INTERNSHIP BOOKLET

MASTER ME & SET

JUNE 2023

INTERNSHIP-ME@UTWENTE.NL

Introduction

Dear student,

After several years of following courses and participating in projects, you are now almost ready to go into the word and test your engineering expertise and skills in practice. During your internship you will work at a company or institute as part of a team of engineers. During a three months period, you will contribute to real life problems and experience what work-life might be like after graduation.

For choosing an internship, a lot of options are available for you. You can go to one of the local companies nearby, select an interesting company somewhere else in the Netherlands or even go abroad. Based on your preference, you can choose to go to a small company, see what it's like to work in a large multinational or work at a research institute.

Having so many options can also make it hard to decide what would be the best option for you. To help you select an internship that fits you, we have gathered internship experiences from students in a wide range of companies in this booklet.

We hope this will inspire you and help you to decide where you would like to do your internship!

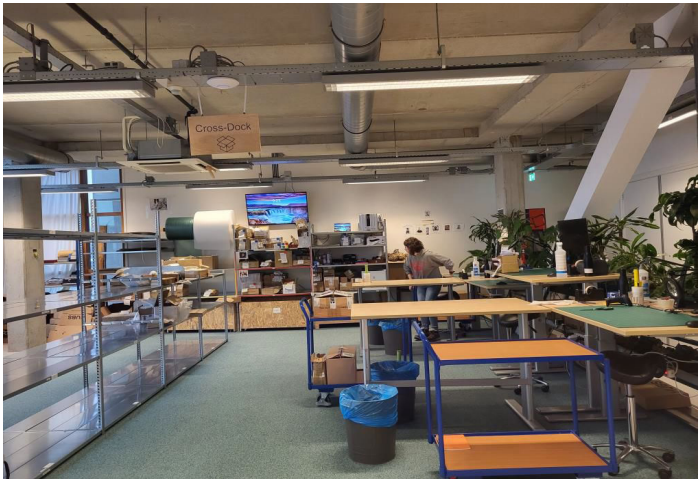
Kind regards,
Lisa Gommer
Programme Director ME

Table of Contents

AMSTERDAM

3D Hubs

The Hubs is an on-demand online manufacturing platform for various manufacturing technologies such as CNC, Sheet Metal, Injection Molding and 3D Printing with global network of suppliers in Asia, Europe, North and South America. Customers can order the desired parts with lot of range in materials and secondary surface finishes. The quotes are generated using machine learning, for the customer which saves a lot of time to produce quotes manually and deliver parts with faster lead times. During my internship my day to day tasks to be done as the quality control intern, involved in the quality inspection of the manufactured parts and quality documents inspection. Two major projects were handled by me first project was the “Quote QC”, it was to make sure that the information on the technical drawing is aligned or is consistent with the quote to avoid discrepancy and confusion with the suppliers during production. “Structured Problem Solving – 8D” was my second project where the aim was to find out from where the problems contributing to the disputes and NC’s (Non Conformances) originate and to provide a solution or remedy to decrease. The 8D tool was formulated and designed by me for the suppliers to identify the root causes causing NC’s and Dispute and to make the suppliers in the network capable to deliver quality parts.



Aeronamic

Aeronamic BV. (formerly UCN Aerospace) was founded in 1988 as a part of UCN (Ultra Centrifuge Nederland), now ETC (Enrichment Technology Company). They are a supplier and service provider for high-speed aircraft subsystems and components. As a vertically integrated company their aim is to provide the entire process of manufacturing steps. This means they have many specialized processes inhouse.

Due to the strict traceability requirements of aeronautical parts, it is important that all parts are marked with the required identification numbers and acceptance marks. This may be challenging since not all parts my be suitable for marking as the marking operation may influence the surface characteristics of the part. Laser-based part marking is currently the preferred method due to its versatility, repeatability and speed.

During my internship assignment at the Manufacturing Engineering Department I explored whether some parts that are currently marked using other methods could be marked by their new laser marking machine. I studied the technical drawings and specifications associated with the part and did lots of practical experiments. During my assignments I got to talk with lots of experts (Manufacturing engineers, Special process engineers, measuring specialists and machine operators) within and outside the company and learned a lot about what it means to manufacture within the strict aeronautical standards.

AmperaPark

Ampera Park is developing an Energy Management System (EMS) for smart office buildings, which will provide services related to clean energy generation by solar PVs, electricity storage in batteries, EV charging and cost reduction. However, a significant concern emerges in this context. This concern is related to the optimal exploitation of excess electricity generation. To this end, the integration of heat storage systems with tanks should be considered. More precisely, the objective of the present report lies in the investigation of different scenarios for the utilisation of excess PV yield by means of heat storage in tanks and EV charging optimisation, aiming to determine the most adequate alternative from a Net Present Value (NPV) perspective.

