

Presidential Note

Author: Lars Essenstam

Hello there,
you may not know me yet, however fortunately a little further up ahead in this Vonk there is an introduction about me and the rest of my board. As you might guess while reading this presidential note, I am Lars and will be entertaining you with presidential notes this year.



I have now been a board for a little over 3 months. During this time, I am starting to feel what it is like to be a board member. My expectations were that I would not get a lot of sleep and that I would be very busy during the first weeks, during the day and evening. However, so far I am starting to feel more and more like a working civilian. I fall asleep before 11 o' clock while watching tv and wake up before 8 in the morning. I go to the Scintilla room early and usually leave sometime between 5 and 6 o' clock.

Of course, there are many things as a board member that make you feel more like a student. One of them is of course the constitution drinks! The first three weeks are filled with them and they have been lots of fun. We expected that the oldest study association of the UT would not be let waiting when visiting the other associations, however that was not quite always true. Because we, as every proper board, do not let that happen lightly, often took the initiative by taking our rightful place. Something the other associations did not always appreciate. Something we learned here is the cooperation with other boards. When

you on your own try to take your rightful place, this does not always work, however when working together with other boards, under the shout of "WIJ ZIJN" you can always take your place. As you read this, the constitution season is already over. The board will again be quite civilian, present from 8:30 until 18:00. During this time the board will be at many scintilla activities. There are many useful and fun activities, especially during the start of the academic year. If you look at the little triangles scattered around the balcony and Educafé you will find many fun things to do. Be sure to look only at the Scintilla page, otherwise you might end up at a "tai-pain" tournament, or at a Harry Potter style house drink.

Of course, as a board this year we would like to change some things slightly, while flipping others completely around, such as cakes. There are many things we would like to add or remove, one of our biggest challenges is making sure all members have a roof over their head. During the year there are many new students, and many of them are not able to find a home on short notice. Which makes them travel for a long time, sleep

in hotels or sleep without a roof above their head. During our candidate period, the board has already sacrificed one house for these people in the hope the situation improves. We hope the situation will improve throughout our board year, and of course we will do our best to help everyone.

Be sure to drop by the Scintilla room for a coffee, tea or a speech about relation between tai-pan and homelessness.

Dames en heren,
Op de koningin, op Scintilla!

Masthead

De Vonk

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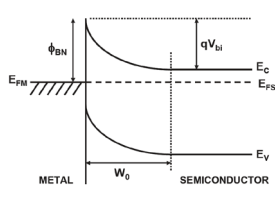
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Maarten Bonnema is working on “analysis and electrical characterisation of vertical nanowire trench metal oxide-semiconductor barrier schottky rectifiers.” read all about this on page 26



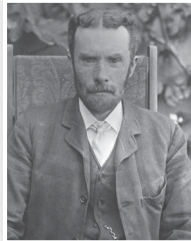
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A few scientists have managed to extensively shape the field of Electrical Engineering. In this edition: Oliver Heaviside



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Editorial

Dear reader,

Treasure this moment. Or at least treasure this Vonk that you are currently holding, as it will be the last of its kind. Over the past few months a great effort has been made to start a new digital platform and after this final edition we will finally be taking the big leap into the digital domain. You can read more on the transition from the first Vonk in 1982 to where we are now in 2019 in the article 'The Last Vonk'.

Rest assured as we want to go out with a bang and have compiled some great articles to be part of this edition, as a lot has happened since the last edition which was released right before the summer holiday. In the summer months, the University's student teams have competed in a lot of competitions. They have made a small summary of their activities during the past few months and describe their successes as well as their failures.

With the start of the new academic year, a new group of people has taken on the role of board members of Scintilla. If you are not familiar with them yet, you can read all about them in the main article where they introduce themselves. For the other new people, the freshmen, a cooking course was held to boost their cooking skills at the start of this year. Our on-site reporter has written down his observations of how this went down.

We welcome you on our website soon after you are done enjoying the content of this last Vonk!

Matthijs



Green Team Twente

Author: Green Team Twente

Green Team Twente is a student team that builds one of the world's most fuel-efficient hydrogen cars. Each year, we participate in the Shell Eco-Marathon (SEM) Europe. Which is a race between teams from different schools and universities where the most efficient car wins. This year, we did not only win the SEM Europe, but also the Drivers' World Championship. In this race, teams from all over the world, with different energy type cars, compete to see who can drive the fastest. This means that we had the fastest, most fuel-efficient car of hundreds of teams!

The projects within the team are very different from each other: some focus on the interface between people and the system, and others allow you to work on controlling the hydrogen system or driving the car with high power electronics.

One of the projects from last year combined power electronics and our knowledge about hydrogen systems. This is the DC-DC converter, that is placed between the fuel cell and the energy buffer. At the start of last year, there was a functioning converter. However, as this circuit was bought, it was hard to understand or control what was going on within the system. It was meant for solar panels and not for hydrogen fuel cells.

The new DC-DC converter was designed to control the load on the fuel cell and to match the outcoming power with the energy already in our capstack. The created PCB had three main parts: a microcontroller to communicate with the other systems in the car and the booster controller that accepts settings from the microcontroller and uses that to switch the final part, which is the actual buck-boost circuitry.

Eventually, the systems worked and

we were ready for the race. We wanted to win, but we also wanted to play it safe. Since we only had four attempts to drive the required amount of laps on the circuit to show that we were able to drive efficiently, all of the variables that we could change were changed in such a way that the car was the most reliable, which was not the most efficient strategy. After doing this and putting down the first valid attempt, we could get creative and start to push the car to its extremes. This meant that during the few days of the competition, we had to change a lot about the electronics in the car, while not being able to test the new settings before starting a new attempt.



One of these things was changing the voltage of our capacitor bank (capstack) from 48 V to 60 V. Because after the technical inspection we found out that we were allowed to use 60 V, so the whole system had to be adjusted in only one day during the race itself. This was off course quite a challenge, but we got it to work perfectly!

We came across a lot of challenges this year, we did not encounter before. You learn to overcome these while being a little bit creative sometimes. One of the best things about Green Team Twente is that you have access to a team of motivated students, funds to help you make your ideas come to life, and companies who can share the knowledge you need to fill in the final pieces. Which makes that, during the year, you gain a lot of new knowledge and skills while being able to apply them immediately.





Electric Superbike Twente

Author: Electric Superbike Twente

Electric Superbike Twente is a student team consisting of 15 enthusiastic people that work on building an electric superbike. The team was founded in 2017, which makes us still a very young team.

This year we will build the third generation bike. The first bike, the Liion-GP, became the European Champion in the Electric Championship and of course we aim to match this result! The vision of Electric Superbike Twente is to show that electric mobility is not only sustainable but also lightning fast and spectacular. We want to beat the MotoGP lap times within a period of five years. To reach this goal, our mission for this year's team is to make a lighter and more agile bike. To achieve this, we are going to reduce the bike's weight by 50 kilograms, compared to the previous bike! This will improve the bike's handling through the corners and ensure faster lap times.

Within Electric Superbike Twente we have three subteams. We have a Chassis team, the Powertrain team and a Communications team. Each subteam is responsible for a different task. The Chassis



team works on the structural part of the bike, like the frame, electromotor and the battery casing. The Communications team is busy working on the marketing strategies, organising events and recruiting partners.

The third subteam is the Powertrain team. Our Powertrain engineers are responsible for all the electric components of the bike. This includes designing and making all the hardware like the ECU, Battery Management System (BMS), and UI, but also the software development. Next to that, the powertrain engineers have to work very closely together with the chassis engineers to make sure every component is provided with our energy from the batteries and given the right directions.

This year our Powertrain engineers will have the challenge to integrate the BMS with our cells, so we need less wiring. This will result in having a lighter and more compact battery pack. Next to designing every electrical component, our engineers produce all our pcb's themselves, together with the help of our partners. After the production phase our most important phase starts; the testing



ELECTRIC SUPERBIKE TWENTE

phase. At this time, we will be able to check if every component works as it should and adjust the software where needed.

To give you a better view on the power we are racing with, here are some specifications. Our battery pack (consisting of 495 lithium polymer cells) provides:

- 700 V
- 170 A
- 120 kW

With all this power on board, the superbike can accelerate from 0-200 km/h within 7 seconds and will have a top speed of around 230 km/h.

To create a bike that can reach these speeds we need a lot of powertrain engineers within our team. Currently we have 2 fulltime members and 3 part time members in our powertrain team, but we can use some more manpower (or female power!). Have you become enthusiastic after reading this, don't hesitate to contact us via www.electricsuperbiketwente.nl/joinnow and maybe you can help us build the best electric superbike so far!





Aerobotic Tech Team Twente

Author: A3T

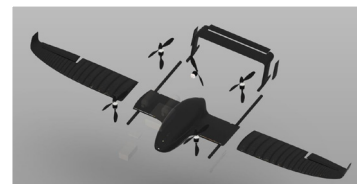
Hi there! We are Aerobotic Tech Team Twente (A3T), one of the student teams of the university. Our team deals with multiple drone-related challenges, in total we participate in four different challenges. In this article, we will focus on the IMechE UAS Challenge 2019.



