimulation electrodes, medical-grade stimulation devices and software, recording signals of just a few micro-volts and analyzing large amounts of recorded data.

Moreover, it can be very helpful to look at the nervous system from an engineering point-of-view. Our body includes an incredibly complex system of nerves. The connections between those nerves comprise relatively simple circuits inside our tissue and spinal cord, and incomprehensibly large networks inside our brains. The combination of specialized stimulators and electrodes with mathematical techniques from statistics, signal processing and telecommunications engineering help to shed light on the properties of those networks.

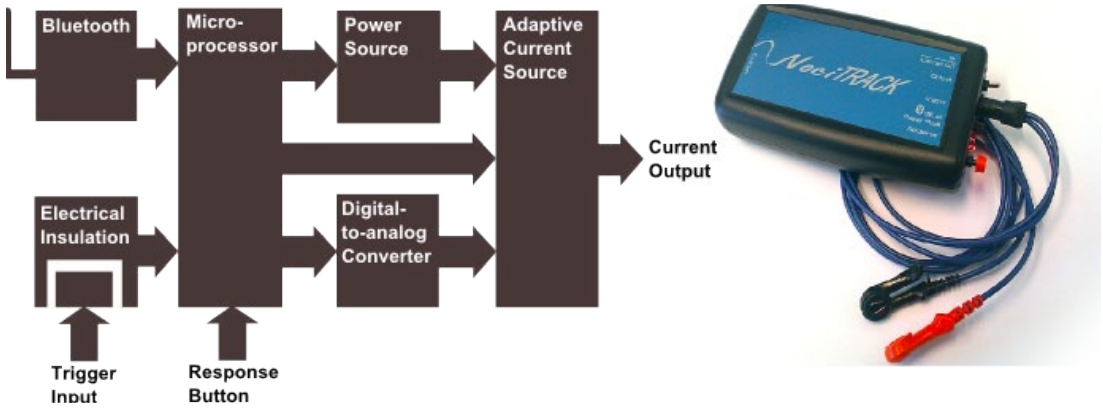


Figure 1.

Stimulation

One way to measure properties of the pain system is by determining input-output relations. To provide the pain system with an input, we use small localized electrical currents to elicit action potentials in pain-specific nerves. A major development project within our group was the NociTrack AmbuStim stimulator, which is designed to provide accurate electrical stimuli to the nervous system. Figure 1 shows a block diagram with the components of this stimulator. The stimulator has to be isolated from the power network for patient safety. Therefore, we have made a stimulator which can be used wireless in most of the cases and a trigger input which is insulated from the stimulation circuit. Furthermore, it can generate arbitrary sequences of stimuli which can be programmed and adapted in real-time via LabView, providing us with an ideal interface for adaptive testing of input-output relations. In addition, this stimulator can accurately stimulate at intensities as low as 8 uA, which allows for very specific stimulation of the neurons located most nearby the electrode. The development of the AmbuStim is still ongoing, as new features are required to improve pain diagnostics.

Even though we can accurately regulate the current pulses, we cannot simply stimulate a single input. Instead, it's input consists of billions of nerve fibers of various kinds spread out over our bodies. Generally, the fibers that provide input into the pain system consist of 3 categories (Figure 2). The largest fibers (A-beta) are responsible for the conduction of tactile signals from the skin. Even though these fibers are not responsible for the sensation of pain, they partially connect to the same pathways in the spinal cord as the pain-specific fibers. Those fibers have a smaller diameter and lie more superficially in the skin, the A-delta and C-fibers. To reduce activity of tactile neurons, which would distort the activity of the pain-specific neurons, it is necessary to stimulate the A-delta and C fibers as specific as possible.

Another practical engineering challenge is to develop electrodes for the specific stimulation ofthese nerve fibers. Development of those electrodes involves 1) choosing the structure and materials of the electrode, 2) modeling the current density during stimulation and the associated activation of nerve fibers and 3) testing and validating the sensations

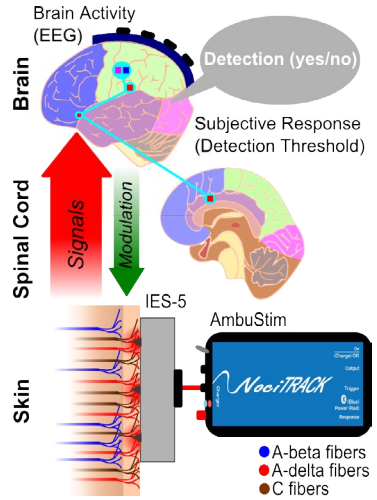


Figure 2.

those electrodes generate. One of the electrodes we developed for specific stimulation of A-delta fibers (the IES-5, Figure 2) uses micro-needles to penetrate the skin approximately 0.2 mm to come close to the A-delta and C fibers [2]. Due to the shape of the needles, the current density will only be strong enough for stimulation of nerves around the needle, excluding the more deeply located A-beta fibers. Since an electrode with needles requires sterilization, development of a needle-less electrode that is as accurate and specific as the IES-5 is a current subject of research.

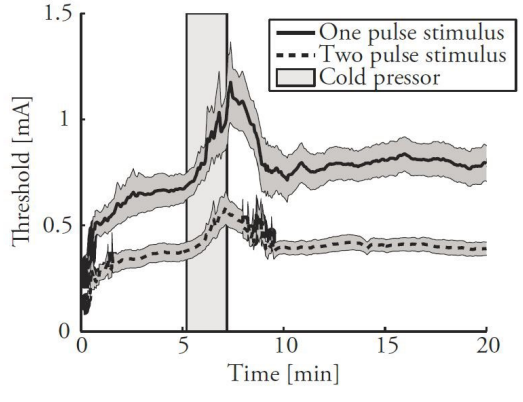


Figure 3.

Recording

It would be impossible to characterize properties of the system, if we cannot measure the output. There is a wide variety of psychophysical and physiological techniques available to measure a subject's response to a stimulus. Because we focus on the development of clinically applicable diagnostic methods for chronic pain, the method should be quick and relatively low-cost. Until recently, we have only used psychophysical measurements to quantify the output. The field of psychophysics studies the properties of stimulus perception. Our

mind is a very advanced classification system and can perceive a wide variety of stimuli: it can distinguish around a million colors, subtle tactile sensations and very low electrical currents in the skin (as small as 0.05 mA), which we use in our research. In the case of pain, the classification of your mind will differ with respect to the input it receives from the spinal cord. Therefore, by measuring the probability of your decision with respect to the stimuli, we can also observe changes in the processing of your spinal cord. One of the methods we developed used a sequence of randomized stimuli to track changes of the subject's detection threshold over time. The detection threshold is the stimulus intensity at which 50% of the stimuli is detected, and is very sensitive to changes in the pain system, such as learning, medical interventions and external inputs to the system, such as from tactile or thermally sensitive neurons [3, 4] (Figure 3). The clinical applications of this technique are currently further researched and developed in the hospital in cooperation with anesthesiologists.

Even though tracking of the detection threshold has proven to be very insightful in studying several processes within the pain system, we are still looking for ways to obtain more specific and objective measures of pain. One way to acquire objective measures of sensation is by measuring the brain activity associated with stimuli. Due to enormous advances in brain research, which are mainly attributable to engineering, various techniques (PET, fMRI, MEG, EEG) are available to have a look inside the black box which is our brain. To observe electrophysiological activity with a high temporal accuracy we can use magnetoencephalography (MEG) and electroencephalography (EEG). While MEG is temporally accurate and provides a higher spatial resolution than EEG, it is only sensitive to activity of tangentially oriented neurons, while pain elicits activity in both radially and tangentially oriented neurons. Therefore, we use EEG to assess brain activity with respect to pain, which provides a good trade-off between temporal and spatial accuracy besides being relatively low-cost and easy-to-use [5]. By analysis brain activity with respect to stimulation, we can measure one step earlier in the system: the neural activity that advances stimulus detection.

Analysis of Brain Signals

In an EEG recording, we attempt to measure the activity of a small subgroup of neurons with respect to a stimulus from the surface of the scalp. As you can imagine, the signal will be very small, and the amount of noise and unrelated background activity very large! Therefore, the EEG signal offers very specific challenges in terms of processing, analysis and interpretation. Using signal processing techniques from electrical engineering and mathematics, we can filter relevant signals from this bulk of activity.

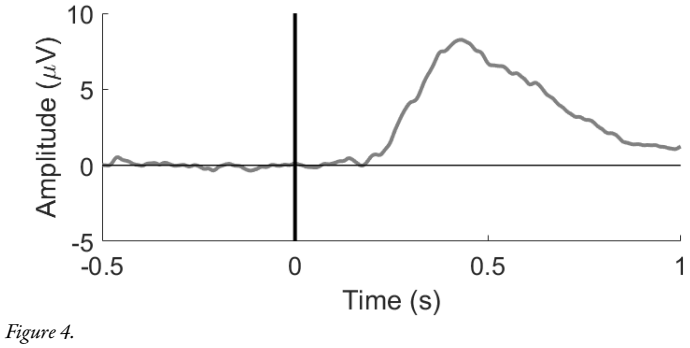


Figure 4.

To understand the difficulties associated with analysis of the EEG signal, we should start at the source-level. The outer layer of the brain, the cortex, consists of many billions of neurons, each creating a small dipole field when they fire. When millions similarly oriented neurons fire synchronously, they might generate a local potential that is sufficiently high to be measured by EEG. The shape of the potential field created by those neurons will depend on their orientation. However, activity of a neuron is not necessarily related to an event: local groups of neurons can be connected to one or multiple neural networks within the brain, which communicate with other networks by generating an oscillating potential field. This means that, no matter how much you constrain your experimental conditions, there will always be a tremendous amount of background activity.