In this context, the present research aims to determine which system components and parameters exert the strongest influence on the NPV. More precisely, the two most significant factors determining the financial viability of the investment are the ranks of EV charging and battery charging in the system hierarchy. In terms of system components, ETB ((1) EVs, (2) Tank Storage, (3) Battery Charging) has emerged as the optimal hierarchy; namely, the electricity generated by the solar panels has to be sent primarily to the EV charging infrastructure, then to the heat storage tank via heat pumps and lastly to the battery. By contrast, BTE constitutes the least preferable alternative, as this hierarchy is the complete inversion of the optimal one. In regard with system parameters, the impact of COP of the heat pumps on NPV is negligible. Nevertheless, a noticeable positive correlation has been found between the temperature difference of the heat storage system and the NPV, as well as a negative correlation has been found between the size of both energy storage systems (namely the battery and the heat storage tank) and the NPV.

Apollo Vredestein

Assessment on Utilization of Residual Heat from Mixing Process

The current development regarding the world's climate has brought a daunting challenge right to our own doorstep and forces everyone to think about their energy use. In this research, the challenge of estimating the amount of available residual heat coming from mixer eight in the factory hall of Apollo Vredestein is estimated and potential solutions to recover the heat are discussed. An energy balance is created to provide a fundamental look into the physical assets within the system and a model is built upon this acquired knowledge.Finally, the most suitable solution for Apollo Vredestein's application turned out to be an industrial heat pump that upgrades water by means of the extraction of heat from the residual water stream.

ASML

At the beginning of the second year of my master's, I did an internship at ASML, the worldwide leader in the semiconductor industry. The internship took place from September to December 2022, at Veldhoven Campus. ASML manufactures the most advanced lithography machines in the world that use extreme ultraviolet technology. The company aims to increase its service performance by becoming more proactive in every aspect. On the way to achieving that, the company launched the Global Operation Center in the Customer Support department, where I completed the internship. The Global Operation Center has a view of the worldwide installed base and aims to increase the overall availability of the machines using, among others, Predictive Maintenance practices.

I completed an investigation in many departments of the company aiming to identify the playing field of the Global Operation Center. After meeting with many employees at different roles and hierarchy levels, I came up with several findings. Combining these with the knowledge got from the university and from studying further literature, and training I got from the company, I proposed suggestions to the identified gaps, which can form other individual projects. One of them is already approved and it has started.

During the internship, I had the opportunity to observe how things work in a high-tech giant company. I had the privilege to work with experienced people who are experts in their domains and grasp good practices and knowledge from them. I was also able to provide my ideas as everyone's opinion is heard and valued. Moreover, meeting with many people helped me improve my communication skills in a working environment and also increase my network.

ASML is a great place for someone to learn, grow, apply their knowledge and ideas, and I feel grateful for having this opportunity.

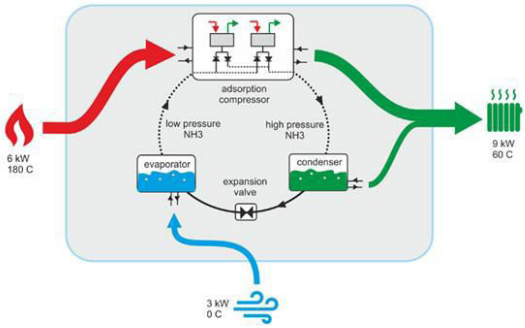
Cirex

CIREX Almelo is a foundry specializing in high-precision investment casting. They have evolved their wax pattern assembly process to increase production output and optimize profits. Cirex is a company where entrepreneurship is important. As an intern, you get a lot of freedom but they expect you to be motivated and come up with solid ideas. The goal of the assignment was to research different methods of pattern assembly and see if there is a better method that can be implemented within the CIREX foundry in Almelo. The focus should be on the increase of quality and the universality of the method. During the internship, I researched different pattern assembly methods for investment casting. After coming up with different concepts 2 methods were chosen to do further testing. A strength setup was constructed and a strength test was done on the 2 new methods and also on the current production process. After comparing these results advice was given, that the implementation of stick-tight waxes was the most promising method. This was determined by using a takt time analysis. Along with this analysis, the quality and failure rate was also analyzed. This all resulted in a setup and advice on how the stick-tight pattern assembly should be implemented within the fully automated production process. During my internship I really enjoyed working at CIREX, the atmosphere in the company is really good. You get a lot of freedom to come up with ideas. If they agree with those ideas you get a lot of support to make things happen.

CIREX
A Signicast Company

Cooll

Cooll is company that is originated from the University of Twente. The founders started their research is sustainable heating and cooling solutions based of adsorption technologies before founding the company in 2009 . Currently the company focuses its resources to design and create a central heating system for typical Dutch households which uses a thermally driven heat pump. The thermally driven adsorption heat pump(HP) is comparable in size to a condensing boiler and is designed to be connected to traditional central heating systems with relatively high temperature radiators. It can therefore be used as an efficient, drop-in replacement for the widely used condensing boiler, while reducing gas consumption by about 30%.