This yearly challenge consists of a simulated humanitarian rescue mission. An example of such a rescue mission is delivering first aid, water and food to survivors in an area hit by earthquakes. Teams of Undergraduate and taught Postgraduate students from international universities compete in the designing, constructing, developing and demonstrating an Autonomous UAS (Unmanned Aircraft System). The system is required to operate autonomously, performing a series of tasks such as area search, navigating waypoints, accurately dropping Aid Packages and returning to base via a defined route. The key challenges involved are autonomy, optimising the configuration and structure of the UAV for the mission, and designing an accurate payload delivery system. After performing trade studies, we settled on a Vertical Take-Off and Landing (VTOL) - Plane configuration that required a lot of optimising in energy and power consumption. We simulated the power consumption over time for different specifications of components and settled on an octa-plane configuration, which means 8 motors are used for VTOL and one for a forward motion. Since these VTOL motors were required for only ~5% of

the mission flight time, we traded the power-energy costs for weight reduction. The total power consumption of the UAV in VTOL was about 2.5 kW as compared to about 500 W in plane mode. The VTOL motors weighed only 50 g each with the propeller, putting the total VTOL weight cost at 400 g. Since we were 5 times more efficient in plane mode, we had enough battery capacity to complete the required mission flight times. Because the optimising of the structure was so important, another big challenge was the building of a high-quality frame. A lot of different materials can be used for the frame of a UAS. We wanted to use the lightest and strongest material available, carbon fibre. Unfortunately, although carbon fibre is a great material, it is quite expensive. The standard way to make a carbon fibre frame is to use a mold. However, the making of a mold is even more expensive and impractical, since the frame would only be built once and then the expensive mold could be thrown away. Fortunately, we found a company called Fiberneering that became our partner and provided us with their in-house developed FRP3D (3D printed composites). This method is able to combine a 3D printed substructure

and the carbon fibre into one. This technique gave us the ability to build the frame of the drone in a cheap and efficient way. The freedom of the 3D-printing gave us all the possibilities in designing the frame, as you can see in the images. We were unfortunately not able to fly our drone at the UAS Challenge, because of a crash two weeks prior to the event. Nevertheless, the team gained tremendous knowledge and experience from this challenge, which will be included in the new version of the drone that is already being developed by the new team. But like we said, it's not the only project we are working on. Check our website and social media to discover all the projects being made reality this year.

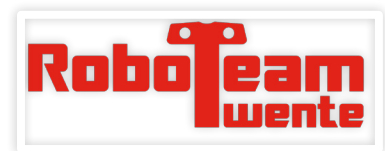




RoboTeam Twente in Australia

Author: Roboteam Twente

Last summer, RoboTeam Twente traveled to Sydney, Australia, to participate in the RoboCup, the world championship of robot soccer. The RoboCup consists of many different leagues where all kinds of robots compete in different challenges.



The Humanoid League competes with walking soccer robots, the @Home League builds domestic robots for day-to-day tasks, the Rescue League builds all-terrain robots with a range of tools. The Middle Size League builds large soccer robots focused on independence, and the Small Size League builds compact soccer robots and focuses on tight control, quick plays, and heavy teamwork. RoboTeam Twente competes in the Small Size League at the highest division with teams from all over the world. This summer was successful, with the team rising from 14th place in 2017, to 7th place in 2018, to 5th place in 2019. As is usual, this success didn't come without some bumps in the road.

Simen - Control team

“During the game against the German team Tigers Mannheim, the communication with the robots was delayed by 50 ms to 500 ms due to an error in the code, which was the side effect of fixing a more crucial feature. Due to this delay in communication, the control loops on the robot had to work with ‘outdated’

commands. A delay of 50 ms to 500 ms may not seem like a lot, but the commands are sent at 60 Hz and the control loop runs at 100 Hz. Still, the robots managed to perform the required actions, albeit in a little more wiggly manner.”

Lukas - Artificial Intelligence team

“Before the RoboCup we had tested all software extensively, but a real match is always different. During our first game we unexpectedly got a segmentation fault. We managed to reproduce it by simulating against other (real-life) matches. It appeared that in one edge case, there could be 0 instances of a shared pointer, subsequently freeing the memory.

We also learned that we received many yellow cards because we interfered when other teams had to place a ball. It is a strict rule that when one team places a ball, the other team should back off and clear a path for the robot with the ball. To do this we used a force model. Unfortunately, with so much robots on the field, a robot would sometimes get stuck

in local maxima and block the path for the other team. After a few games we realized that we could simply put the robots in specific formations, which also gave us more protection during free kicks.”

Cas - Mechatronics team

During the RoboCup, not much could be done on the hardware front as we only had limited replacement parts. Therefore, much more effort was put into protecting our robots from wear and tear. This was accomplished by swapping and cleaning the robots after every game. During the 10 days, robots were driving almost nonstop, giving a constant flow of robots with (small) malfunctions. This resulted in a short time frame for fixing them in order to keep a healthy selection of robots up. During games something will break or lose performance as a result of pushing the robots to the edge of their capabilities at a relentless pace. Having 8 robots in the field playing meant improving the other robots at the same time at the sideline. As such in the mechatronics team there was never a boring moment.”



The 90th board of Scintilla

Author: the 90th board of Scintilla

On the 3rd of September, the 89th board handed over the scepter to the 90th board of E.T.S.V. Scintilla. We have asked them to introduce themselves by writing something about their history. Get to know the new board members a little better by reading their stories in this article and learn about what is driving them and what will be keeping them busy coming year.

From Lars Essenstam
President

Goedemorgen Zonnestraaltjes, Good-morning Sunshines,
You might already know me for a few years, maybe for a few weeks or you might get to know me by reading this text. In this short piece I will explain who I am and what I will be doing this year.

My name is Lars Essenstam and will be the president of our lovely association for this year. As president, I am the face of the association. This means you will see me a lot on activities or hanging around in the Scintilla room, or just walking around somewhere on the UT. I am always open for a short (if I am busy) talk or a long talk.

Now you might be wondering, how do you end up in this position. Well, for me it started around 3 years ago, when I started studying Electrical Engineering. Back then I was still a cute first year student, quite naive and not really sure

what I wanted to do, I was planning to join some kind of sports association, but due to a football injury in my first year that was not possible anymore. One day my do-group parent dragged me to the committee market. It was quite easy to convince me to go there because I am a big fan of lunch, especially free lunch. While there, I talked to some kind people and I decided to join the first-years committee.

Back then I was still a cute first year student

During, the rest of my first year I had lots of fun with this committee. We often got together at evening to 'evaluate' activities, or 'brainstorm' about new ones, but of course this was just an excuse to have fun. In my second year I joined many more Scintilla committees, such as the Kick-in committee. During there I learned organising more serious activities and got more responsible because of it. The rest of the year I also



joined some other activities, SCALA, Scintilla's committee for all likeable activities, and de Borrel, the bartender's guild. Due to this I got a lot closer to the association and got to know a lot more people. I more and more started to find myself at home at Scintilla, and sometimes spend a whole day sitting in the Scintilla Room. In my third year I



decided to become a member of de Borrel Board, which meant quite some responsibility.

When the option came to become a board member, I did not have to think twice. I knew for sure that as a board member I would get to know many new people, learn new skills, organize even more activities and, most importantly, have an awesome year. After a long period of being a candidate board member, I can now finally proudly say I am a board member. Together with the four other board members, we run around, work every day, and drink ridiculous amounts of coffee. But that's my history (and future) with Scintilla, now a little more about the rest of my life:

I was born in Hoenderloo, a small village in the middle of a forest in Gelderland. I had lived there for 18 years when I moved to Enschede when I started studying there. I live in quite a small house together with two other students and have lived there for my whole student time. I do not sport much; however, I do plenty of things to keep myself busy. Such as hanging out with friends, gaming and going to Scintilla activities.

I hope to meet all of you this year!
Lars



*From Maarten Bonnema
Secretary*

G'day dear Scintillian,
Most of you will hopefully know me already or have seen me walking around over the past three years. My name is Maarten and a little more than 21 years ago I was born in the city of Groningen, all the way up North in the Netherlands. Although my parents come from small towns in Friesland and Noord-Brabant, I feel strongly connected to my city of birth.

In September 2016 I started my studies here at the University of Twente. While I was completing my Bachelor, I decided to sign up for a board year at Scintilla and now I am writing this article! This academic year I fulfil the function of secretary of the association. You can always find me in the Scintilla room, reading and writing e-mail after e-mail. Whenever I am not in a meeting or working on the minutes of the General Member Meetings (GMMs), I have the honour to manage and maintain our snack list, SWIPED!

Before I moved to Enschede, I went to primary and high school in Groningen. Fun fact: my high school was called Maartenscollege, certainly a coincidence! Besides my academic career, I



also did various other stuff. Many would not expect, but I played the recorder (no not the electronic device I use at GMMs, but the wooden flute one) and the piano for a few years. I spent all my sporting life on competitive swimming, I did this for approximately twelve years. Remarkable, during the last four years, the trainings started at 5:45 am. Doing this for a couple of years made me a real early riser, this explains why I am always present early in the Scintilla room.

I am always in for a good discussion ranging endless subjects.