Signals related to the stimulus consist of a transient change in the potential measured by EEG (Figure 4) as well as modulations in the frequency domain. Transient changes in the potential typically have an SNR of 0.01 to 0.3, depending on the electrode position, and frequency modulations even lower. We can estimate the true signal by averaging a large amount of the same signals. This can be done by applying the same stimulus a large amount of times and measuring the associated EEG activity. If the measurement includes a range of continuous variables, the averaging is done over bins of those variables. One can imagine that, if the number of samples in a bin is low, the fit will be of poor quality: the power of the background activity scales with 1/n with respect to the number of samples.

We are currently working on the development of more sophisticated analysis methods. In our measurements, a large variety of stimulus types and amplitudes

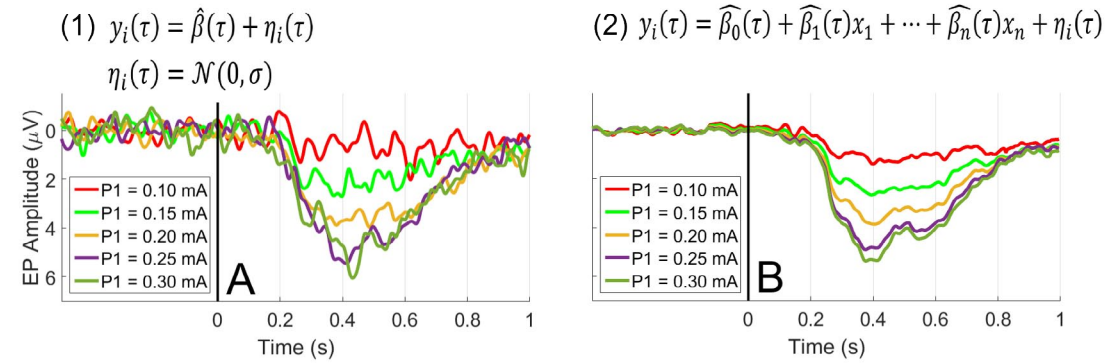


Figure 5.

is used, which leads to exactly the aforementioned problem: averaging does not lead to an accurate estimate of the transient signal (Figure 5A) or frequency spectra. Current work has shown that we can exploit the approximately linear relation between stimulus intensity and brain activity to do a regression over all trials instead of averaging over small subsets. Where averaging minimizes the residual (η_i (τ)) in Equation 1, linear regression minimizes of the residual in Equation 2. Regression is implemented by including relevant factors as regressors (x_n). This requires the assumption that the variations with respect to the regression parameters are linear, which can be largely verified by checking model residuals. Figure 5B shows that this approach generates significantly cleaner data which can be used to study the modulation of brain signals with respect to stimulus properties. For example, this technique will be used to observe the difference between patients with chronic regional pain syndrome (CRPS) and a healthy control group.

Future Research

Our first technologies are starting to find their way into clinical practice with the cooperation of companies and hospitals, and with the help of clinicians. However, there is still much work to be done. The current approach sheds light on variations in brain activity during perturbation of the pain system but is by no means as efficient and elegant as system identification approaches that are currently applied for the identification of electrical and mechanical systems. The problems encountered in developing such an approach are numerous:

- To keep working on the development of state-of-the-art pain diagnostics we need the help of biomedical engineers, technical clinicians, electrical engineers and more. Our current roadmap includes several new challenges:
- It turns out that for 72.5% of all stimuli, we can identify if somebody detected the stimulus based on the EEG signal by using a linear model. However, we can do better: we want to use machine learning techniques to develop an optimal brain-activity based estimator of stimulus detection.
- We are one of the only groups in the world that apply system identification techniques on the human pain system. We would like to take our experiments to the next level by development of new system identification methods which efficiently use the data generated by stimulation and EEG recording.
- The AmbuStim stimulator is not only used at the University of Twente, but also at several hospitals. Although the stimulator already successfully used for chronic pain research, we would like to continue improving the usability of the stimulator in the clinic and in research. We have a wish-list including several improvements to stimulator hardware and software.

Are you interested in working on an assignment including technical and medical challenges? Do you want to work in the research group with the highest number of open access publications of the faculty EEMCS? And are you interested in working on one of these interesting topics? Please send an e-mail to j.r.buitenweg@utwente.nl or drop by at the lab.

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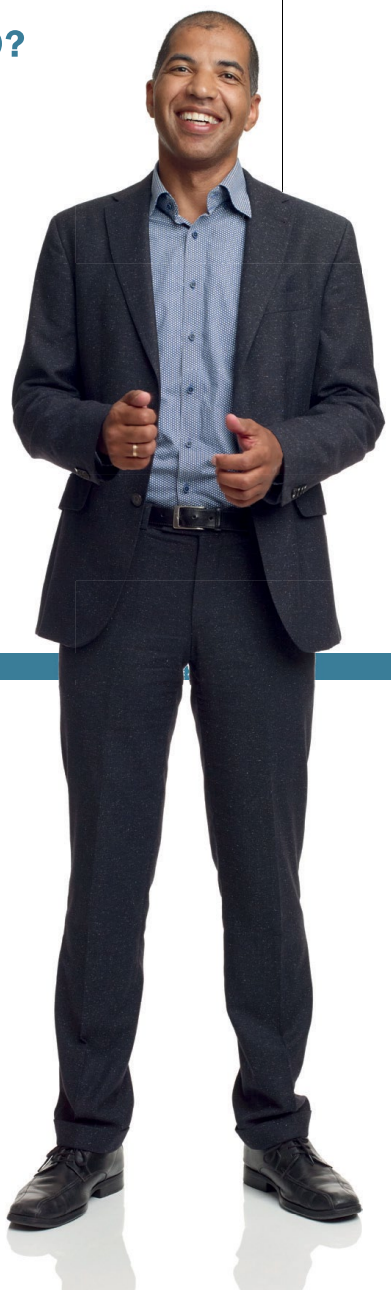

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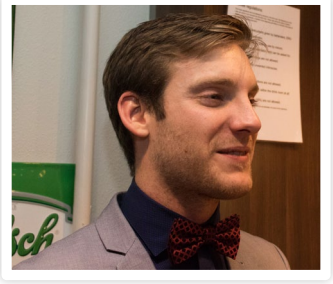
Activities

Authors: Bas Keet
Matthijs Minnen
Gabriel Damiel

This period scintilla, again, organized lots of interesting and fun activities. Here are a few of these fun activities mentioned.

Christmas dinner



Each year SCALA organizes one amazing event. It is the talk of the town, scratch that, the talk of Scintilla come Christmas. That event is of course the Christmas dinner. The best way to give an impression of this fabulous dinner is probably with the following sketch

You are standing outside. It is December and you have strangled yourself in a combination of sweaters, coats, scarfs and gloves in an attempt not to get cold. As you walk you keep looking down every now and then to make sure you do not step on an icy patch and slip. The cold wind blows meticulously in your face, the only part of your body you were not able to cover. A snowflake hits your eye and you look around. Most of the world is covered in white. The wind is almost gone now and snow is softly falling from the sky. Your way is lit not by lampposts but by little twinkling lights spread across all the houses in sight. It is almost like you are walking through a fairy tale. You did not leave the safe warmth of your house to admire the view outside though. Your journey brings you to the Zilverling. Upon arrival you shake off the snow and unwrap yourself. You walk into the Educafé and you know why you braved the cold.

SCALA's Christmas dinner has just begun. Everyone slowly enters; groups of friends, couples and dates alike. Dressed in suits and gowns they sit themselves at a large array of tables set with glistering tableware, gourmet sets and food. Tubes of light hanging through the room, a crisp fire projected on one of the walls and an ornate Christmas tree decorate the Educafé. The chatter quits a bit as the chair of SCALA tries his hand at a speech. Afterwards the president of Scintilla takes over and his practiced speech shows ahum. Everyone knows there are just two important notices in both speeches though, the price per bottle of wine and the start sign for dinner. Once the latter one is given the Christmas dinner really starts and an evening rich of joy, laughter, gourmet and wine begins.

Most have now finished baking and eating their food or have at least tried. Although the food is somewhat finished, people are still buying and amicably sharing wine. Someone seems to have gotten their hand on a Christmas card. Once others realize this the hunt begins. As is common at the Christmas dinner, the board hands out Christmas cards. But just a plain card is boring, of course. The quest is thus to collect a personalized message of each board member on your card. Collecting six messages is more difficult than it sounds though, especially in this state and chaos.

Around half past one the Christmas dinner comes to an end. Everyone now has to brace the seemingly less-cold weather again. Fortunately, they don't have to clean, that is SCALA's job in this case. And after a good nights sleep there are only a few more lectures (if your headache permits it) and the holiday starts. Aaah... I am already looking forward to next year.

Bottrop Skiing trip

The Dutch love the snow[1]. A hobby that does not mix well with the Dutch landscape, unfortunately. There are solutions however, but they require you to pack your things and get in a car to enjoy the 900km ride to Austria. Luckily, Germany is just a few kilometers away. And as it so happens, Germany is host to the longest indoor ski slope in the world. Alpin Center Bottrop is located a mere 100km away which makes the ride a lot easier.

Once inside, you can decide to enjoy the long ski slope or go to the restaurant area and eat to your heart's content. After going down the slope at top speed taking no time to make zig-zag turns, you would need to go back up using the lift belt which was very slow and would stop everytime somebody would fall off again. Fortunately, we went with a nice group of people so there always was good company around. Moreover, it had become a challenge to find the Scintilla stickers that were placed in the lift's tunnel, some from a long long time ago. After everyone was exhausted at the end of a day going up and down the ski slope,

we went to the bar to order some drinks. The student entrance ticket sadly only allows for three alcoholic drinks, which as it turns out is not unovercomable. We were not the only ones exhausted and as other skiers passed by on their way out, they were happy to deposit their beer coupons on our table. This way, whilst drinking we obtained even more drinks. Unfortunately, I was the designated driver for the night, which left me no other choice than to stay away from the alcohol and observe from a distance. Luckily the trip back is short.