My internship assignment revolved around the adsorption compression that drives the heat pump. I was building a numerical model in Python that can determine the theoretical heat recovery rate during an adsorption cycle. The model was created in a way that the initial conditions could be varied so it would open up a way to observe different scenarios.
The company has friendly and welcoming atmosphere where you can turn everyone for help or guidance. The assignment gave me an opportunity to learn more about coding and modelling which changed my previous view of the topic to a positive trajectory. During your time at the company as a student you would have a chance to work on your own while having a constant support of Cooll behind you.

Cooll

Cooll is an innovative Dutch company developing an energy-efficient and affordable adsorption heat pump for existing and newly built houses. The internship was about running experiments to test the effectiveness of different deaerator configurations to determine the most effective one to be used in the final product. During this experience, literature research has been conducted regarding heat pumps, adsorption processes and especially deaeration theory. The setup to run tests and five deaerator configurations have been designed and built. Then deaeration tests were conducted.

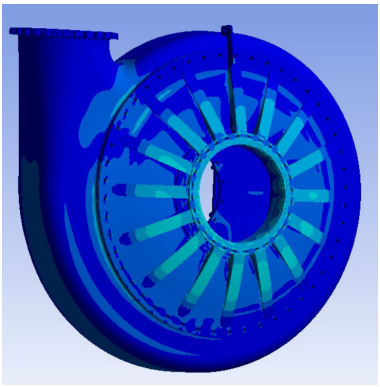
The experience at Cooll was really positive, the environment is cosy and the people are always willing to help and give advice, I really felt welcomed. I learnt a lot, theoretically and practically, and I consider this experience helpful for my personal and working growth.

Damen Dredging Equipment

Damen Dredging Equipment(DDE) is part of the larger Damen Shipyards Group. At DDE in Nijkerk, cutter suction dredgers(CSD's) are developed, designed and built. An important and expensive part of such a CSD is the dredge pump. At the Research, Development & Innovation department(RD&I) of DDE, there is continuous research into optimising these dredge pumps. The internship was also focused on optimising the dredge pump in terms of wall thickness.

During the internship, the dredge pump casing was analytically analysed in terms of stress distribution by using Excel and Python. After the analytical analysis was completed, these results were validated with the use of an extensive Finite Element Analysis with ANSYS. This resulted in very interesting and promising results for the company which made the internship a success.

DDE is a great company with a pleasant working environment in which interns are professionally guided. During the internship, you do not feel like an intern but more like a colleague. DDE and Damen offer a wide range of internship and graduation projects for students from all disciplines.



Picture of the Dredge Pump during the Finite Element Analysis.

Demcon

DEMCON is an organisation that develops innovative high-tech systems that contribute to solving societal issues. Within DEMCON Defense & Security Systems (DSS), ongoing research is conducted on autonomous systems. Their UGV development platform uses Lidar inertial odometry to locate itself in GPS-denied environments. Lidar is an expensive sensor, and its usage can be detected and jammed, making it not optimal for military or security applications.

The main aim of my internship was to evaluate if visual inertial odometry (VIO) could be used for self-localization instead. Here, I integrated publicly available algorithms to work with a stereo camera and IMU.

This internship gave me insight about software development for robotics. I believe that this was a missing part from my mechanical engineering studies and am glad to have done this internship.

The employees at DEMCON are very friendly and easy to approach. Communication via email goes quickly, and employees were willing to schedule meetings or make time for me whenever I was stuck. This made DEMCON a pleasant working environment.

ENSCHEDE

Demcon

My internship was performed at Demcon Multiphysics. A Demcon group that specializes in numerical simulations such as FEM and CFD problems. I was tasked with exploring the options regarding topology optimization in Ansys. The main goal was to improve the design of a lightweight bracket. The bracket's mass was reduced by an additional 30% and allowed for easier 3D printing due to an overhang constraint. Additionally, test cases were created to test specific functions. An interesting result is the creation of a flexure-like hinge inside of a structure to limit local rotations. Lastly, recommendations for postprocessing a design and the general workflow of topology optimization were formulated.

The internship at Demcon Multiphysics was an enjoyable experience. Especially the guidance and brainstorms with my supervisor were good learning moments. All in all, it resulted in an internship without hiccups. The rest of the group was also very welcoming, there was always somebody available for questions or a coffee.

Optimized bracket design

DGS-PS

DGS-PS is a Line builder primarily for the meat industry, it designs and manufactures all sorts of automatization solutions and custom machinery from slaughter equipment to transport conveyors. What makes DGS special is their flexibility, they will always cater to the customers needs and help to find an ideal solution.