Before I became a member of the 90th board of Scintilla, I have been active in various committees. In my freshman year I joined the Scrapheap Challenge committee. Apart from organising some general stuff for the weekend activity, our main job was to gather as much junk as possible. A very accessible committee for freshmen. I also have been chairman of the activity committee SCALA, think of the Christmas dinner and the Summer Barbecue, and ST-UDI. During my time in STUDI I enjoyed discussing relevant and lingering educational issues with many students and staff from the programme. More-



over, I am a proud member of Censores Cantus Scintillae, the committee which upholds the quality of our wonderful cantus. Furthermore, I am in my second term of the EEMCS Faculty Council. During our meetings with the faculty board we provide advise and consent on serious matters, such as but not limited to the Quality Agreements (Dutch: WSV-gelden), housing, and human resource of the faculty.

Once you have been an active member of Scintilla for some years, you develop some strange habits and other weird customs. Like a real Electrical Engineer, I also named my soldering iron: Patricia. As an enthusiast of SWIPED I have also developed my favourite snack, the Nacho Cheese flavoured Doritos. When the working day is over and I am not in the drinking room, I usually watch various movies and series. I am a great fan of Bond movies, especially the older ones with Sean Connery. Furthermore, I am always in for a good discussion ranging endless subjects.

I hope to see you around at the Scintilla room or at our activities!

Kind regards,
Maarten



*From Jessie Huiden
Treasurer*

Hello awesome Vonk reader,

A new academic year has started and for a lot of you that means a new year full of lectures, tests, lab sessions but also a lot of new opportunities and fun activities. For me this is only half true since I am part of the 90th board of Scintilla. This means a lot of opportunities and fun activities and hopefully a really awesome

year without any education obligations. My name is Jessie Huiden and my function in the board is treasurer. This means that I will be handling all money related cases and issues, which in case of Scintilla is a lot of money. At least compared to the money I have as a student. Of course I will not only be busy with treasurer work. A big part of being a board means executing our policy plan and other general board tasks which for sure are things I will be doing this year.

Being a treasurer means doing a lot of administration on the computer which requires a lot of sitting. I therefore really like being a bit more active in the evening. Around three times a week a play volleyball at the student volleyball association Harambee. A volleyball training and game usually consist of two parts: actually performing the sport and what my fellow board members call 'training'. The main goal of this 'training' is to stay hydrated, be social (ieuw) until it is time to escalate right into the Vestingbar. Just like a real work-out this training also sometimes results in some kind of muscle pain, usually a headache. Unfortunately this kind of muscle pain is not that healthy and means that you escalated a bit too much. It however does also most



of the time mean that you had a really nice and fun evening. Luckily I actually do some physical exercise beforehand so that might compensate a bit for the second part of the training. At least I hope.

“Each of these committees were really fun to be part of and ideal stepping stones in becoming board member.”

Of course the Thursday evenings are reserved for the Scintilla activities. I really enjoy a nice BBQ, theme drink or any other activity together with other Scintilla members. Since I also really like to see other people enjoying an activity I decided to join a committee during my first year at the university, almost three years ago. It all began with the parentsday committee in 2016. After that I joined more committees such as the Borrel, EE-Sports and SKIC leading up to becoming a board member of Scintilla. Each of these committees were really fun to be part of and ideal stepping stones in becoming board member.

A very nice thing about being an active Scintilla member is the amount of nice people you meet and get to know. The only thing you have to do for a fun conversation is to pass by the Scintilla room and, excluding the early mornings, there are always a few people who are procrastinating their work (just like me writing this piece) and thus are in dire need of some distraction. This makes the scintilla room a fun place to be however also not to most efficient work space. This concludes my piece of the Vonk. If you have any questions about me, the association, the education or any other

things feel free to walk past the Scintilla room and I will try to answer them or help to find an answer. For now have fun reading this Vonk and I hope to see you anytime soon.

*From Lars Holm
Commissioner of External Affairs and
STORES Administrator*

Obviously, you guys are expecting another bunch of cliché outings in this piece of the Vonk. Probably the hardest part about writing this is not to be cliché and write something inspiring, something to look back on after this year and be proud of, and with good reason. Dark times are coming, as this is the last analogue Vonk, and we are the last board to write something in Scintilla's Periodical in its current form. Enlightening times, however, are already here as the Vonk will continue on-line! Kindly we are waiting to see this article there as well!

One may have already looked on the website to discover what my functions will be within the 90th board of E.T.S.V. Scintilla. New business relations, maintenance of business relations and providing members with the appropriate information to start their careers. It's only



a handful of the tasks that touch my first function, Commissioner of External Affairs. Nowadays there is a vast jungle called the “Labour Market”. Going there means being pulled towards open vacancies of companies that would like to hire you, by 10 companies at the same time. In this vast jungle, the external affairs and the LEX will help guide everyone towards a nice company!

“Coming from a salesman and going to finances is quite a big step.”

Now, you may know that this is not my only function. Only the function of External Affairs did not seem like a large-enough mountain to climb. Pursuing another, unknown, discipline was something that seemed like the real challenge. So, after working many Stores-shifts the last few years, I was inspired to become STORES Administrator for the 90th board of Scintilla! Coming from a salesman and going to finances is quite a big step. Incidentally, this is also my first time as treasurer of any part of Scintilla, which makes it even more of a challenge. Now, after being trained well by Sebastian, I will face this challenge head on, and I'm confident that we'll have another great year with the STORES!

Toward the end of this little piece of text, I would like to let you in on a little secret. It's no secret that board-members like to toast during drinks or other gatherings. Ladies and Gentlemen (dames en heren...) are the three words that will attend all Scintilla members that something is about to happen. Logically, this love for our association and her toast made me decide to also become Vice-President of Scintilla.

All in all, I'm really excited to face this board year head on, and, together with



my fellow board members, keep this association the best and most fun one on the University!

Now, because Lars Essenstam is also on this page, I may not end with a toast, but I left a little surprise for you all in the paragraphs above, can you figure it out?... (Don't tell the president...)

Kind Regards,
Lars Holm

*From Sjoerd van den Belt
Commissioner of Internal and
Educational Affairs*

Hello dear Vonk reader,

My name is Sjoerd. Obviously, I am an electrical engineering student that has decided to spend a year on doing stuff that have a lot less to do with electrical engineering. To be a bit more specific, I will be functioning as a member of the board of Scintilla, as both internal affairs and educational affairs. Briefly, I will tell something about me and why I choose to take this path.

As stated above, my name is Sjoerd, I am 20 years old writing this, possibly 21 when you are reading this. My hometown has been Zutphen for the most of



my life. Of course as soon as I started studying, I moved out to Enschede to realize my student life. Now for over 2 years I have been living here and am more than enjoying it. This year I have started my 3rd year of being a student, which to many people

“For me a board year sounded like a natural choice.”

closely associated to Scintilla sounds like just the start of studying, however, to me it sounds like more than two year have flown by like it was nothing. So, I thought, why not stick another year somewhere in between those (hopefully) 5 years. And then I thought, what will in do in such a year? This was for me a question easily answered, in the past two years I have had so many great time being present at Scintilla that for me a board year sounded like a natural choice. Then the final question is of course, does one want a bachelor before going into a board year? Well, no, of

course you don't. So being enthusiastic about switching life up for a year, I started doing a board year.

So then I had some choices to make on how to spend this year, and being a fan of all the great activities and drinks Scintilla organises, I choose internal affairs. Then there was educational affairs, something I was not associated with to the slightest extend before I started the trajectory of being candidate board. Nevertheless after some good thought and conversation I decided that this is precisely the reason that this is the function from which I can learn the most. Furthermore, during my candidate period and now shortly during my time as a board member, I find that this was a great choice. I am learning a lot already in a very short period of time, and with a long year ahead of me I am sure to learn a lot more in the future.

Hopefully I will see many of you plenty this year either in the SK or (preferable) in the Abscint!

Cheers,
Sjoerd van den Belt





Quality agreements

Author: Sjoerd van den Belt

Since 1986 Dutch students have enjoyed the generous study grant given out by the Dutch government that many of us know as “studiefinanciering” or stuif for short. This grant was meant to give students equal opportunities to participate in a study to their liking. In 1991 changes were made: Stuif was lowered and, to compensate, other subsidies were put in place such as free public transport for students. Nevertheless, for roughly 30 years there had been a grant that all students could equally benefit from.



This changed in 2015, in this year the Dutch government made the decision to overthrow the idea of an equal grant to all students. Students would be able to borrow money from the state over which they would not have to pay any rent. The money saved by cancelling the study grant would be put into improving the quality of Dutch higher education.