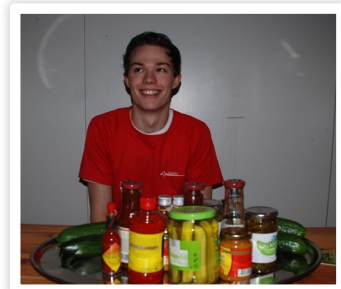
[1] E. Weinberger, "Why the Dutch Hit the Slopes", The New York Times, Feb. 14th 2014.
https://www.nytimes.com/2014/02/15/opinion/why-the-dutch-hit-the-slopes.html

Eating contest, no sport!?

Throughout the year, the EE-Sports committee is host to a large variety of sports activities ranging from the Batavierenrace to the stAf-tournament and obviously the Eating contest. Many people seem to have troubles with this last activity and I do not get why.
Take for example the preparations; there are at least 25 people signed up. All of them want a proper diner, which requires a lot of food. The theme of this year was 'spicy sandwiches'. Assuming that the average hungry Electrical Engineering student eats roughly one baguette, this would require 25 baguettes. Adding spiciness requires copious amounts of sambal, jalapeños and more extra spicy sambal. These come in large and heavy jars. Finally, you need some filling for the sandwiches, so we needed to include some lettuce, cheese and ham too. Pack all of this in a couple of the large shopper bags and you got yourself a real exercise. As it so happens, you are still at the shop and far removed from the destination: the eating contest. What comes next is a tedious journey back home including the heavy bags. If you disagree, feel free to join us next year.
With the preparation of some delicious and more importantly spicy sandwiches, another challenge arose. There was a huge pile of sandwiches which had to be eaten. Nine ambitious men started this challenge and most of them were able to reach the end, but not without some struggle. The sandwiches became logarithmically more spicy which came as a surprise to some. This brought some grown men to tears. Besides the spice there was the struggle to eat an entire baguette as quickly as possible. This resulted in bright red heads and loads of sweat and effort. I would certainly call this a sports event!

Student's secret recipe for FUN

What would be the best student activity you would ask me? Well, first you need some basic ingredients for a successful recipe. Those are, in my opinion, good friends, a pizza for everyone, unlimited alcohol, and of course, laser gaming! No need to look any further. If you manage to assemble all those ingredients for a night, rest assured that you can expect an unforgettable night (or at least for the majority).
Luckily for the first year students of Electrical engineering, that's exactly



what happened the December 11! After a few months of preparation, Sjaarcie, the first year committee of Scintilla, managed to pull off an incredible night of fun for the hard working students who all desperately needed a break.
The night started with the two true student spirit animals: pizza and beer. Or, as most would call it, the typical student diet. After each student completed devouring their pizza and drank a few glasses of (95%) water, it was time for the last ingredient. LASER GAMING.
But before we could all enjoy the madness of darkness, killer lasers, and unlimited drinks, students first had to defeat the Netherlands' most feared monster. Snow. It was everywhere. Roads were covered and slippery, the cold was flowing through our bones and the way from the student bar to the laser gaming bar proved to be a long and tedious way. However, students did not get discouraged. It's only after half an hour through this wild arctic expedition that the sign of the Tapperij ultimately lighted up in front of our eyes. The Holy Grail of the night was finally reached.

That's when the true fun started. Once we all got inside and warmed up, teams began to form. Different parties emerged, preparing to face old friends as enemies in the darkness of the laser gaming arena. Teams split, as some entered the fighting arena and others the bar and vice versa. When you wouldn't be sipping on a drink chatting with your friends around a pool table or a dart game, you would find yourself running around with the most powerful weapon ever created: a laser gun. That's when the adrenaline would rush through your veins, forcing you to dive in the heat of the battle to collect as many points as possible by shooting at your enemies.
Glasses piled up at the bar and you could feel the atmosphere of the Tapperij gradually warming up. Pool players would become better, dart players a little more dangerous, and laser gamers true stormtroopers. It was, nevertheless to say, an amazing night.
Even when we ran out the clock and we all got kicked out of the bar, the fight still persisted. As soon as you would step outside, you would find yourself in the middle ground of a snowball war. Coming from all directions, there were no teams, only oneself against everyone. Though, every good story has an end. Fingers got cold and everyone decided to return back to the campus to complete the night, where we always do, the Vesting Bar. From there on, some went home but some courageous student decided to fight back their exhaustion and stayed until early in the morning, just a few hours before the next class.
One thing was sure after this night. We all got to know the best recipe for FUN!

advertorial

Applied Micro Electronics, AME

Author: Remco Bonten, *Applied Micro Electronics (AME*

"My graduation project extended the bidirectional isolated DC/DC converter to an innovative and modern conversion stage that combines most advantages of the state-of-the art solutions currently in use". Remco Bonten (27) is a fresh master graduate of the TU/e that performed his graduation project at Applied Micro Electronics "AME" B.V, where he performed his research on control of series resonant converters with bidirectional power-flow capability. With the research results, a prototype converter was build. The main contribution of Remco's work was extending an existing unidirectional modulation method for resonant converters to allow bidirectional power flow.

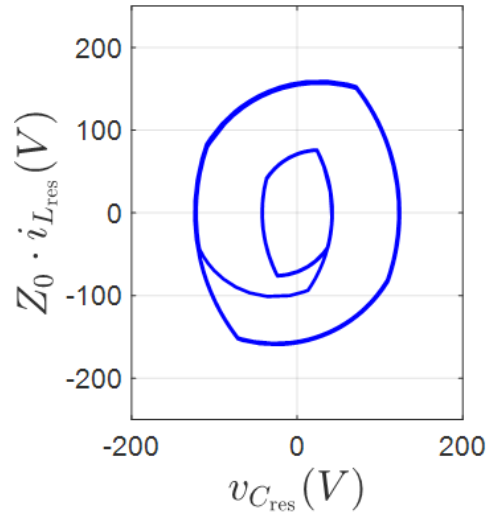
"Although I already worked on some smaller DC/DC converters, the medium-power application did certainly arouse my interest. Along with the challenge that the converter should be able to operate in a bidirectional fashion made the graduation project challenging."

AME is a company that is always searching for opportunities to develop new, innovative, and high-tech products. The design goal was to achieve a large-step down ratio (400V to 48V) for electric vehicle applications. With the chosen specifications the converter would be able to transfer power between the storage battery of an electrical vehicle (400V) and the lower voltage used by the vehicle's peripherals (48V).

"Initially I had some problems grasping the core of the problem. Many converters that operate in a similar fashion were already developed and I did not want to copy someone else's work, but

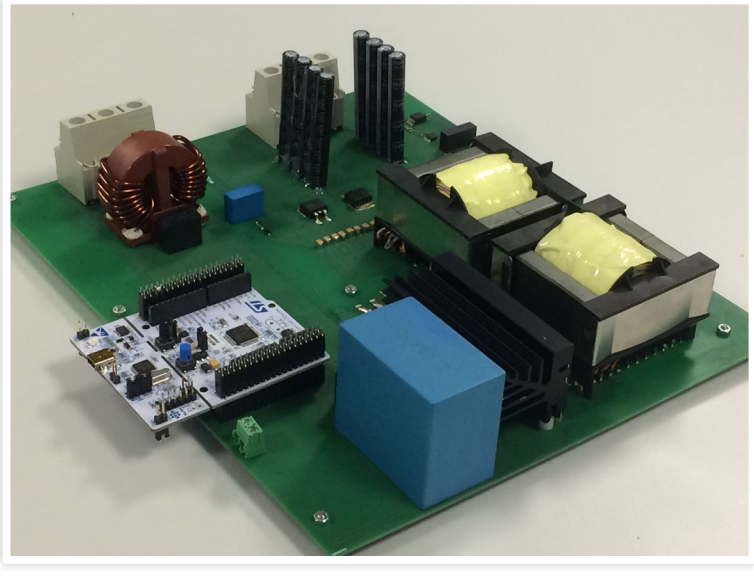
> "I was fascinated with the possibilities of these converters."

really contribute to the field of power conversion. As such, my research covered a large scope and I came into contact with resonant converters. Series resonant converters are often dismissed due to its complex operating nature, however, I was fascinated with the possibilities of these converters. Although resonant converters are not new, they generally use a control algorithm that operates under the assumption that the converter is in steady-state, i.e. there is no change in the load or the voltages applied. This assumption really limits the dynamic performance of resonant converters."



Remco started to work on optimal control (OTC). OTC is a control method that regulates the amount of charge that is transferred to the output during each resonant cycle. To do this, it calculates the exact moment of switching required for the set amount of charge that should be transferred. OTC is not yet used in industrial and commercial products but is an actively research topic at universities. Solutions for unidirectional power flow were already developed at the EPE group. In order to realize bidirectional power flow, he had to extend the OTC algorithm to take the bidirectional power flow into account. Through calculations and simulations, the design became conclusive and a prototype was built.

"I still remember the moment when the converter first operated as designed. The first seven months of the graduation lead to this moment and the struggles were all worth it! Without the tools provided by AME and the knowledge of my colleagues, I'm not sure whether such a prototype would have been possible."



At this moment, Remco is working at AME as a System Engineer, where he is working on various projects. However, within some months he will start with his PhD. Due to his innovative design and the doors that the design opened,

> "This assumption really limits the dynamic performance of resonant converters."

he was offered to continue his graduation project in order to expand the research done on bidirectional optimal trajectory control. AME offered to provide the resources and possibilities for Remco to reach his doctorate. "I cannot thank AME enough for the options and the possibilities they have provided and are still providing me!"