Whereas this sounds like a dream for every customer, it poses some challenges for DGS. Catering to the customers needs requires a lot of flexibility and flexibility ads complexity. During my internship I had the chance to help tackle this problem. During my internship I had the chance to make a product configurable. To do so it first had to be made from as much standardised modular parts as possible. Secondly, a solution had to be found for the parts which could not be made modular. The proposed solution was a Solidworks Product configurator called “Tacton design automation”. Using this program dimensions and features of parts can be altered based on simple input question. Simple coding could also be used to implement logic in the configurator. This allowed us to make a fully configurable product in which the configurator performed simple strength and stiffness calculations, automatic adjustment of the product based on simple user input variables and even Especially now that there is such a scarcity on the job market this allows the company to efficiently use their engineers, prevent errors and work in a coordinated standardised manner.

Energy Watch

Energy Watch is a small energy consultancy located in Holten, the Netherlands. They specialize in renewable energy analyses and assessment of innovations which can support the energy transition. While the focus is on a technical level, Energy Watch also keeps in mind the business case and possible product-market combinations. An internship assignment was carried out on the topic of thermal energy storage (TES) for high-temperature industrial processes.

The most apparent function of a high-temperature TES is to increase the self-consumption of electricity production. By increasing the self-consumption of electricity, the gas consumption can be decreased. A simulation tool was constructed in which the production and consumption patterns can be implemented. By adjusting the parameters of a storage, the effect of a thermal energy storage can be determined for different configurations. For extreme user cases, the gas consumption can be reduced significantly, however, this is not the case for most real user cases. Often, due to space limitations, the generation of renewable energy is small in comparison to the energy consumption.

Next to the main internship assignment, also some other smaller tasks were performed. One of these 'side assignments' was on the effect of home batteries. This resulted in a report, which was sent to the client directly. This indicates the level of responsibility Energy Watch offers to a student.

Due to the small size of the company, there was a lot of personal contact with the daily supervisor. Also, there is a daily coffee break with other entrepreneurs in the 'Holtens Ondernemenshus', in which Energy Watch is located. Both my supervisors at Energy Watch, as well as the other people in the building made me feel very welcome.

H2Hub Twente

My internship was conducted at the organization of H2Hub Twente, located in Almelo. The H2Hub along with other partners-companies are in collaboration to create a prototype decentralized electrolysis system for the production and storage of green hydrogen. The basic component of the project is the production and storage of green hydrogen via an alkaline electrolyser of 70kW electrical power and a storage of 60kg capacity.

The project is at its starting phase so I had to create a proposal for the process flow diagram (PFD) of the whole system, to make a rough Process and Instrumentation Diagram (P&ID) and to cooperate with other interns from different educational backgrounds to create a model for mass and energy balance calculations.

The communication and cooperation with many professionals from other engineering companiespartners, which are involved in the project gave me perspective on how to deal with challenges and gave me the opportunity to make critical decisions.

ENSCHEDE

HoSt

HoSt is a bio-energy company offering several technologies such as biogas installations, biogas upgrading, biomass boilers and biomass power plants. This internship was focused on the latter. The company has two biomass power plants in its possession, one in Andijk and one in Bemmel. These power plants are generating electricity and delivering heat to nearby customers. However, they can also be used for testing, which is what was done a lot for this internship. The tests include optimizing the furnace control by adjusting the air input and recirculation in the furnace, and reducing the NOx emissions by means of urea/ammonia injection with the lowest cost possible. Several important findings were made which let to direct improvements and recommendations for the future.

HoSt

HoSt is a global organisation that focuses on developing and designing waste-to-energy systems. Organic residues, such as pruning wood, untreated wood and other waste flows from the food-processing and agricultural industries are used to fuel these systems to generate renewable energy. HoSt builds bio-energy plants for their customers, but they also have two in-house plants in Bemmel and Andijk for electricity and heat production.

During the internship, an initial version of a plant monitor was to be designed. This plant monitor checks the performance of many different operations in the plant and will give an alarm once a certain process exceeds its operating limits. Besides giving an alarm, actions that operators could carry out to get the process back within its operation limits were to be designed as well . In order to design the plant monitor, the plant in Bemmel was visited to get a better understanding of the workings of a biomass plant and many interviews were carried out with operators to define correct limits and actions. HoSt included the student in meetings with other companies and gave the student responsibility to carry out other important tasks as well. This lead to a nice relation between HoSt and the student, such that the student continued to work at HoSt for some time after the internship had ended.

HoSt

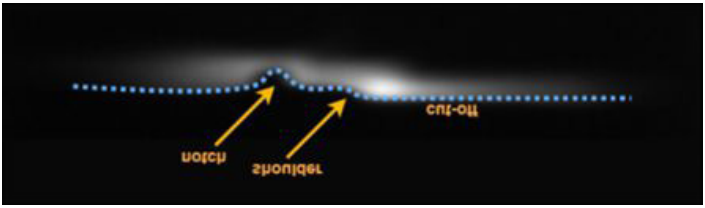
HoSt develops, designs, manufactures and maintains installations which create renewable energy from biological waste streams. HoSt has installations all over the world. Besides their offices on Kennispark, where I did my internship, they are also located in France, Latvia, Poland, the UK, Germany and the USA.