Here at the University of Twente part that money has been put into so-called quality agreement funds. These funds are supposed to improve the quality of the study for the good of the students. Since the funds are supposed to go to improvements for the students specifically, the University of Twente has decided to have the budgeting drafted from the ground up. This implies that students can come up with ideas on what to spend the funds on. After some ideas have been gathered the program committees within EEMCS examines the

ideas and picks out ideas which are realistic, useful and can fit within the budget. The ideas, refined by the program committees, are then submitted to the faculty council. Once the faculty council has approved of the plans, the plans are made definitive and money is budgeted in order to realize various ideas. Recently the faculty council has approved of the budgeting for 2019/2020. The quality improvements go to various resources such as:

- Financing MyDAQs for students
- Education for technical support staff
- Improved teaching assistant training

The integrating factor to these resources is, again, improving educational quality. The total sum of the budget for the quality agreement funds depends on the amount of money the government saves, on yearly basis, from the abolishment of the study grant. Since the grant has recently been abolished, there are still

some students that are actively receiving the former grant. As the upcoming years pass the number of students still receiving the grant will approach zero. Logically, as the amount of grant receivers declines, the money available from the old grant increases. This increase means that the amount of money the faculty will budget for the quality agreement funds increases yearly for the coming few years.

The quality agreement funds will benefit students for the coming years. They are meant to improve educational quality for students, and so students have the privilege to draft ideas they deem useful for their quality of education. Until the day that the students’ holy grail of income, the former study grant, returns to students, we better make sure we spend the funds we have to the best of our ability and accept that uncle DUO is not as generous as he used to be.



Lighting in tunnels

Author: ir. J.J. Kerpels, Witteveen+Bos

Tunnels are used in places where regular roads are difficult to build (for example in mountain areas) or where space is very limited (for example in large and crowded cities).

Tunnels are equipped with many installations to ensure traffic can pass safely and incidents can be handled, such as ventilation, fire detection, fire extinguishing, communication systems and traffic management systems. One of the most obvious, but also important installation is the tunnel lighting.

Witteveen + Bos

Design of tunnel lighting

Everyone is familiar with regular street lighting on highways and in residential areas, which is switched on at sunset and switched off at sunrise. Not many people know that tunnel lighting, on the other hand, is mainly used during the day. This is due to the fact that the human eye can not adapt very well to a transition from light to dark, which would happen when you enter a tunnel without lighting. Just imagine how long it takes your eyes to see the contours of your bedroom again after switching off the light.

The lighting in tunnels is designed by taking a few aspects of the tunnel into account:

1. the traffic type (cars / bicycles / pedestrians) and the speed limit;
2. the ratio of the visible exit divided by the visible entrance, as viewed from a stopping distance from the tunnel entrance;
3. the amount of light a road user 'sees' when closing in on the tunnel entrance, also seen from the stopping distance.

When the tunnel is only used by 'slow traffic', such as cyclists and pedestrians, not much lighting is necessary for traffic safety. Lighting is in this case however necessary to obtain social safety (people don't feel safe at night in a dark area), but we won't go into that in this article.

When the tunnel is used by cars, a basic luminance is required, similar to the street lighting outside of the tunnel at night. Whether this lighting is also switched on during the day, depends on the

ratio of which you can see the exit from a stopping distance from the entrance. When this ratio is lower than 15%, the third bullet comes into action, and the tunnel must be equipped with a full and complex lighting system. In this case, the lighting consists of the basic luminance throughout the tunnel, but also extra luminance in the entrance zone of the tunnel to counteract the luminance outside of the tunnel and give the human eye time to adapt.



Figure 1: Daylight cave inside the Laredal-tunnel in Norway





L20-method

The amount of luminance necessary at the entrance of the tunnel depends on the exact situation of the tunnel, and can be calculated with the 'L20-method'. In this method, one must place himself at a stopping distance from the tunnel, which is dependent on the speed limit. For a velocity of 100 km/h this distance is about 150 meter, for example.

When positioned at this distance, a mesh is projected on the view of the driver, see figure 2. For each part in the mesh (100 parts), the type of surface is determined (such as sky, grass or concrete). Measurements have been done to obtain luminance values for these surfaces, which are also different when viewed in different orientations. For example, a clear sky seen in a south direction accounts for 15.000 cd/m², when seen in a north direction this is only 5.500 cd/m². Concrete has a value of 720 cd/m² (south) and 3.780 cd/m² (north). The surfaces seen by the driver are then averaged out to come to the 'L20-luminance'. This L20-luminance is then scaled by the so-called k-factor, which is a factor dependent on the type of lighting (whether the light bundles shine towards traffic, with traffic or symmetrical) and preferences of the tunnel operator (such as Rijkswaterstaat), to come to the required entrance luminance (with P_i the parts of the L20-mesh, and L_i the luminance of the surface on that part of the L20-mesh):

$$L_{\text{entrance}} = k \cdot \sum_{i=1}^{100} \frac{P_i \cdot L_i}{100}$$

Energy consumption

Tunnels consume a lot of electrical energy, especially due to lighting. COB Netherlands estimates that the average tunnel uses about the same amount of

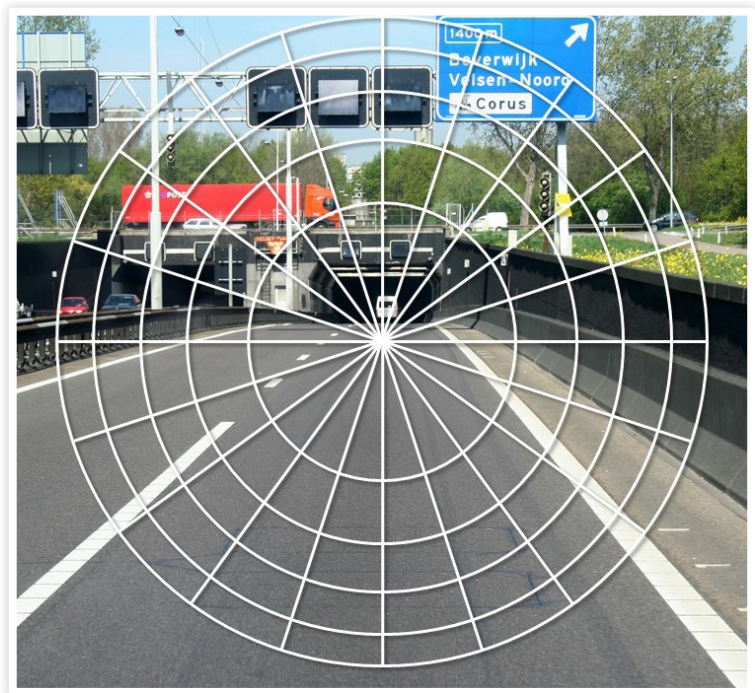


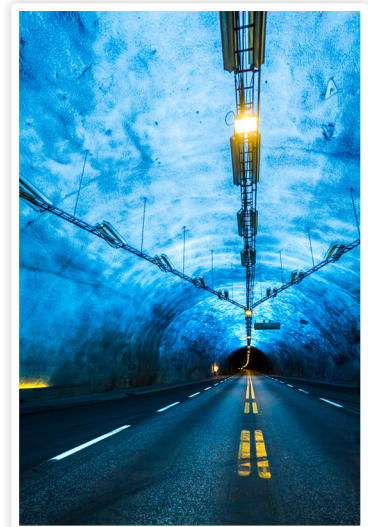
Figure 2: L20-circle

energy as the average city district, which is about 1,5 to 2 million kWh per year, of which lighting uses about 50 percent. A few things can be done to reduce the amount of (entrance) light within tunnels. First of all, the design of the entrance can be done in such a way, that the road users don't see much light when closing in on the tunnel. For example, trees can be places on top of the tunnel entrance to reduce the amount of visible (bright) sky. Or bright walls and roads within a tunnel van be used, in order to optimize reflections of the light and therefore reduce the amount of light that needs to be installed to achieve the required luminance.

Conclusion

Tunnel lighting is very important for traffic to safely pass a tunnel, but it also consumes a lot of energy. It is therefore important for designers to optimize the tunnel design both to improve safety and reduce energy consumption. At

Witteveen+Bos we do this by having an integral approach in the design process, in which multidisciplinary teams of civil, electrical and mechanical engineers collaborate intensively to achieve optimal results.





Active Member Outing





Eind-P Drink

SumYer Party



Intro Cantus



Intro Camp





Constitution Drink





Dies



Do Group Market

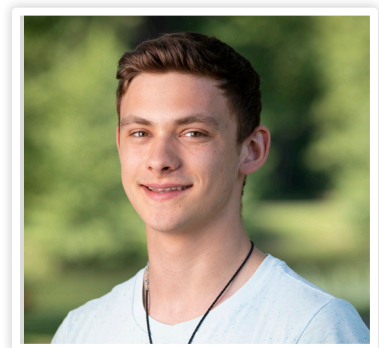




Privacy and security

Author: Herjan Barkman

You have probably heard of or read the book, *1984*, in which the phrase “Big Brother is watching you” is central. A frightening futuristic image is sketched by the writer who had already made the book in 1949. It is about a country in which privacy has completely disappeared, the government rewrites history and puts pressure on the people with propaganda. All very dystopian and you probably think that will never become reality. However, in the area of privacy, for example, a development has started in China in recent years that puts privacy on the brink of collapse. Handy software and good cameras are to blame for this. Of course there are disadvantages to such a surveillance system, but also advantages.



It is important that you can do what you want, as long as it is not to someone’s disadvantage, and that you can express your opinion. However, it is also true that safety in the country also has a high priority. China, for example, has also thought about this and decided to give in a bit of privacy. By hanging up cameras with facial recognition, among other things, authorities can view the country and collect information. This can be used to combat theft and terror. By recognizing people who have gone wrong more often and making certain places inaccessible to them, you can keep thieves out. But people can also be recognized who have terrorist intentions, for example they can already be intercepted on the route to their target. But it can also view traffic accidents and make the culprits clearer. Quite a few benefits that the population itself should be happy with.