Scinterklaas

Casino night

Cantus

DaP(h)NE

LasEErdrinking

Constipatieborrel

SKIC theme announcement drink

Junction

A chat with: Michel ten Bulte

Author: Marissa Jonker, Rik Engel

I was born in Deventer 56 years ago. I've lived there until I came here to study. After my pre-university education I studied Analytic Chemistry in Deventer, which was a 3-year HBO course. After that, I went into military service, which was still mandatory back then. I was military engineer and was in the nuclear biological chemical disinfection company, which means I designed disinfection streets. Thereafter I had a job during the holidays, and in the summer of '85 I came here. I started with the study Applied Mathematics. That's how I ended up here and that's how I stayed here. I had a bit of a delay with my study, I'm a so-called long-term student. I spent exactly 22 years on my study and during my study I had to earn money to pay for it. I mostly did that by being a student assistant, nowadays the flex jobs. I had flex jobs at the faculty, and those jobs eventually led to a permanent job. Since 1996 I've been the official facility manager. I started as secretary, as replacement for my pregnant wife. After half a year of doing her job I picked up my other work again. I met my wife here during my study and at the moment we have 2 kids who've both moved out. We have been living in the centre of Enschede for lots of years now.

What used to be your dream job?

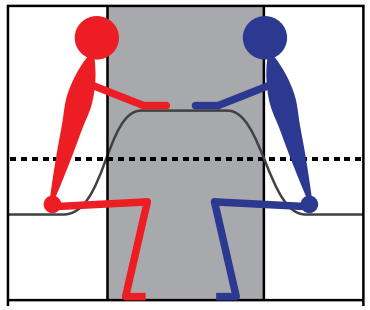
I have never had one. I never thought: "This is what I want to be when I grow up."

What kind of student were you?

How should I put this: a serious party animal. I liked parties, but I also did my homework pretty well. Mathematics is an education of lots of practicing. I'm not the most clever student, so I have to work for things, which I always have. So, I did like to go out partying until 4 o'clock on a Thursday, but I would be present at a lecture on Friday morning at 8:30, that went pretty well.

Is there anything you would have done differently as student?

Yes, I spent 22 years on my study, that could never have been on purpose. As a student, I would have done my internship differently, since that's where it went wrong. Also, as a student I would have liked to get my drivers license. I started taking lessons back then, but I've got my license for about two years now.
What kind of internship did you do?



I did an internship at Fokker, at Schiphol, the plane factory, on the department of numerical aerodynamics. That's also the direction I graduated in.

> "I did like to go out partying until 4 o'clock on a Thursday, but I would be present at a lecture on Friday morning at 8:30"

Why did you become facility manager after the study mathematics?

I kind of rolled into it. A lot of people get a job that's very different from what they studied, and that is the case for me too. One of my flex jobs was facility manager, making an inventory of workplaces, arranging new workplaces, arranging new furniture. That's how I rolled into it, and I felt happy doing that job.

What do you think of the new elevator and the balcony?

I like that they're here. I'm glad we've been able to push it through, in consultation with the facility company. The elevator had to get there eventually. The associations rooms, were some of the few places of the university which were public, but not accessible for wheelchairs. We're glad that they are now. Plus, it is beneficial for the associations, for carrying heavy materials etc. The extra balcony and storage room underneath are a nice bonus. I like it the way it is.

> "I think we have a nice club of students at EWI. I recognise lots of my own student life in it."

What do you think of the new styling of the entrance of the Zilverling?

I like it, could be better as it is not completely finished yet. The lockers are going to be moved to the other wall, on which new plates will be attached first. Then the letters have to be adjusted. I like the way it has become, though.

What is your view on student culture?

Well, I have been a student myself and I think we have a nice club of students at EWI. I recognise lots of my own student life in it. It's one of the best periods of your life, you can do lots of things, you're discovering yourself, you have

Michel ten Bulte

Age	56
Favourite Color	Bright Pink
Favourite artist	Bob Marley
Favourite food	Chinese, Indonesian
Favourite Drink	Coffee

lots of freedom. All I can say is, enjoy. I like being in contact with students. On the other hand I have the impression that serious work is being done. I like seeing that combination. I have had that experience myself as well of course.

What do you like most about what you do now?

The diversity, there are many cases you run in to everyday. Cases that need immediate attention. Being able to respond quickly in situations. Lots of contacts in the faculty, with students, with co-workers. Lots of contacts outside of the faculty. I often leave my spot. I like the diversity.

What are your hobbies?

I like to do sports, playing soccer. I like playing softball. Next to that, I am a pretty active geocacher, which I've been for a few years now. For those who don't know: imagine that there are little tubes hidden all over the world, which are registered on the internet, and based on GPS-coordinates, you're going to find those tubes. The GPS system is quite accurate, so you can reach the location of the treasure with maybe a few meters difference. That's where you search, and when you find the tube, which contains a logbook, you can write your name on it and register it online. Should you find it under special circumstances, for example with a full logbook, that it's soaked, that something is broken, you can inform the owner of the cache that something is wrong. That's how the whole thing is being held operational, and I think that's fantastic. Sometimes the GPS-coordinates are just given, but sometimes you have to solve puzzles to get the numbers. That brings me to another hobby, solving puzzles. I love to solve all kinds of logical puzzles, and to attend pub quizzes. I attend one every week, on Monday evening. I really like doing that. I even organized one here for Abacus, together with colleagues and students.

What keeps you up at night?

Nothing. I sleep well.

Is there something that you would still like to achieve?

I would like to find all geocaches in Enschede. There are a few hundred, but that's just a matter of keeping up. I only have a few left to find, but those are really hard to reach, for example in a tree. If there is someone with climbing equipment who would like to geocache with me, please.

Do you have an advice for students?

Not really, other than the usual clichés: enjoy this time, think of the future, work seriously, but don't forget to just enjoy it.

Ornithopter Flight Dynamics

Measurement and Analysis of the Robird's Flapping Wing

Author: Steven Gies

It was back in January 2016, when I visited an overfull lecture hall in Carré for a lunch lecture by UT-spinoff Clear Flight Solutions. This company is the developer of the Robird; a robotic bird that looks like a falcon and actually behaves similarly, since it uses flapping wings to achieve flight. Not only is the Robird of great interest for research (the combination of 3D aerodynamics and moving, flexible body parts is pretty difficult stuff), it also has some very nice field applications: The Robird looks and behaves like a bird of prey, so it can be used to scare away pest birds, for example at airports or in agricultural areas. I like the art of biomimetics (imitating nature to create technology), the fact that the Robird faces multidisciplinary challenges as well as the idea of doing research on something that is actually already being used (many people have actually seen it on TV) and thus I quickly knew that this would be a nice topic for my Master's thesis. At the end of the lunch lecture, I left my e-mail address. One year later, after I finished most of my courses and my internship, I was ready to start my Master's thesis.

Ornithopters

Research has shown that ornithopters (machines designed to achieve flight by means of flapping wings) require two key motions to stay airborne: Heave and pitch. A simplified, 2D situation of this is shown in Figure 1, where h indicates heave and θ indicates pitch. The Robird is also able to generate both of these motions. The mechanism behind this is semi-secret, and thus you will have to visit the Robotics and Mechatronics group to find out. Although the Robird already flies, we don't really know what is the best combination of these motions (i.e. what is the optimal degree of pitching, the optimal flapping frequency, etc.). Of course, there are many more

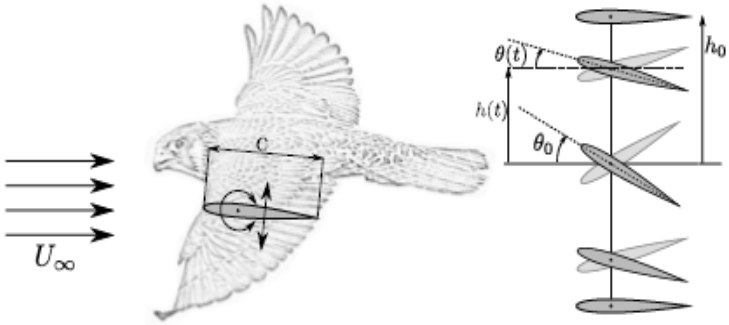


Figure 1: Ornithopter flight is achieved by the combination of a heaving motion h(t) and a pitching motion ϑ(t).

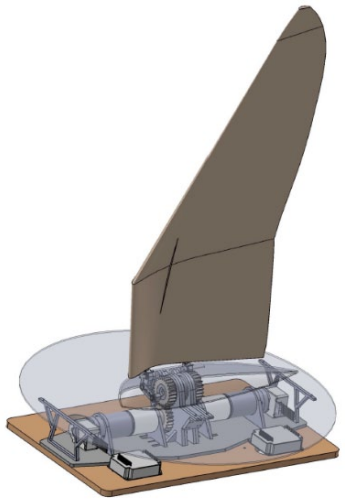


Figure 2: Drawing of the flapping wing setup.

parameters that are known to have a great influence on the flight performance, such as the flexibility of the wing, the size and shape, and the flight speed.

"Real birds tend to use long hauls with a high amount of pitching"

Nature forms a nice source of inspiration: real birds tend to use long hauls with a high amount of pitching when they take off, compared to very short and quick wing beats when flying at a high velocity. In contrast, the current version of the Robird flies at a constant amount of pitching and usually also at a constant flapping frequency. It would be interesting to see whether its flight performance can be improved by making these control settings variable.