Organic waste is converted into energy in digesters. These are large vats where organic material is inserted and broken down by methane producing bacteria in an oxygen poor environment. This creates biogas, which can then be upgraded to natural gas and inserted into the gas mains, thus creating high quality energy from waste. The types of waste that can be anything from manure, hay, to organic municipal waste to the sludge from water purification.

Because this digestation process performs best at 40 degrees Celsius, new feedstock has to be brought up to this temperature. This can take a lot of energy, sometimes up to 25% of the production. By recovering heat from digested material, a lot of energy can be saved. This is what I investigated in my internship. I investigated the theoretical side of heat exchangers using these unusual flows, estimated the performance of different heat exchangers and created a cost-benefit analysis on the implementation. Furthermore, I worked on creating an experimental method to find the particle sizes in these flows.

IMS

IMS is a company that develops and builds production lines for manufacturing small, innovative products. They mainly focus on smart, automotive and medical devices and are located in Almelo with 120 professionals with a passion for technology. I worked on the alignment of automotive headlights by using deep reinforcement learning. During the production process of these headlights, the optics need to be aligned with respect to the light source in order to get a correct projection. Currently, these parts are aligned based on geometrical features and the projection is only checked after the headlights are permanently assembled, which can result in rejects. Therefore, it would be good if the headlights can be aligned based on their projection shape. I worked with a setup where a hexapod could move the light source with respect to the fixed lens. This light is projected on a black screen, of which a camera is taking pictures. These pictures are used as inputs for a convolutional neural network using Python that is used to create a model that will learn what actions to take with the hexapod to get a correct projection within the least amount of steps. I learned a lot during the internship at IMS and got a good insight into what it is like working at the company. The people are always very helpful and it is nice to see what other people are working on.



Correct projection shape of the headlight

ENSCHEDE

Inorganic Material Science Group

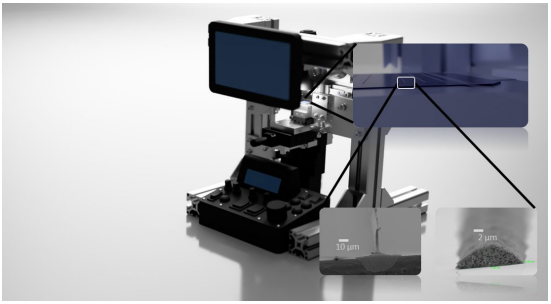
Development of improved printing device for fabrication of high aspect-ratio photovoltaic front-contacts

With the effects of climate change being felt world wide, and more recently the energy crisis in Europe in the wake of the ongoing war in Ukraine, the necessity to transition to renewable energy is as pressing as ever. To make the most of the energy that reaches solar panels, researchers are ever chasing the incremental improvements in efficiency, which ultimately lead to a more sustainable future.

The internship project is a continuation of previous work on the novel string printing method for solar cell metallization. The method focuses on improving solar cell efficiency by reducing the amount of light that is reflected off the electrodes of the cell. The task was to develop a new and improved device that can better and/or more repeatably perform the string printing process. The process involves coating a thin filament with a fine amount of silver paste, then transferring that ink onto a heated substrate, and using surface tension to pull it to a tall, narrow shape.

As a technology still in its infancy, there is a high level of uncertainty about the right direction. Rapid prototyping was widely used to shorten the development cycle and was key to managing the 4 iterations done over the 4 months of the internship. Part of the challenge of the project was the necessity to cover all aspects of the mechatronic design- mechanics, software, and electronics.

I used Solidworks for the mechanical design, and Arduino IDE for the software. Using DesignLab facilities I had access to 3D printers and the laser cutter for making prototype parts. Where precision CNC was needed I communicated with technicians at TCO to get my parts fabricated. Ultimately, I produced a final prototype, using which contacts can be printed. Results produced using this device have been used to garner interest in this technology with potential industry partners.



Pictured a render of the final prototype, with Scanning Electron Microscopy images of contacts printed with an earlier prototype device

Lely Technologies

Lely technologies is one of the Research and Development departments of Lely. The company is located in Maassluis. Lely's main goal is to make the life of a farmer easier. Therefore they focus a lot on automating recurring tasks. At Lely Technologies new concepts are developed and tested.
They had an idea for a new product and during my internship I did some research on what was already on the market. After that I designed some experiments and executed those to determine the feasibility. I experienced the working environment as very pleasant. Everyone there was highly motivated and there was a lot of technical knowledge available.

LochemEnergie

Neighbourhood Energy Strategy – Kring van Dorth

LochemEnergie is a local energy cooperation. The task I took on at LochemEnergie is to work on a neighbourhood energy strategy. What is a neighbourhood energy strategy you might ask? Well, many local inhabitants feel concerned about climate change and the energy transition. Some inhabitants also want to take the initiative to start a project group for a certain area. This way some traction is generated to start working on a neighbourhood energy strategy. But what does a neighbourhood energy strategy entail? Well, this is specific from neighbourhood to neighbourhood. In the case of Kring van Dorth, the work objective was to facilitate an affordable and reliable energy transition, and therefore reducing the dependence on fossil fuels.