However, some people are not happy

with the surveillance system at all. It does take away some of the privacy. If everything is recorded of what you do and where you are, you will soon feel being watched. If there are also consequences, you can also feel pressured. This may limit your behaviour and may even make you feel as if you are in prison. If there is an error in the software by accident and you are seen as a thief, then suddenly you can no longer go to certain stores. On the other hand, it is true that many people think that if you do nothing wrong you also have nothing to fear. Unfortunately, database companies are also hackable. If databases contain so much information about people, then it can be very unfortunate if the data just ends up on the street, even though you may have done nothing wrong.

So there are some advantages to such a surveillance system, but also some disadvantages. If you as a country really want to do well, then you try to find the

right balance for that. This can be more difficult if the country is somewhat larger. Then you should try to prevent such a dystopia where “Big Brother is watching you” becomes a reality.





The drama of living

Author: Kasper Muller

The first year; doesn't it bring back fond memories? In our first year at pre-school we could build with blocks all day, every day. In the first year of high school suddenly we had lots of different subjects and lots of different tests. But you didn't really have to study and almost everyone passed. Then came the university...



I don't know what to say. While in some studies a half full lecture hall may be a rare occasion, in the first week of Electrical Engineering it felt like people were afraid to even think about leaving the self-studies early. In fact, it was only a few weeks ago that the students became more comfortable skipping what they know or become more comfortable at gambling. This is a story about one of my gambles.

It was September the 17th, I remember the day very well. I would finally get my programming book and I had decided that instead of attending the programming lecture I would go home early and take a driving lesson at 14:00. Our lecture had just completed and we retrieved an optional assignment to work on. I decided to go home even earlier and rest before my lesson. It was 11:26 so I had all the time in the world. Still I kinda wanted to get on the next train. This should be doable... While leaving the classroom I thought to myself "I need to take a piss". I could do that in the train, but the toilets at university are better.

11:32... "Ok I need to be quick now!" I rushed through the Horst, jumped

on my bike and started pedalling. "If I get to the roundabout without seeing

"Still I kinda wanted to get on the next train. This should be doable..."

the train I will be fine." Just before the round-about I saw the train. To save some time I dumped my bike in the nearest rack and ran up the stairs. The doors did not open anymore. I quickly remembered someone saying that if you miss the sprinter you might still be able to catch the intercity to Den Haag by cycling to Hengelo. So I went. While biking I contemplated. "Supposing the train goes an average of 80 km/h and takes about 5 minutes to reach Hengelo. I would have to travel like 7 km. 12 min average wait on the next train means I have about 14 min left. 14 min to travel 7 km, is half a kilometre in a minute...

I better speed up a bit..." I dumped by bike in the nearest rack and ran under

the station, with loud squeaking I heard the train leaving.

The next train was said to not go further than Hilversum. I didn't care much. I reached Deventer in no time, but then the conductor said: "The engines have stopped, that's usually not a good sign. This time is no different." On the screens outside I saw that all trains upcoming hours were cancelled. I did not think twice but ran to the bus station. There are no busses to Apeldoorn, but Twello is closer at least and perhaps I can take the bus from Twello to Apeldoorn. I wanted to check on my phone but when I unlocked it, it shut down due to low voltage.

There was just one place left in the bus and everyone needed to go to Twello. Still the driver decided to stop at every stop and tell the upset people not to get into his full bus.

When I finally arrived in Twello it was 13:36. I ran to the other bus that was waiting. The driver said I better go into the bigger bus that would go straight to the station. So I asked him if that bus





has a good connection. He didn't know. I went over to the time table across the road and saw the times: 28 past every hour. I turned around and the other bus left. I walked to the train station and when I got there I heard the broadcast: "Due to a malfunction no trains will stop at Twello". When I turned again

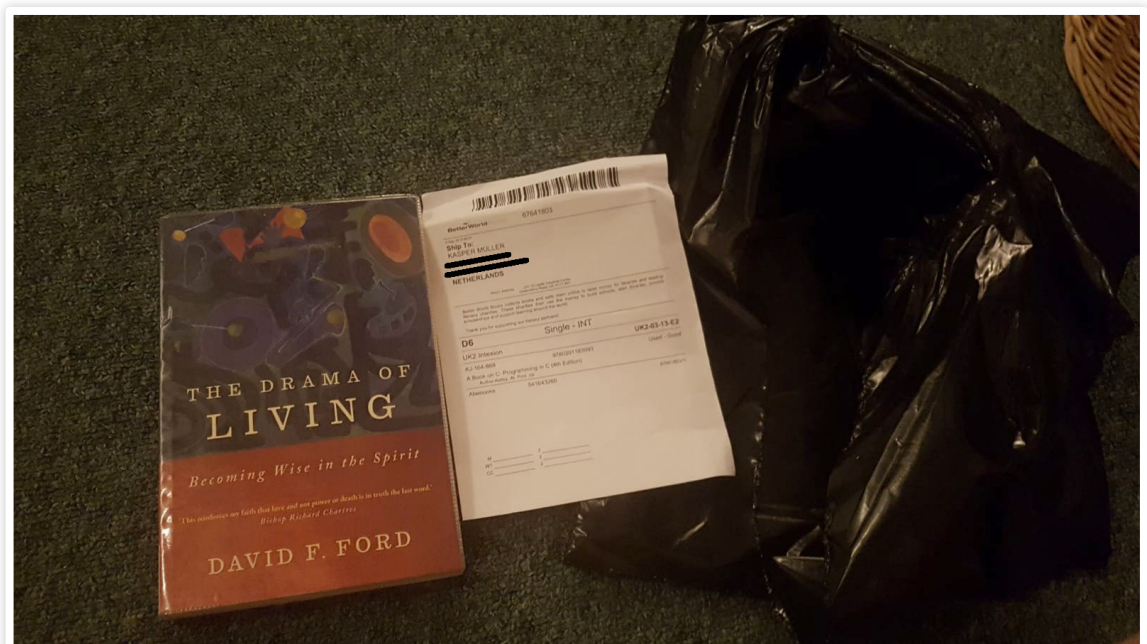
Programming in C. Could it be so small?

my intercity wooshed past me. Not long after, the sprinter as well. After a few minutes my phone was charged a bit from my laptop and I called the driving school. They couldn't pick me up in Twello and I wouldn't get my money back. After contemplating the meaning of existence for a while, another bus showed up.

I ended up in Apeldoorn around 14:30. Luckily I could still follow part of my driving lesson. But it didn't go too well and I had to bike back home through the rain. At least one good thing today I thought. I finally opened the package with the book I ordered. Programming

in C. Could it be so small? I ripped it open. A book did come out. I read the front page. "David F Ford - The drama of living

So, what should you take away? Well, no matter how many cables are broken, how many capacitors you blow up, how many mistakes you make; you can always write a nice article about it! Or perhaps more importantly: never take a piss when you have a train to catch.





BSc assignment

Author: Maarten Bonnema

Hey there! Are you curious to know what module 12 - the Bachelor thesis - entails? Keep on reading! My name is Maarten and I will tell you all about how I battled my way through the last eleven weeks of my Bachelor. If you do not yet know me, you can flip back to the start of this Vonk and read all about me and my fellow board members! I have worked on my thesis called “Analysis and Electrical Characterisation of Vertical Nanowire Trench Metal-Oxide-Semiconductor Barrier Schottky Rectifiers” at Integrated Devices and Systems (IDS). For obvious reasons I shall abbreviate the diode name to VNW-TMBS.



I started my assignment on the 23rd of April last academic year, but I was already looking around for a potential assignment in the last weeks of module 11, something that saves time in module 12 for the assignment itself. In those last weeks, I explored the possibilities and made appointments at research chairs of interest. Do not be afraid to just e-mail or walk by professors in your discipline of interest, an assignment does not present itself. For me it was rather straightforward: my programming skills have never been exceptionally tremendous, I have always been interested in physics and the mathematical and theoretical side of electrical engineering. After a couple of meetings and reading some interesting papers, I came to the decision to graduate at the research chair of IDS. However, I was not there yet, within IDS I still had a wide variety of assignments to choose from; ranging from micro-sensors up to transistor characterisation. After several talks with professors I decided to analyse and characterise the intriguing VNW-TMBS diodes.