The assignment

As with many Bachelor's and Master's theses, I started with a pretty vague description of my assignment. In my case, it was described as follows: Previous students have developed a mechatronic setup (Figure 2) on which you can place one of the Robird's wings. In this way the setup replicates approximately one half of a Robird. Using 20-sim 4C, the user is able to control both flapping frequency ([0, 6] Hz) and the amount of pitching by means of a parameter defined as γ. In the past there have been students who placed the setup in the wind tunnel (at the UT) and even in a vacuum chamber (at ESA). They performed force measurements as well as stereo vision measurements (more on that later), but due to lack of time and limitations of the setup, the processing and application of these measurements has remained limited. Another problem was that the force and stereo vision measurements could not be related to each other, since they were performed with different wings and the control settings differed. My task: ...to start by processing and analyzing these measurements, and then to perform follow-up research using the setup.

And so I started processing the old stereo vision measurements. These measurements were performed as follows: The flapping wing setup was positioned in front of the UT's wind tunnel, and forced to flap at a given flapping frequency f. Two cameras recorded the flapping wing, while a stroboscope (consisting of LEDs and an Arduino) was configured to flash at a frequency a tiny bit smaller than f (i.e. 0.99f). By then turning off the lights and using a wing covered in black spray paint and stickered with retroreflective tape, a very nice "slow-motion" video of the flapping wing is obtained. Since the on-time of the LEDs is very small (1 ms), the videos do not show any motion blur, even though they only record at 30 frames per second. These videos were produced for various combinations of wind speed, flapping frequency and pitch control input γ.

Figure 4: The wing used during the experiments is covered in black spray paint and a retroreflective checkerboard pattern. The corners of this pattern can be tracked with computer vision algorithms. Another checkerboard is placed on the windshield and acts as a static reference frame.

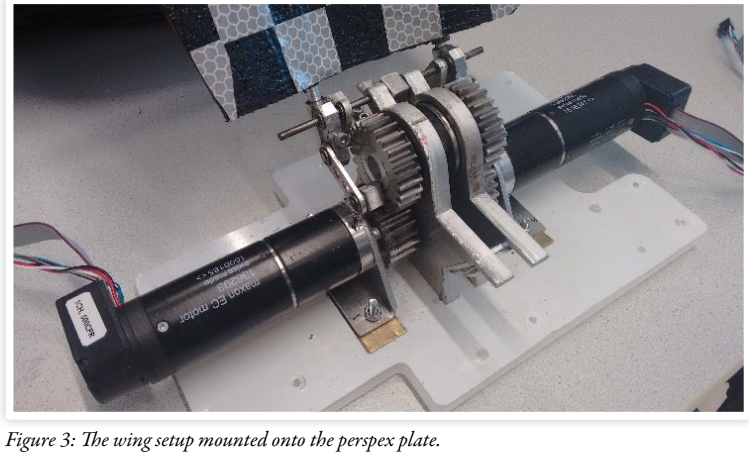


Figure 3: The wing setup mounted onto the perspex plate.

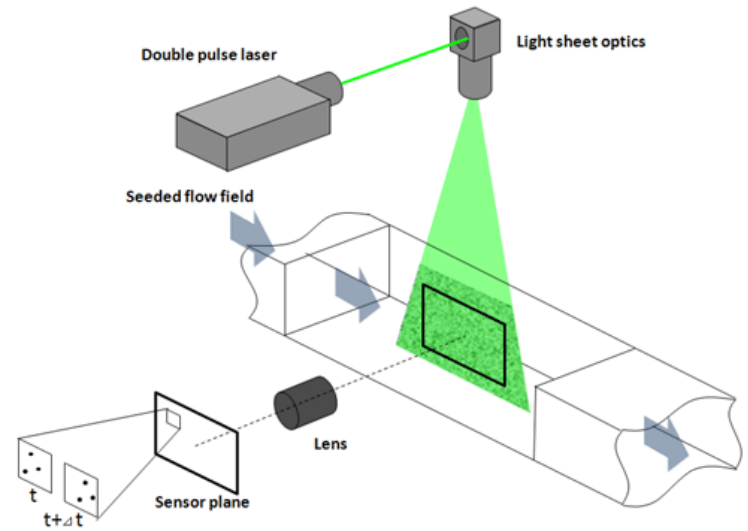


Figure 5: Principle of particle image velocimetry (PIV).

As you might know, a 3D reconstruction of an object can be made when it is imaged from two or more different angles. With some computer vision skills and a lot of Matlab coding I managed to do just that, for each frame of each video, and thus I ended up with full digital reconstructions of wing beats.

Surprisingly, what I found out was that the pitch control input γ did not have any influence on the wingbeat at all; any differences in amount of pitching were caused by wind speed or flapping frequency instead. Similarly, the force measurements showed no change as a result of pitch control either. It would later turn out that the wings used during the experiments were too stiff, and the setup was not able to implement the pitching motion very well. The controller software was thus redesigned (as part of a BSc assignment) while I prepared a new series of force and stereo vision experiments.

"Surprisingly, what I found out was that the pitch control input gamma did not have any influence on the wingbeat at all"

Figure 6: The measurement setup with the wing flapping in front of the wind tunnel. Left: Stroboscope and stereo cameras. Top: PIV camera. Right: PIV laser. The force sensing plate is underneath the black wind shield.

I managed to borrow a six degrees of freedom force sensing plate, developed at the department of Mechanical Automation. Using a laser cutter I produced a perspex plate such that the wing setup could be mounted onto the force sensing plate (Figure 3). In particular, I could now measure the force in the forward direction, i.e. the thrust force, for any combination of flight speed (wind tunnel air speed), flapping frequency and amount of pitching. I also measured input power for each experiment by monitoring the current drawn by the motors, such that I could compute the propulsive efficiency as the ratio of output power to input power.

Clear Flight Solutions provided me with the latest, more flexible wing design and spray painted it black. I then applied my own design of reflective markers in the form of a checkerboard pattern (Figure 4). This allowed me to apply the simplified twenty strip analysis method to multiple parts of the wing.

During the preparations, I also teamed up with the chair of Engineering Fluid Dynamics. Of course, they were very interested in the Robird's flight dynamics as well and proposed to use one of the

latest measurements techniques available in the wind tunnel, called particle image velocimetry (PIV). The concept of these measurements is shown in Figure 5. A laser module produces a horizontal sheet which intersects the wing at a height that is configurable (by moving the entire laser up or down). A particle seeder injects tiny liquid particles into the flow of air. A high-speed camera, focused at the same height as the laser sheet but oriented perpendicularly to the sheet, then takes two consecutive

> "The whole PIV setup had to be triggered exactly at the moment when the wing passed its upright position."

images, and correlates them to obtain the path and velocity of the particles around the wing. Since the wing is a moving object, the whole PIV setup had to be triggered exactly at the moment when the wing passed its upright position. The wing controller was thus configured to excite such a trigger signal once during every wing beat. Since the laser unit inside the PIV setup was quite powerful, I had to take a short course on laser safety first, which was fun.

Within two very busy weeks, I worked together with the technicians of the EFD chair to install the entire measurement setup in the wind tunnel, did some test measurements, performed the actual experiments and then de-installed a large part of the setup again.

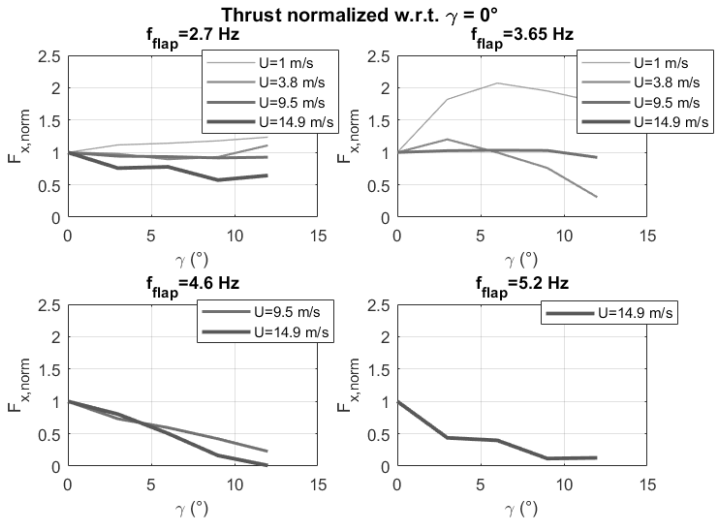


Figure 7: Thrust normalized w.r.t. the case when no pitch is forced by the controller, i.e. when γ=0°. The plots show that it is beneficial to decrease pitch as flight speed increases.

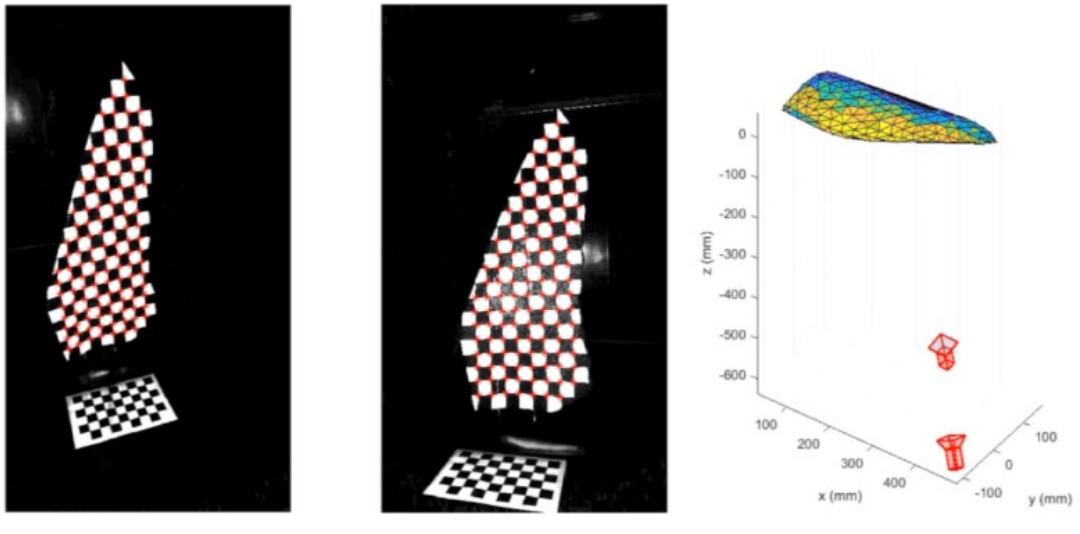


Figure 8: The high-contrast video frames (left). The 2D locations of the checkerboard corners in each video frame can be triangulated to obtain 3D coordinates (right). All 3D coordinates in all video frames will together form a digital reconstruction of the wing beat.