During my internship I carried out activities such as extracting useful data from a data sheet Liander delivered regarding households' consumption over the past 5 years, making energy profiles for monthly and daily basis, doing analysis on a potential grid battery to balance the electricity grid and exploring innovative solutions which can be applied in the region. Furthermore, I visited many companies during my internship, and I have been at Liander's office a couple of times.

Medspray

Medspray contributes to a sustainable world by developing innovative spray nozzles for user-friendly health and physical care products, by making propellants redundant. The Medspray nozzles can be used for various purposes, especially where a slow-moving soft spray is required. Thanks to their high-tech nozzle chips, sprays can be tailored to suit any application. Products manufactured range from inhaler, nasal sprays to eye sprays and humidifiers.

The generation of soft sprays is an intricate process where air flow manipulation is a major influencer. During this internship I had the opportunity to develop CFD simulations that were used to analyse the air flow patterns. The fruits of the labour resulted in an optimized design. With the facilities present at Medspray, I was able to test the designs with a Laser Diffractor and an Aerosol Particle Sizer.

I had a wonderful experience at Medspray. I was given the freedom to steer the internship in the direction that I thought was most interesting. I was encouraged to develop myself and pushed to broaden my professional skillset. I would recommend Medspray to any student who wants to get practical experience and be challenged by micro fluidics.

Medspray

Medspray manufactures and invents innovative spray nozzle chips. These nozzles are designed such that a slow-moving soft spray is formed, without the usage of any propellants. These silicon based microscopic nozzles are essentially based on the physical phenomena: The Plateau-Rayleigh instability. An example can be seen in Figure 1. The goal of this internship was to examine and develop a generalized testing method to measure the jetting performance of these nozzles, which differs not only in geometry, but also in terms of fluid properties. Specifically, the initial jet-formation process had been studied intensively, the droplet formation.

During the internship, many experiments were conducted using several testing machines in the lab. The most fascinating experiments were the ones where a high-speed camera was used. It captures physical phenomena in a very captivating way. Especially the formation of a liquid jet and the break-up phenomena could be perceived very well. Additionally, I had the opportunity to go to the clean room, which is located on campus.

Even though the internship was rather short, I learned a lot in terms of how the knowledge I had from my studies were applied to a real application. Also, it helped me to develop on a personal/professional level.

Jetting example

Metal World

MetalWorld is an established cutting tool manufacturer from Italy specialized in producing cutting tools for the woodworking industry. This internship was dedicated to optimizing the solid carbide tool production at MetalWorld. MetalWorld experienced difficulties with coping with the growing demands and therefore wanted to optimize the department to increase the overall production output of the department. Therefore, a production scheduling method was made to effectively spread production orders over the available machines and combining them to increase the machines up time and consequently decreasing the idle time. Herein, the orders that had similar characteristics were filtered and grouped to the right machine. The time savings that were found were relatively small compared to the scheduled production time. However, these time savings were found by only changing the order of producing orders and without the investment of any capital. The solution was inspired by the Single-minute exchange of dies (SMED) method which is dedicated to decrease setup time as much as possible. Since in our case the setup time was the only variable we mostly applied SMED and lean manufacturing. Herein, I experiecend that implementing such ideas is more challanging in a ”real world” environment since implementing new strategies is a risk. Such a risk could be e.g. production disruption. Overall I found it very useful to do my internship abroad since you learn a lot from the countries culture. Which helps you to further develop your social, academic and professional skills.

The cutting tools that were produced in the department

Ministerie van Defensie

Within the Dutch armed forces, the Engineers Regiment has the task to apply the knowledge and techniques about (contra-) mobility on the battle field. The personnel of this oldest regiment (founded 1748) of the Royal Netherlands Army (23.000 employees) has a wide variety of specialisatons in the fields of combat engineering, construction, demolition, advanced search and CBRN. Within military warfare, contra-mobility has been of increasing interest since the introduction of (motorized) vehicles on the battle field and has gained new interest with the latest developments in world politics. By using contra-mobility tactics in an effective way, the opponent is hindered in its movement either by time delay or by forcing them to take alternative routes. On the other side, mobility on the friendly side of a conflict can be of vital importance. Contra-mobility effects can be realised by changing the terrain by for example digging ditches or by constructing obstacles, such as the classic Czech Hedgehogs or improvised constructions. All obstacles have their own typical characteristics and 'stopping value'. For me the task to join one of the projects on further development of some contra-mobility products at the Centre of Expertise Military Engineering at the Van Brederodebarracks in Vught, the Netherlands. This internship gave me insight in this very special 'company' with its typical hierarchic working environment and extensive military procedures. It also gave me the chance to work together with several departments within the armed forced. All this with the motto 'When there is no road, we make one. Sodeju!'