The first few weeks of the Bachelor

assignment are often the worst ones. The roster is completely empty, except for the weekly meetings with your supervisor(s); everything comes down to your own effort and motivation. I noticed that an overwhelming majority of my peer students had no clue where and how to start their research. Since I was doing research in the area of device physics, I guessed that the best way to start is to revise the Device Physics course of module 7a, large parts of the subject had subsided anyways. After-

wards I spoke to some Master students and asked for books of Master courses in the same discipline. During appointments with my supervisors we arranged the external members of my graduation committee and I received more papers and articles to read about all kinds of rectifiers and new concepts. The VNW-TMBS diodes which I investigated are 3-Dimensional silicon Schottky diodes. The diodes discussed in modules 3 and 7a are all 1-Dimensional, this implies that the

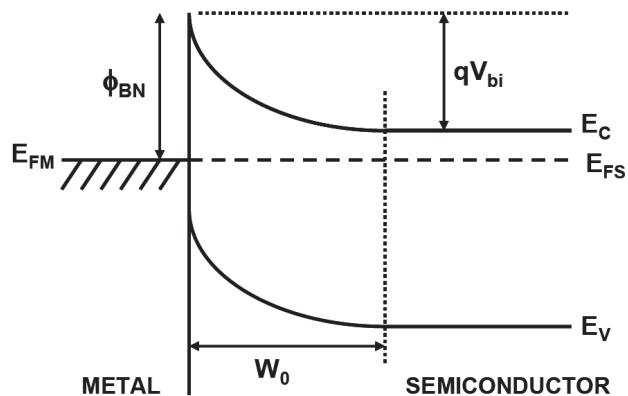


Figure 1: Energy band diagram of a Schottky contact with n-type semiconductor in thermal equilibrium [1].



structure only varies in two dimensions. The rectifier I was dealing with has a complex nanostructure which varies in two dimensions, in order to adopt various physical effects which enhances the electrical performance. The fundamental trade-off in power rectifiers is that of the on-state resistance (forward) and the breakdown voltage (reverse), this also became the essence of my thesis. The Schottky part of the topic might (or should) sound more familiar, a Schottky contact implies that a semiconductor forms a junction with a metal. This structure can best be described by the energy band diagram of Figure 1.

$$J_{ns} = A_n^* \cdot T^2 \cdot \exp\left(-\frac{\Phi_{Bn}}{u_T}\right) \left(\exp\left(\frac{V_A}{u_T}\right) - 1\right)$$

The energy band diagram of this Schottky diode is basically the energy landscape (vertical axis) plotted against distance or depth through the device (horizontal axis), and the Fermi level is indicated accordingly. Due to the negative doping in the semiconductor, a built-in voltage arises with an energy equal to q (elementary charge) times the voltage. The junction causes a region of space charge denoted by W_0 . However, the most interesting property of Schottky junctions is the Schottky barrier height, caused by the built-in voltage and abbreviated by Φ_{BN} . Due to the Schottky barrier, the primary mechanism of conduction is the thermionic emission current (J_{ns}), which strongly depends on this barrier height. The current in forward mode can be described as the following, where A_n^* is Richardson constant [2]. A low Schottky barrier allows for more current to flow in forward mode. When looking at the reverse mode, and assuming a bias voltage much larger than the thermal voltage, the leakage current can be described as [2]:

$$J_L = -A_n^* \cdot T^2 \cdot \exp\left(\frac{\Phi_{Bn}}{u_T}\right).$$

In order to minimise the leakage (or in fact increase the rectification), a large

barrier height is favoured, this contrast reflects the fundamental trade-off in rectifiers. By experimenting with different types of nanostructures, varying numerous physical parameters, and looking into various physical effects, the trade-off can be improved.

Since the objective of my assignment was to analyse and characterise the VNW-TMBS diodes, eventually I had to perform series of measurements. In order to get acquainted with the measurement setup and equipment, I received trainings in the third week. Finally, the fun and exciting part could start. The background research has been done and the first sections of the report were written, it was time to gather as much data as possible! Figure 2 shows the complete measurement setup.

Fortunately, I was able to schedule all the measurement timeslots myself. This gave a lot (convenient) flexibility, for some reasons I never reserved the measurement setup on Friday (mornings). Nevertheless, I have spent lots of days and afternoons in the Measurement Test Centre in Carré.

In the last few weeks the focus shifts to the report, I handed-in multiple preliminary and concept versions and received useful feedback from different people. Eventually 'D-day' came closer and closer: the presentation of the thesis. If you think that presenting is nerve-racking, the questions that are fired at you afterwards are even worse. Fortunately, this went quite well and soon we could all enjoy the free drinks in the sun, discussing end results with peers and supervisors. At last, I really enjoyed my assignment, a good balance between in-depth theoretical research and hands-on measuring.

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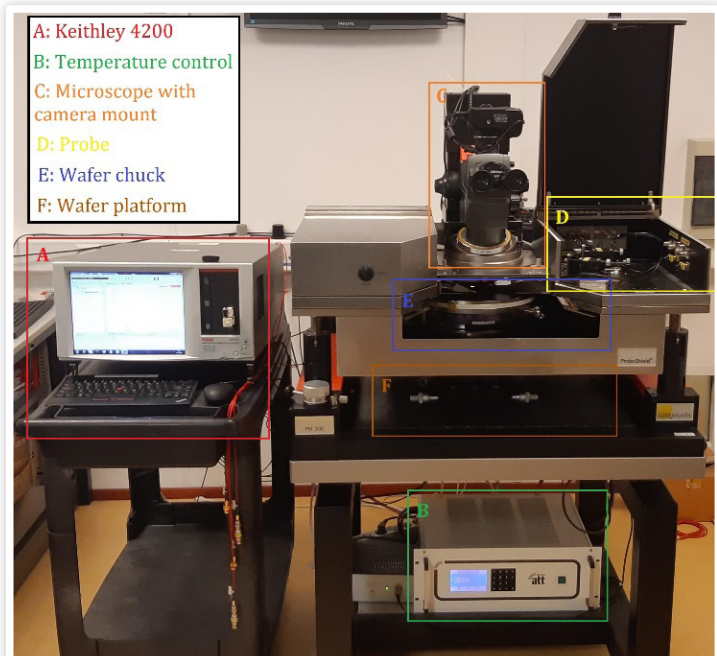


Figure 2 Labeled overview of the complete measurement setup, the Keithley 4200 (left) connected to the PM 300 probe station (right).

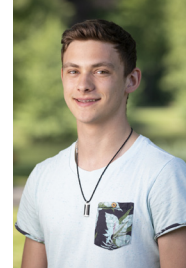


On location

The cooking course

Author: Herjan Barkman

Are you also a person who sometimes burns the food you are cooking? Or do you try to experiment with spices once in a while, but does it always end in a big mistake? In that case, try to follow a cooking course! A while ago the committee MasterClass organised a cooking course. Here you could get a lot of information about different recipes and spices. If that wasn't already enough, for the real escalation participant there was also free beer and wine!



The evening began around 18:00 when we went to a primary school. There, one of the most happy and enthusiastic persons I ever met welcomed us. The chef who was present to teach us, was bursting with energy which was very contagious. First of all we were given a snack and some coffee while he explained what the purpose of the evening was. The different recipes were distributed among the participants, after which we were led to our own cooking islands.

other. So we actually learned something extra in addition to cooking.

One of the dishes was a type of dough that you could later dip into a homemade garlic sauce. This was very tasty and quickly finished. After this the duo could start with their next recipe which was a variation on very spicy meatballs. This was, as a meat lover, personally my favorite.

Another recipe called Muckalica Leskovacka is a recipe from Serbia. This recipe did cost a lot of time because a lot had to be cut, including 2 kilos of chicken breast. It was also hard to season the dish well, the cook indicated that we had to use Vegeta. However, this was very salty and therefore had to be added carefully. Luckily the dish was a great success in the end. The Indian Roti was also present. A lot had to be cut with this dish

“Almost all the recipes that were present had an exotic flavor.”

Almost all the recipes that were present had an exotic flavor. Serbia, Syria, India and other countries were available. That was pretty cool, because you really got to know a few special dishes. The kitchenware and ingredients were already present so you didn't have to bring your own things or groceries. Most knives were unfortunately not very sharp. After some struggles the cook came to us and showed how to make those knives a lot sharper by scraping them past each



The spicy meatballs



as well, but it did not cost that much time. The people working on this did a really great job, as it tasted wonderful. Another duo was busy with Shamburak, this dish is from Syria and I never eaten it before. It is a type of dough that you fill with vegetables and minced meat. That way you get a kind of bag and it was very tasty. With this dish it was especially difficult to bake the dough for a very short time and not to make it too thin, otherwise all the filling would fall out. Meanwhile some people were working on Sopska, which is a Bulgarian salad that includes bell pepper, cucumber and tomato. It was so good. Indonesian thousand layer cake was made for dessert. This was very difficult and had to be done accurately. But the intensive work was well rewarded, I had never had such a delicious cake before.

“The cook helped pretty well and gave clear instructions.”

Wine and beer was also included, so if you had to wait for a while you could enjoy it while watching what the other participants were doing. This alcohol enhanced the enthusiastic atmosphere even more. Cooking obviously includes tasting in between, so that was certainly possible. Along the way, you also tasted the different phases in the recipe and what the herbs had to do with it. You did this not only with your own recipe, but also with the other recipes. The chef then shouted loudly through the room that we had to come and have a quick look and taste. Sometimes I felt as if I had no idea what I was doing. Fortunately, the cook helped pretty well and gave clear instructions. Because of this, all dishes were very successful in the end in my opinion.



Shamburak: left the bag, right the filling



Sopska

We finished the evening with a nice dinner in the form of a buffet. That way everyone could enjoy the delicious recipes again. With wine and candlesticks the atmosphere got even better and the after-sitting was therefore very pleasant. Fortunately we didn't have to do the dishes, so we could all go home carefree, full of cooking knowledge and with a well-filled belly.