Figure 9: Top: The influence of pitch control parameter γ on the actual pitch and heave profiles over one wing beat period (at constant f_{flap}=3 Hz and U=14.9 m/s). Bottom: The influence of wind speed U on the pitch and heave profiles (at constant f_{flap}=3 Hz and γ=6°). Clearly, the pitching profile is dominated by wind speed instead of pitch control.

The results

After the measurement stage, I had about a month to process and analyze all the data I had obtained.

I first focused on the force measurements. For each of the 55 experiments (combinations of flapping frequency, degree of pitching, and wind speed) I recorded the forces excited by the wing for 30 seconds. I then averaged the forward force F_x (t) to obtain the mean thrust force. See Figure 7 for an overview of the influence of pitch control on the mean thrust force. We can conclude from this graph that it is beneficial to apply more pitch at lower flight velocities, while it is beneficial to reduce pitch at higher velocities. In other words: The measurements support what we observed in nature! Of course, this is not all there is to it yet; flight performance is not only about thrust – lift forces are just as important.

Next, I also processed all the new stereo vision measurements. The tracking algorithm I developed was well able to track the wing's checkerboard pattern in each video and created some nice slow-motion reconstructions of the wing beats. A reconstruction based on one video frame pair can be seen in Figure 8 (I wish I could show videos in the Vonk). Fortunately, in contrast to the previous stereo vision measurements, this time the controller was able to control pitch, but only to some extent. You can see this in Figure 9. As γ increases, the pitching profile changes a bit. But most of the pitching is caused by the flexibility of the wing and the forces acting on it while it is flapping. I also visualized the effect of the wind speed in the same figure. It is clear now that the wind speed has a much larger effect on the pitching profile, than the pitch control parameter γ.

The PIV measurements took a lot more time than expected due to a lack of experience with the setup and the fact that the entire setup has to be moved whenever I wanted to focus on a different section of the wing. In the end, I was able to produce some nice visualizations of the flow, however I could not draw strong conclusions from them. Proper analysis of the wing using the PIV setup will take a lot more time and will therefore be performed as part of a new research assignment.

Conclusion

The experiments I performed resulted in two main conclusions. In line with observations in nature, the force measurements suggested that it is beneficial for the Robird to decrease pitching of its wings at higher flight speeds. The stereo vision measurements showed that the current mechanism is able to control the degree of pitching of the wing, although the overall pitching profile was dominated by the flexibility of the wing and wind speed. The first PIV measurements on the Robird's wing did not result in strong conclusions, but are to be continued in follow-up research.

Finally, my Master's thesis turned into a multidisciplinary challenge with a lot of practical work, which I definitely enjoyed. I would like to thank my supervisor Geert Folkertsma, Clear Flight Solutions, and the research chairs RaM, EFD and PE for their support and collaboration during my thesis.

Shell Excursion

A look at the plant in Moerdijk

Author: Eva Plas

On the fourth of December, Scintilla organised a trip to Shell in Moerdijk. At this facility Shell makes chemical products using petroleum. In Moerdijk we got an explanation of what the facility does exactly, a case to work on, and a tour.

Moerdijk is not a short drive away from Enschede, therefore we were going to drive to Shell in two vans. The first would go to Moerdijk directly. The second would first pick someone up along the way and then continue to drive to Shell. After some time, we arrived at the point where we had to pick someone up, 10 minutes too late. This would not be a mayor problem for the day. Driving to Shell was fun as everyone was chatting with each other and singing along to the music that was played. However, after having been on the road for a while, we took the wrong turn and ended up in the middle of nowhere. This gave us a delay of more than half an hour. So, as the first van was already in Moerdijk, we were still on our way there.

I have been to an industrial site before. However, that was nothing compared to Shell. Moerdijk was impressive. As we arrived, I saw the whole site. It is just a whole lot of nothing with a couple of huge installations. As we were a bit late, the planning was changed, and we could immediately go have lunch, which was provided by Shell. During the lunch we got to talk to some of the employees of the company. Being in my first year, it was interesting to find out how people from different studies worked together for one big company and what they exactly did after having studied, as I had never orientated myself on that before.

After lunch, multiple employees of Shell came and went to give us presentations. The presentations ranged from topics such as what Shell as a company in its whole does to the chemical processes that goes on in the installations at Moerdijk. The main two themes that most of the presentations revolved around were the optimisation of the processes and how to be better than the competition.

> "The presentations ranged from topics such as what Shell as a company in its whole does to the chemical processes."

The presentation I found most interesting was the latter. It showed how one system might seem simple, but so much thought has gone into optimizing all the different chemical processes, which all influence each other.

The group that joined the visit to Moerdijk

Luckily for me, this was the exact subject for the case that was planned. In groups, we got a sheet of paper with a couple of the large columns of the installations just talked about. We had to connect certain sensors to vaults to regulate the flow of liquids and gases in the pipes and columns. Even though this had nothing to do with Electrical Engineering, I still found it very interesting. There were two main types of regulators we could create. The first used information from the sensors further in the system to determine how much chemicals could pass, the information so to say pulls the amount of chemicals. The second type uses information from the sensors that are earlier in the system to determine the amount of chemicals that can pass through. The system pushes the information instead of pulling it. Both regulation systems had to be used to create the best system for two of the columns in which all the chemical processes take place.

> "We also got to see how these processes got monitored and altered"

We also got to see how these processes got monitored and altered during the tour. In a room full of screens, camera footage, graphs and schematics of the big installations outside were showed. As the personnel was just changing from dayshift to nightshift, we sadly could not ask them any questions regarding their work. However, it was still very interesting to see how the site was monitored and how the information of the sensors was processed. We also learned that everyone who works in this room must have worked outside for several years first. In order to work in the control room, you need to know everything about the installation and that is only possible if you have worked with it in person.

We were able to see the personnel working outside as we continued our tour. One of Shell's employees showed us around the site and explained what everything was. I was fascinated by how complicated the installations were compared to the schematics that were shown before. I don't think I would be able to design any of that. As the sun went down we were able to see the fire that peaked out of one of the enormous high pipes.

After the tour, our visit was over. We said thanks and goodbye to the employees of Shell. The drive back to Enschede was accompanied with the view of an orange moon and again a lot of chatting and music. Overall, I really enjoyed the day. I might not have understood everything and not everything was applicable to Electrical Engineering. Nonetheless, I found it very interesting!

Rick van Keken giving a lunch lecture on behalf of Shell

Datasheet

Author: Celine Steenge

These cold days make you want to stay inside. But you still want to impress people. With these receipts, you can make the perfect breakfast, dessert and quiche with limited ingredients and time. Do you have a receipt that is worth sharing? Do not hesitate and sent it to vonk@scintilla.utwente.nl!

System on a chip (Kaiser rolls with egg and bacon)

You want a fancy breakfast, but you don't want to be in the kitchen for another hour. These rolls will safe your life. They are easy to make and look so fancy your roommates might start thinking you can actually cook!

Ingredients (4 rolls):

- 4 home-final baking Kaiser rolls
- 4-6 pieces of breakfast bacon
- 4 M eggs
- Some herbs (chives, pepper, whatever you like)
- Some cheese

What to do:

1. Pre-heat the oven at 200 degrees
2. Hollow the Kaiser rolls out. Make sure there is no hole in the bottom!
3. Put some breakfast bacon at the inner side of the hollow rolls.
4. Add some cheese if you like and press everything a bit into the roll
5. Break 1 egg per roll
6. Add some herbs and maybe some more cheese
7. Bake the rolls for 10-15 minutes in the oven
8. When you like the egg more cooked, cover the rolls with aluminium foil and bake them for another 10-15 minutes.

Variations:

This is the easy basic breakfast type, but you can fill the rolls with whatever you like!

Booster (Quiche)

Is it a cake? Is it is main dish? It is both! Make this easy quiche with left over vegetables or just buy whatever you like (or has discount) in the shop.

Ingredients:

- Puff pastry (how much depends bit on the cake tin that is used, just buy the one in the freezer)
- 800 gr vegetables (carrot, paprika, bunch onion)
- 500 gr smoked chicken strips
- 5 medium eggs
- Bit of cheese
- 600 ml milk or cream
- Some herbs (chives, pepper, salt, garlic powder, whatever you like)

What to do:

1. Pre-heat the oven at 200 degrees
2. Defrost the puff pastry
3. Cut all the vegetables
4. Mix the 5 eggs with the milk/cream
5. Grease the cake tin.
6. Spread the puff pastry at the inside of the cake tin, make sure also the upper ring is covered.
7. Put the cut vegetables in the cake tin.
8. Add the egg/milk mixture to the vegetables.
9. Add all herbs you want to use.
10. Finish the mixture bit some cheese at top
11. Bake the quiche for 30 minutes in the oven. Take a look once in a while, when the quiche is nicely gold/brown, it is also finished.