Novio Sound

Novio Sound is a startup company based in Enschede developing unique in-ear hearables that oer class-leading active noise cancellation that protects ears from damaging sound levels while keeping users safely connected to their environments.

I joined the R&D department for the internship. For the internship assignment, I investigated methods to compensate for non-linearity in an acoustic control system using LMS cost function based controllers. In addition I streamlined processes surrounding the control system development.

I was provided a great level of freedom regarding how to tackle certain problems and the feedback I have received from the external supervisor has been positive.

Overall it has been quite the educational experience and I have signicantly developed my skills, particularly with collaborative software development.

novio sound

PCV Group

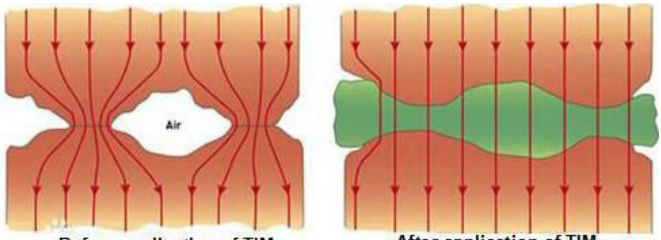
PCV Group is a product development and consultancy company. They operate in several high-tech fields, most importantly consumer products, professional and medical. They are specialized, but not limited to, dispensing of liquids and solids. The engineers at PCV Group mostly consist of mechanical engineers and industrial design engineers. Most of them are young adults, which I found to be very nice.

During my internship I worked on several projects that involved CAD modelling, testing, multidisciplinary teams and sometimes working in the workshop. However, most notable of my internship was the individual project that I received. I was asked to make a tool which would help PCV with performing leakage tests, the result is shown in the figure. These leakage tests need a lot of components which is often quite time consuming to setup and with the tool the preparation time would be cut down significantly. I received a list of requirements and a rough idea of the tool, from which I had to design and make the tool. There was no concrete idea what it should look like, or do. I was not familiar with this from my study, neither was I familiar with leakage tests, or compressed air. I was eager to tackle things that have not learnt in my study during the internship, which has definitely been the case. After the concept for the tool was complete I was allowed to make the tool in the workshop, which I enjoyed a lot. Projects at mechanical engineering are rarely made in real life which is why I liked creating one of the concepts that I designed. Also the tool would be helpful for a lot of engineers at PCV Group and will be used a lot, which was very rewarding. All in all, I really enjoyed my internship at PCV Group and I would definitely recommend this company if one is looking into concept development, is looking for a varied internship, or wants to do things that were not handled during mechanical engineering.

Philips Engineering Solutions

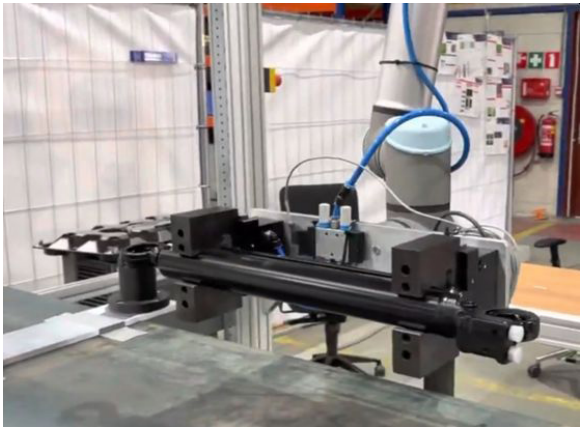
Characterization of thermal interface materials for application in a vacuum environment

When dealing with heat transfer in multilayer materials, large thermal resistances can be found at the interface of two layers. This phenomenon is known as thermal contact resistance. It is caused by small irregularities at microscopic scale, which are related to the surface roughness. For a lot of applications, like cooling systems, this thermal contact resistance is undesired. This problem is even more significant for vacuum applications due to the absence of conduction through air. Thermal interface materials can be used to significantly reduce the thermal contact resistance. Philips Engineering Solutions is developing a system for qualification of optics, which operates under vacuum conditions. A solution to their problem, based on thermal interface materials, is explored. An analysis is performed to assess the outgassing and thermal performance of some promising types of thermal interface materials. Low outgassing rates are required to minimize the pressure load on the vacuum system. Outgassing of the materials is analysed using a residual gas analysis (RGA) system. The thermal performance of the materials is assessed using an in-house developed thermal contact conductance (TCC) system. The measurements show that certain types of vacuum greases and metal foils are suitable for vacuum applications. These materials are able to significantly reduce the thermal contact resistance, whilst keeping outgassing of the system low. With the information from this research, Philips Engineering Solutions is able to come up with new solutions based on thermal interface materials.