Curious about the recipes? These are on the Scintilla site!

Master
C.L.  S.S.

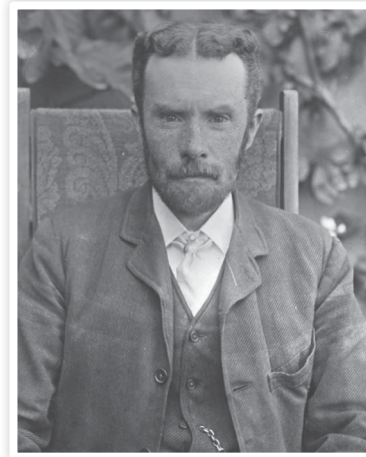




Oliver Heaviside

Author: Matthijs van Minnen

In the last edition of ‘Icons of Electrical Engineering’ we met Richard Feynman (See Vonk 37-3). Among other things, he is famous for the creation of ‘The Feynman Lectures on Physics’ which are commonly used to lecture students on a wide variety of physics subjects including electrodynamics. As you all (will/should become to) know, electrodynamics can be described by the four Maxwell equations. However, James Clerk Maxwell derived a total of 20 equations with 20 unknowns to describe this part of physics. That is why we have to go further back than the year of 1918 when mister Feynman was born.



It may come as a surprise, but it was not Maxwell who derived the final 4 equations we now use to describe electrodynamics. This can be instead be credited to the man who goes by the name Oliver Heaviside (Footnote: That’s right from the step-function! If you want to know, the inventor himself preferred the notation [1]) This is why our story starts

school career ending short handed, he continued studying on his own.

Short-lived working life

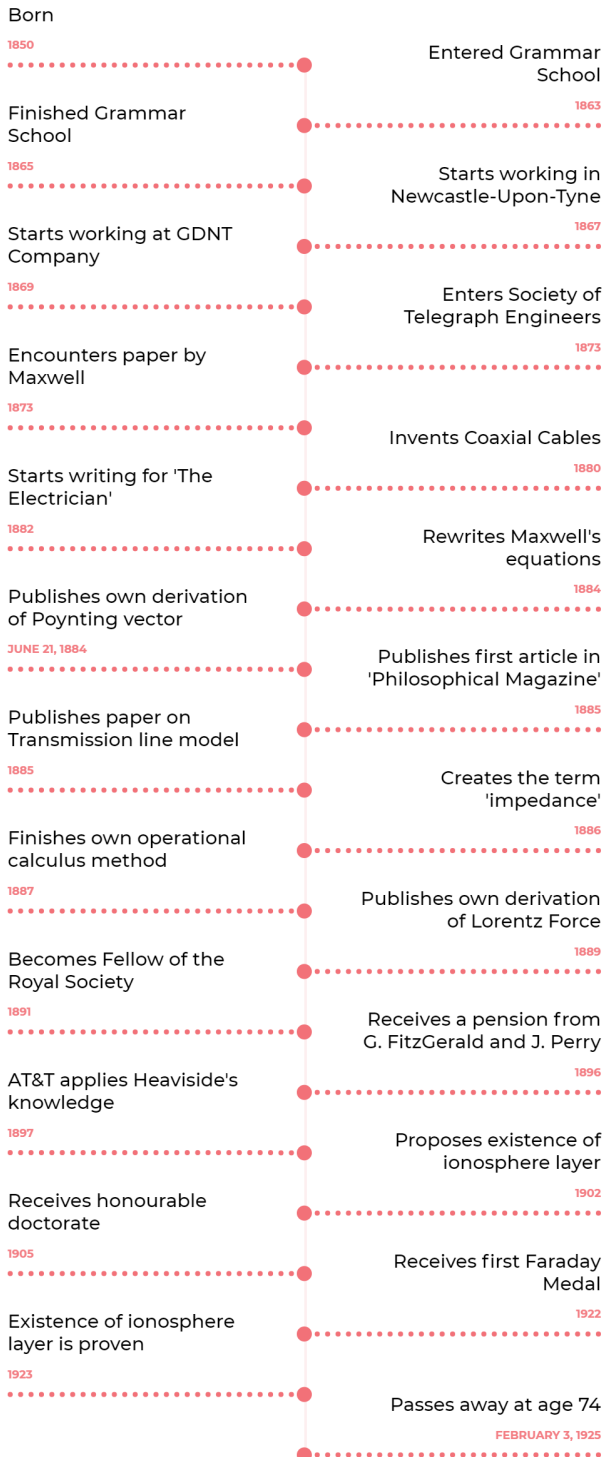
A bit of good fortune came his way as one his aunts married Charles Wheatstone (Get ready we will encounter more familiar names along the way!). This man, known best for his invention of the Wheatstone bridge, was also one of the co-inventors of the first commercially successful telegraph. Seeing that his invention was commercially successful meant that Wheatstone could offer jobs to both Oliver and Arthur Heaviside at his telegraphing company in Newcastle-upon-Tyne. During this period Heaviside studied languages such as German and Danish, but also topics such as electricity and morse code. Which made him more so eligible for a job as a telegraph operator at the Danish Great Northern Telegraph Company in Denmark. After gaining experience for 3 years he moved back to Newcastle-upon-Tyne to handle overseas commu-

nication for the Danish Great Northern Telegraph Company. Like his school-career, his professional work-life was also rather short. Again, Heaviside did not waste his time and as he quit his job as a telegrapher, he went on to study and research from the safety of his parental home. During this time he made another useful invention, particularly for telegraphic purposes, namely the Coaxial cable, or as the original patent describes it: “two insulated conductors [...] one of them inside the other” [2]. At the time, coaxial cables would mostly be applied to eliminate crosstalk between parallel wires, which was one of the main problems plaguing telegraph wires. During the last few of his working years Heaviside had already started to publish articles. One of which was on the topic of his uncle’s measurement device and titled: ‘The Best Arrangement of Wheatstone’s Bridge for measuring a Given Resistance with a Given Galvanometer and Battery’. This work delivered him many positive comments, including those from both James Clerk Maxwell as well as Sir William Thomson, other-

“A few short years before passing away, Heaviside was the first scientist to receive a Faraday Medal.”

halfway through the 19th century in the year 1863 in London. Heaviside enters school at the age of 13 but seeing that he grew up in a rather poor family, his academic career unfortunately ends at age 16. Within this short time Heaviside had managed to end up among the top 5 students of his school. Despite his





wise known as Lord Kelvin (you are surely familiar with the unit named after him). On the one hand Maxwell was inspired by the works of Heaviside, to such an extent that he used Heaviside's derivations in his own work 'Treatise on Electricity and Magnetism' where he publishes his 20 Maxwell equations. On

"Luckily, in the later years of his life, people started to understand the significance of Heaviside's discoveries."

the other hand, this work by Maxwell inspired Heaviside and—after applying vector terminology to yield the famous 4 equations—gave him the required knowledge to derive the 'telegrapher's equations' which are at the basis of transmission line theory.

For the analysis of existing telegraphing systems, Heaviside developed his own operational calculus method (which is similar to Laplace-transforms, but his version was easier to use according to Heaviside himself). For this method, Heaviside did require a new technique to mathematically excite the system. In the current days this operator goes by the name of Heaviside step-function or unit step-function. To complete his transmission line theory, Heaviside needed terms to describe a number of (transmission) system parameters. As such, he conceived terms such as admittance which together with the previously known real resistance would form impedance.



Other discoveries

By now, you may have noticed that the late Heaviside can write many inventions and discoveries to his name. However, he also—individually—discovered other noteworthy phenomenon in his field which were, unfortunately for him, credited to other great scientists. Take for example the Poynting vector describing the electrical flux of an electric field. Whilst John Henry Poynting himself had his discovery roll of the presses on the 19th of June, our Oliver Heaviside published an article about the same topic only two days later, on the 21st [3]. Likewise, Heaviside continued

“During this time Heaviside made another useful invention, particularly for telegraphic purposes, namely the Coaxial cable”

on the work of others to find a more complete description of what is now known as the Lorentz Force by applying modern vector notation and including the influence of Maxwell’s field equations. However, it was Hendrik Antoon Lorentz who derived the current day formula by including the influence of the electric field, resulting in the effect being named after him instead.

Back in 1885 when he developed the transmission line theory, Heaviside also proposed a solution to significantly reduce the distortion in transmission lines by applying a crude form of impedance matching, using what is known as the Heaviside condition. Although simple, this method was also a radical one, as it required the installation of loading coils (large inductors) at precise intervals along the connections. This would result in a huge amount of coils to be installed along the long telegraph lines. Due to

the size of this undertaking as well as an ongoing conflict between Heaviside and the United Kingdom Post Office superiors, this solution was not implemented in the United Kingdom.