Variations:

A quiche can be made with any vegetables, meat or fish you want. Just think of some nice combinations and try them out! When you have puff pastry left over, decorate the top of the quiche before you spread the cheese. Also some sesame seeds look nice on top!

Do you want to build a snowman? (snowman dessert)

Do you want to play outside? We are not Elsa and Anna and our world is (hopefully) not frozen, but these little snowmen are easy to make and look lovely.

Ingredients (8 snowmen):

- 16 frozen whipped cream puffs
- 8 marshmallows
- 1 tb XL chocolate sprinkles (but normal sprinkles work as well)
- 8 strawberries
- Bit of powdered sugar
- Some edible dye
- Cocktail sticks

What to do:

1. Stack 2 puffs and fix them with cocktail sticks.
2. Add 1 marshmallow per stack at the side where the cocktail stick is out. Make sure the cocktail stick goes through the whole marshmallow.
3. With a cocktail sticks, make little hole in the marshmallow for the eyes and the nose.
4. Add chocolate sprinkles in the holes.
5. Give the snowmen a mouth with the edible dye.
6. Remove the crowns of the strawberries.
7. Halve the strawberries and put the lower side on top of the marshmallow at the cocktail sticks.
8. Finish off with some powdered sugar over the snowmen

Variations:

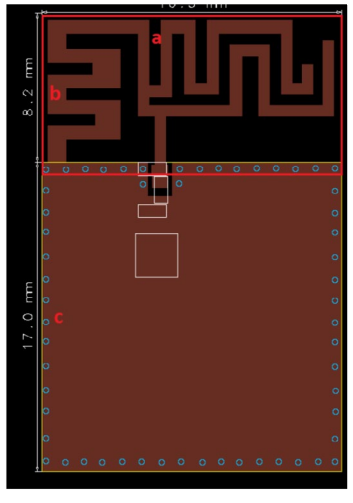
These snowmen are lovely, but how much more lovely will they be when you add a chocolate hat?!

Bluetooth in a racing motorcycle

Author: Jeroen Goudswaard

Electric Superbike Twente is currently in its production phase. That means almost all hardware design is done and that the hardware is in production at our technical partners. The electrical engineers worked hard to finish the designs in time: three custom PCBs forming the battery management system in collaboration with Prodrive Technologies, one PCB as ECU (Electronic Control Unit, the main vehicle controller) in collaboration with Dialog Semiconductor, and other hardware, including supporting hardware for external communication and two liquid cooling systems. In this article, some technical details of the ECU are explained.

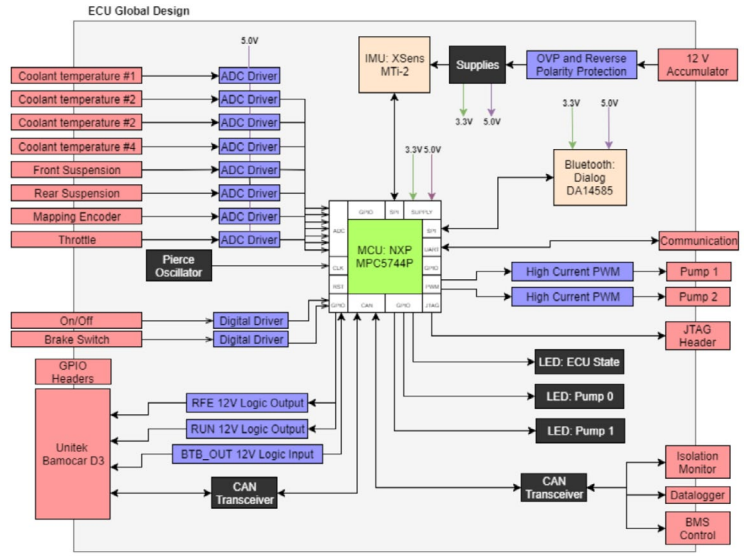
First, it is important to give some functional requirements about the ECU. As mentioned, the ECU is the main vehicle controller. That means it should handle a lot of input and output. Inputs are the throttle of the driver, sensor data of the cooling system, sensor data of the battery management system, sensor data about vehicle dynamics (brakes, suspension) and, of course, some start-up and shut-down commands. Outputs are at least as important, and include the inverter (also known as motor drive or controller), the battery management system, data logging systems, antenna, and the driver's display. On top of that, it should have some processing power, to enable decision-making based on input variables.



To make the ECU as reliable as possible, all components are required to be classified as automotive grade. This holds for the main microcontroller, but also for simple components such as transistors, op-amps and connectors. This makes the selection process for components a time-consuming part of the design. In a few weeks, the automotive grade is also a very important aspect in software design. It should be robust, and in the exceptional case of a design fault or error, the ECU should enter a safe state for both the driver and vehicle.

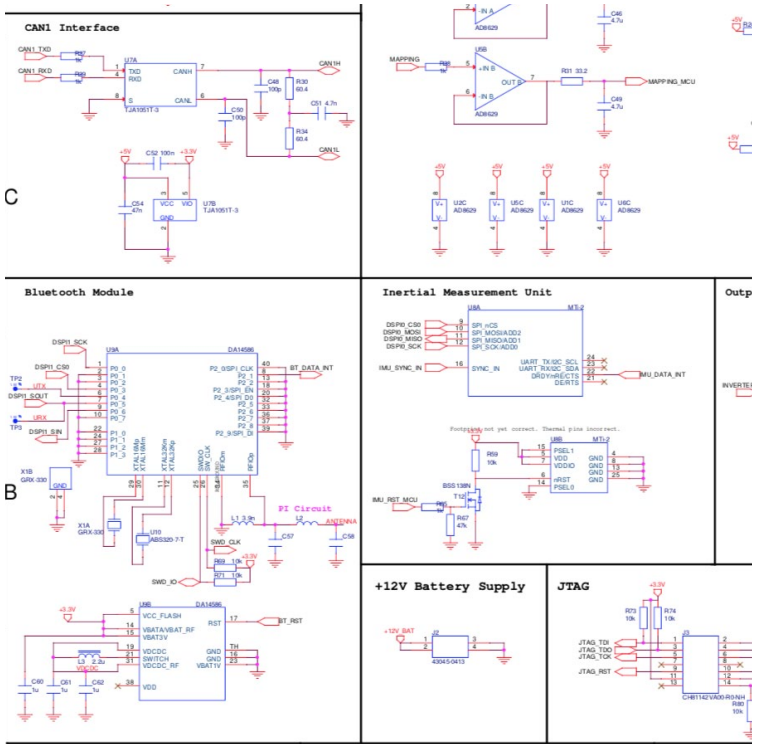
> "To make the ECU as reliable as possible, all components are required to be classified as automotive grade."

The microcontroller is chosen to be the MCP5744 from NXP. This microcontroller has enough processing power and enough dedicated and GPIO pins to support our needs. To meet the functional requirements, the surrounding hardware futures multiple high current PWM stages for the coolant pumps, a CAN driver and UART driver for internal communication, ADC buffers, an IMU (inertial measurement unit), multiple power supplies (1.25 V, 3.3 V, 5 V), multiple GPIO stages, and some protection hardware against reverse polarity for the 12 V supply. On top of that, a Bluetooth chip will be integrated.



The Bluetooth chip is a very cool integration project between Electric Superbike Twente and Dialog Semiconductor. Dialog has developed an automotive Bluetooth chip, and we are integrating it as a proof of concept. The integration consists of an onboard Bluetooth chip of Dialog and an integrated antenna in the PCB. For now, only the wireless tire pressure monitors will make use of Bluetooth, since the other sensor data is too critical to miss. However, in the future, the ECU is ready to enable a complete sensor network over Bluetooth. The collaboration with Dialog is very exciting, since the Bluetooth chip is not yet on the market, and we are the first to use it! On top of that, we work closely together with them to review our designs, to make the ECU as reliable as possible, and to show the automotive industry the possibilities of Bluetooth.

> "For now, only the wireless tire pressure monitors will make use of Bluetooth, since the other sensor data is too critical to miss."



The final product, a PCB with all the hardware included, is currently being finished. It is designed to fit perfectly in a selected polyester box. Also, the high frequency antenna for the Bluetooth signal has very specific requirements for the thickness of the copper and sheet layers. Finally, a little bit of thermal management is included as well, since the PWM drivers will dissipate some heat.

All in all, the ECU is a very exciting piece of hardware the team has designed. It has turned out to be very specialistic, due to the automotive requirements and the integration of a high frequency Bluetooth antenna. If you have any questions, ideas, or if you are just interested in the superbike of our team, feel free to come over for a cup of coffee. We are very happy to talk about racing, technical details, designs, electric transportation, or anything else.

Advertorial TNO

Author: Vincent Voogt, TNO

TNO innovates with impact by bringing together a wide range of disciplines and thereby tackling societal challenges. At TNO electrical engineers work on a wide range of themes, with a focus on signal processing, control technology, automation software development and systems engineering. The know-how developed by TNO is used in practical applications up to the level of demonstrators or prototypes.

Projects our electrical engineers work on are, among other things, a sonar that detects mines, a self-driving car, a simulation tool for smart mobility, semiconductor equipment to improve chip production, smart grids for far-reaching integration of energy sources and the development of 5G for mobile telephony.

Spectrum Intelligence

Vincent Voogt studied Electrical Engineering at the TU Delft. He is Scientist Integrator at the research group Electronic Defence and works on Spectrum Intelligence, monitoring and analysis of signals in the electromagnetic spectrum. “Detection and classification algorithms are used to create a real-time picture of who is transmitting, what is being transmitted and what the content is of the transmitted message. The application of Software Defined Radio enables the design of flexible receivers to carry out this task autonomously.”