As this idea went unused, it was never patented, which allowed the engineers of AT&T in the United States to pick up the idea and develop it into a working design. Scientists George Ashley Campbell and Michael Idvorski Pupin both worked on developing solutions to resolve signal distortions based on Heaviside’s invention. As was often the case during those times, both scientists found a solution but filed patent request at different times leading to disputes over who owned the idea. In the end, AT&T bought off all beneficiaries to ensure that they could fully use the loading coil design. As a part of this, they also offered a (small) sum of money to the original inventor. Heaviside would only accept the offer if he was also fully acknowledged as the original author. Since AT&T already had disputes with two other scientists on their hands, they declined this request and Heaviside went empty handed.

Receiving recognition

Luckily, in the later years of his life, people started to understand the significance of Heaviside’s discoveries. Whereas the British Post Office did not share the views of Heaviside, the British Royal Society granted him the status of Fellow of the Royal Society. And despite never following any form of formal education after finishing grammar school, Heaviside receives an honourable doctorate from the University of Göttingen. Finally, a few short years before passing away, he was the first scientist to receive a Faraday Medal.

Despite becoming an eccentric hermit in the last few years of his life, Heaviside was greeted with one final discovery, back in 1902 he proposed the existence of a charged layer in the earth’s atmosp-

here able to reflect radio waves allowing for long-range wireless transmissions. It

“Despite his school career ending short handed, he continued studying on his own.”

took some 20 years but its existence was finally proven in 1923. This proof alone was enough to grant the researcher, Edward Victor Appleton a Nobel Prize. Oliver Heaviside would finally pass away in 1925, aged 74. But, his knowledge and discoveries still remain the foundations of today’s Electrical Engineering.

[1]: Wikipedia contributors, “Oliver Heaviside”, Wikipedia, The Free Encyclopedia, https://en.wikipedia.org/w/index.php?title=Oliver_Heaviside&oldid=917289737 (accessed September 29, 2019).

[2]: O. Heaviside, 1880, “Improvements in Electrical Conductors, and in the Arrangement and Manner of Using Conductors for Telephonic and Telegraphic Purposes.”, 1407.

[3]: P.J. Nahin, 9 October 2002, “Oliver Heaviside: The Life, Work, and Times of an Electrical Genius of the Victorian Age”, JHU Press, ISBN 978-0-8018-6909-9.





ASML: A technical graduate's playground

Author: Pieter Afslag

Pieter Afslag is a production engineer at ASML, working in vacuum systems in our EUV (Extreme Ultraviolet) factory in Veldhoven, the Netherlands. Pieter studied electromechanical engineering at Group T at the Catholic University of Leuven, Belgium before starting his career at ASML in September, 2017.

“Someone from the ASML EUV factory came to my classroom one day and gave a presentation about ASML. It got me interested. I’ve always been interested in companies that design and built their own machines, but ASML does more than that. Their machines are so huge and complex that they exceed the limits of technology. You really have the feeling you’re contributing to the future of technology.”

“I really didn’t know what to expect before I started working here. When I looked at the vacancy that the ASML contact had forwarded me I only recognized a few words in the job description. But when I came in for an interview, I saw the machine and started asking questions and was really intrigued by the answers I got and I started to think, ‘Hey, this is something I could really get into. This might be the right job for me’. But in the end, you’re never completely sure – it’s always a bit of a guess. I think it’s hard to find the right job immediately

after university – I was a bit lucky in that, I guess.”

“In my daily work, I focus on continuous improvement. We’re always trying to look for solutions and improve processes. Currently, we’re trying to de-

“Every day is different here, but that’s what I like about my job. You never know what you’re going to experience.”

crease cycle time [the time it takes to manufacture a part, module, or (sub) system from start to finish] in the factory. I guess you could call the production engineers like me the link between the factory itself and the Development and Engineering (D&E) department. We have to make sure that something that

Development makes or fixes will also work in the factory. We’re often sitting together with D&E and suppliers to see how we can make things work.”

“Every day is different here, but that’s what I like about my job. You never know what you’re going to experience. But I learn something new every day. Really, the knowledge I gather on a daily basis is unbelievable. I really like that.”

“As a graduate, you can pretty much start anywhere you like at ASML. There are so many departments to choose from. You can even change functions after a while or move to other departments. In some companies, you might get stuck doing one thing, but not here. You definitely won’t get bored.”

There’s something for everyone at ASML. If you want to become a designer or architect you can work in D&E. If you prefer interaction with the factory and like to solve problems, then Troubleshooting, Test or First Line support might be something for you. If you like to travel and focus on building a relationship with the customer, you can work in our extensive Customer Support department, at locations all over the world. The list goes on...

Puzzle

to win a Bluetooth speaker!

Across

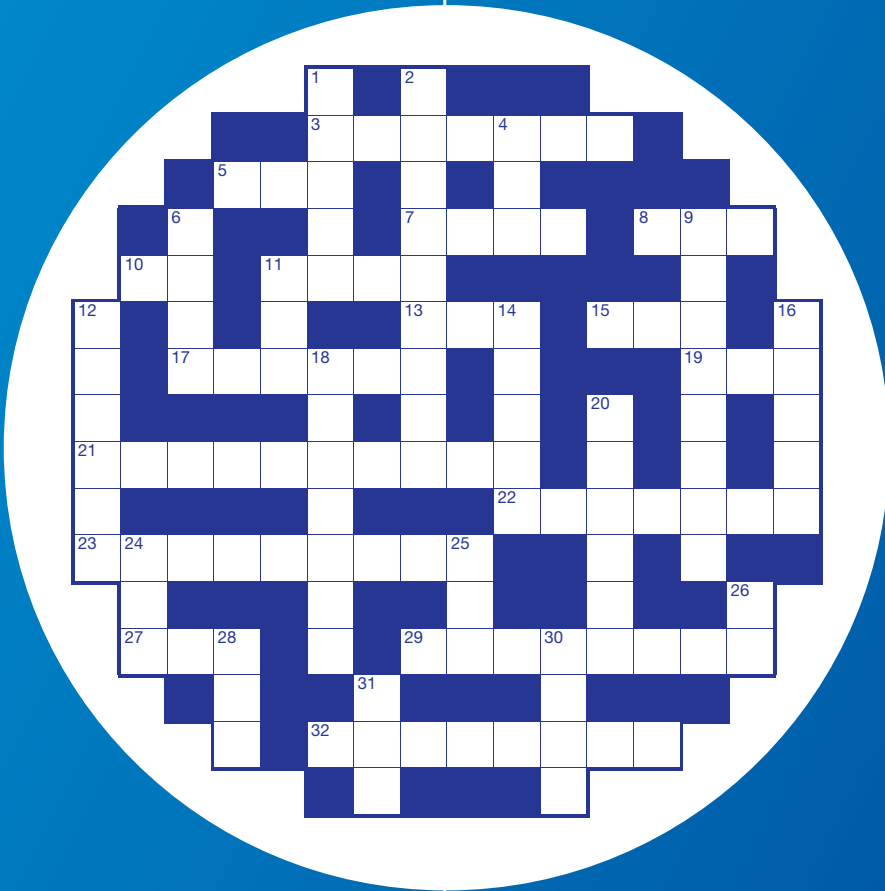
3. Second profession of the inventor of Morse code
5. Frozen water
7. Component considered to be ASML's heart of the DUV system
8. State of the ... technology
10. Japanese board game
11. Starting material for wafer production
13. Carpenter's tool
15. Chemical elements: Hydrogen + Iodine element + Sulfur
17. Transistor layout
19. Environment friendly
21. First person to win two Nobel prizes for Science
22. Part in ASML system that contains the customer's pattern for chip production
23. Location of ASML's headquarters
27. One of the partners in the 'Metropoolregio Brainport Eindhoven' sponsorship
29. Famous physicist who became a guitarist
32. Decade in which ASML was founded

Down

1. Type of web browser
2. ASML system to measure on-product overlay
4. Metal used in ASML's EUV light source
6. One of the two sports that has been played on the moon
9. Department that conceives ASML's future technologies
11. Star at the center of our solar system
12. Science fiction writer that invented the three laws of robotics
14. Chips are cut from a ...
16. The Law driving the semiconductor industry
18. Production facility to manufacture a complete ASML system
20. Program language developed in the Netherlands
24. ASML's latest lithography technology
25. Near-infrared
26. Internet country domain for Malaysia
28. Laboratory
30. ASML's biggest market
31. Device that makes you able to interact with a computer

Curious to learn about our opportunities for students?
Visit www.asml.com/students

ASML



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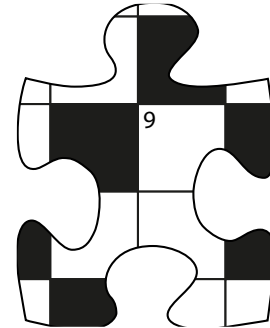
Submit the correct answer by November 30 by e-mailing it to campuspromotion@asml.com
Out of the correct answers we will randomly select one winner to win a Bluetooth speaker.
The results are not open for discussion.



Puuzle

Author: Truusje

The puzzle Truusje has prepared for you this edition is a bit different it will involve some decoding on your part. good luck!



This edition's puzzle involves steno-
graphy. This is the art of hiding a mes-
sage into something else. Try to find the
hidden message. you need to use every
bit of information you have.

Send your answers to vonk@scintilla.nl
in order to participate!

The closing of a chapter makes way for the beginning of another
chapter thank you all for being a part of the journey