Creative and dynamic environment

Vincent tells “Working at TNO allows me to prove the potential of new ideas and technologies by demonstrating their benefits in proof of concept designs and how they fit within the customer needs. I like that this requires a lot of interaction with different kinds of customers and their work process in order to create a good understanding of these needs. TNO has provided me a creative and dynamic environment in which I can grow and develop new skills. Within my department there is a good balance between experienced senior co-workers and enthusiastic juniors, as well as a good balance between serious work and social interaction.”

Manage your own career

When you start at TNO, from day one, your work at TNO will involve active participation in projects and you can directly apply your knowledge of signal processing, measurement and control technology, cyber physical systems, chip design and much more to societally relevant themes. You will work together with other experts within and outside TNO and with clients.

> “Working at TNO allows me to prove the potential of new ideas and technologies.”

At TNO you are given a lot of freedom to manage your own career. This ranges from choosing your own projects to determining the direction in which you want to develop. You always have the option of taking part in projects at other departments, too. What’s more, the projects involve plenty of variety. Each project you work on is different

> “At TNO you are given a lot of freedom to manage your own career. “

and so your own creativity and expertise are always required.

The people of TNO

TNO employs around 3000 people with all kinds of backgrounds, qualities and interests. This multidisciplinary aspect is essential to be able to innovate. We combine the right, existing and newly acquired expertise from different disciplines to get the optimum results. Together with universities and top technology institutes we develop knowledge that is closely aligned with the latest international trends and developments.

Ambitious starter?

Are you interested in getting a flying start at TNO? There are many different options within our organisation. Whether you want to be a top researcher, consultant, project leader or business developer. Once you join us, you will have the freedom and responsibility for shaping your own career path.

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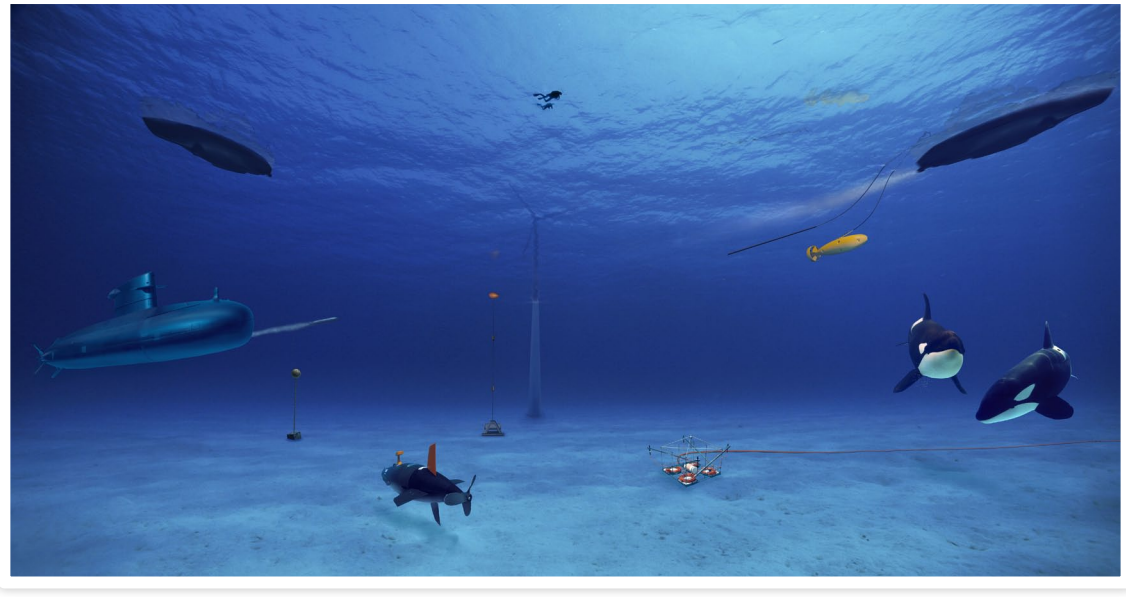


Education

Student involvement in the university council

Author: Stef van Zanten

My last educational article in the Vonk (35-4) was about educational issues close to the association, but games are being played on many more levels, in many more organizations. How does education work on an institutional level? And what influence could you exert as a student on the decision-making processes higher up in the UT hierarchy? I will try to give a nice, idealized overview of how it all works and provide some options for you to make your opinion heard!

Organizing education

The University of Twente has about 10.000 students supported by many staff members. These staff members have organized themselves in several departments that all work on executing the two core tasks of the university: providing education and doing research. On a university-wide level the executive board (in Dutch: College van Bestuur) is charged with administration and management, it is supported by the secretariat of the university which acts as the highest official adviser of the board. In this role the executive board can think of policies and have them worked out by the Strategy and Policy department. An example of an impactful university-wide policy on education introduced by the executive board was the Twente Educational Model. Currently, the executive board is working on revising it in a new Learning2020 policy.

The executive board answers to the University Council, which mainly acts as an advisory body. Sometimes the executive board has to acquire approval from the University Council for impactful discussions. The council treats topics that are university-wide, like housing, funding and the language/internationalization policy. At the University of Twente, the council consists of nine staff members and nine students that also take seat in several specializing 'committees', just like in the parliament on a national level. The students have organized themselves in council parties that each have different views on the implementation of education.

> "Currently, the executive board is working on revising it in a new Learning2020 policy."

Being involved as a student

How do these council parties look after the interests of the students they represent? And how can you as a student make your voice heard? The answer is simple: elections! The members of the University Council are elected every year around June. Cast your vote to make sure the students that share your opinions on education end up in the council! If you cannot find anyone that you think is fit to represent your interests, you can always try to get elected yourself.

Of course there are numerous other ways in which the student members of the council gather feedback from students. The party members often take seat in important university-wide meetings on internationalization and education that are being attended by board members from most study associations, also Scintilla. In addition, there are often member meetings organized by the different parties where you can have nice discussions on various topics. If you're interested, have a look at the activities the council parties are organizing in the near future!

Puuzle

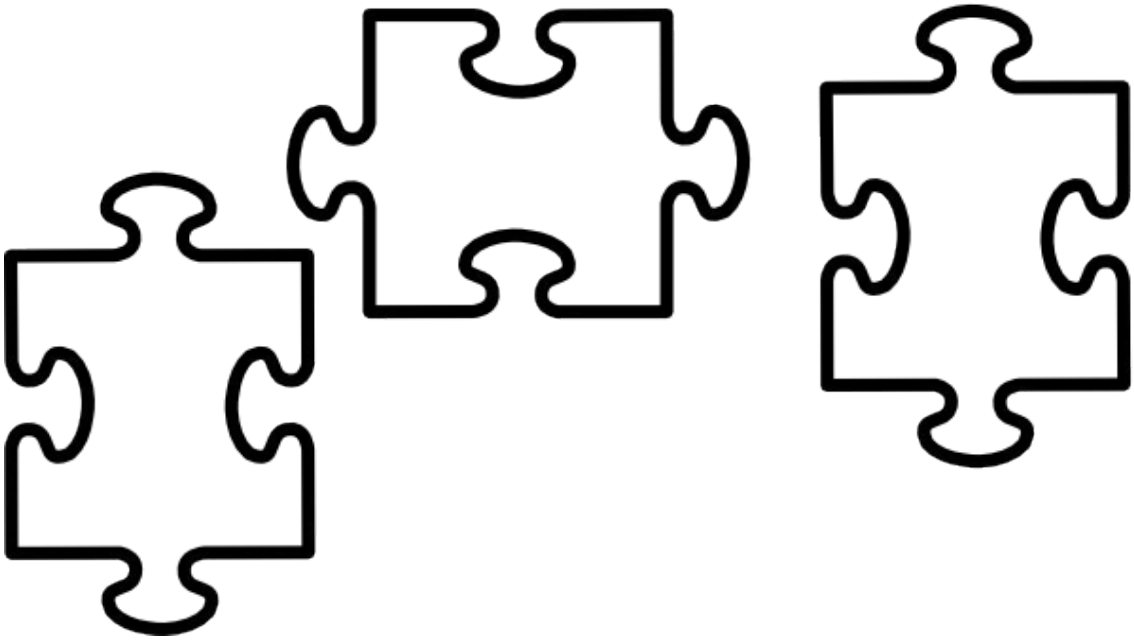
Author: Truusje

Dear sparkling friends,

Last edition's puzzle turned out to be very popular. I have received some awesome creations. Unfortunately, i cannot award each entry with a pie. The lucky contestant of the price puuzle of the last edition is Thomas Hoen, Congratulations! You can contact the Vonk about your prize!

For this edition I have been somewhat creative. I have had some laughs with our cover artist Matthijs and we came up with the following. This edition features a cover which is an artist impression on a particular object. The puzzle is quite straightforward, I am looking for the object which is hidden in the EEG waves. So take a good look at the cover, and send in your solution before July first to be eligible for a delicious pie!

Love,
Truusje



WHERE GREAT MINDS WORK

Innovation Cluster

high tech systems Drachten

We are a group of high-tech companies in the Northern Netherlands that joined forces to work on solutions for the big challenges of the future at the cutting edge of technology. We call this the Big 5 of High Tech: 3D metal printing, remote sensoring and big data, robotics, visual intelligence and all-electric propulsion. We do this by using the latest technology and developing in-house if necessary. We can do this because of the unique collaboration between our R&D departments that, instead of competing with each other, support and reinforce each other. The result of this collaboration is more than 50 new product innovations a year worldwide. These introductions include products that save people's lives, render the control of complex systems easy, adjust products to the individual needs and wishes of consumers, and make data needed for further improvement of food quality accessible. Our collaboration is called Innovation Cluster Drachten and is the heart of the smart factory region in Northwestern Europe.

icdrachten.nl

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