Power-Packer

I did my internship at Power-packer Europa B.V. It is a company that engineers a line of hydraulic position and motion control products that are being used for tilting, latching, levelling, lifting and stabilizing systems used in some of today's most demanding markets. My assignment was to improve the ergonomics of the labour carried out by operators in production cells were cylinders are being tested. Relatively heavy cylinders (12 Kilograms) have to be loaded and unloaded from testbenches and have to be placed on transportation bocks manually, the labour turned out to be heavy and caused injuries. I scheduled meetings with multiple companies, specialized in lifting solutions, to discuss several solutions. At the end I provided an overview of the found solutions and graded them on criteria to come up with a suggested solution that could potentially be implemented. The best solution turned out to be a cobot that will load and unload the testbenches and place the tested cylinders on the transportation bock . Accompanied with the lifting aid I also made a layout of the cell and the machines, provided a time table to see if the cycle times would be reachable and made a calculation to validate the if the remaining labour done by the operator was ergonomically justified. At the end I also had the opportunity to use a cobot, and created a test setup and programmed the cobot to prove my idea by lifting and placing cylinders, by a self designed gripper.



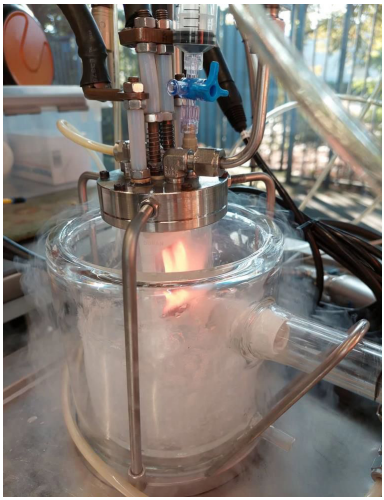
Pure Energie

Pure Energie is an energy supplier on the Dutch electricity market, selling power which has been generated from its own wind and solar farms. The assignment focussed on improving the accuracy of the availability planning. This planning contains information on when standstills are scheduled, like maintenance and inspections. To be able to give suggestions for improvement, the current process through which the planning is made was analysed for problems and the accuracy of the current planning was quantified. At the end of my internship, I gave a presentation with the key take-aways for colleagues and my UT supervisor.

I enjoyed working in the office, where I worked with colleagues from the department Asset Management. During my internship, I spoke to many people which helped me to get a better understanding of the possibilities in the field of sustainable energy. One of the highlights of my internship was an excursion to Windplan Groen, where Pure Energie is working on constructing and repowering wind turbines.

Pureps

The goals of this project is to explore the decomposition of polystyrene back to styrene monomer, dimer and trimer and study the effect of temperature, holding time and pressure. To achieve those goals a screen heater pyrolyser was used. Experiments were performed in vacuum pressure and various temperatures (425, 500, 575, 650 C) and holding times 5s and 10s. Then focus shifted on 500 C and 575C and additional experiments were performed at 2s and 30s holding time. Finally experiments were performed in atmospheric pressure, temperatures 500 C and 575 C and holding times 2s, 10s and 30s. Each pyrolysis experiment yields a liquid product, which was analysed by GC-MS and GPC, a gas product, analysed by GC, and a solid residue which was polystyrene that did not react rather than char or tar. In general the mass balance closure and the reproducibility of the liquid yield were good, but the reproducibility of the styrene monomer yield proved to be more challenging. The primary pyrolysis products were styrene monomer, dimer, trimer and a variety of dimeric and trimeric species. Bibenzyl was was very often observed and in general there was no substantial quantities of EB, toluene and alpha-methylstyrene, meaning that these components are secondary reaction products. It was concluded that less solid residue results in more liquid yield, high liquid yield results in high styrene monomer, dimer and trimer combined yield. Dimer and trimer yields correlate in a linear way. Liquid yield is affected by temperature, holding time and pressure but styrene monomer rises with the rise of temperature up to a point but is more insensitive to holding time. There are temperature-holding time combinations that perform better than others in terms of liquid and styrene monomer yield. Atmospheric pressure experiments produce less liquid yield and higher solid residue than vacuum but either same or higher styrene monomer yield.



Qirion

Qirion is a subsidiary of Alliander which specializes in consultancy in the field of the energy transition. This internship was done in the heating- and cooling technology team at Qirion Energy Consulting. One of their activities is the development of modular district heating networks.

The internship was on the modelling of the dynamic behaviour of a radiator system in a building connected to the district heating network in order to be able to develop new control algorithms. Also, the heat loss of buildings to the outside environment was investigated. I learned a lot about dynamic processes in heating and cooling, but also on general work in a business environment. At the end, I had developed a model of the radiator behaviour in a real building and started work on calculating the heat loss to the environment of buildings based on the outside temperature.

I liked the mix of theoretical and practical work. Qirion had good possibilities for me to test my theoretical models in the real world. Therefore, it was nice to see that the theoretical models that I developed were actually working in the real world.

Qirion had a hybrid working policy, where it was both possible to work either remotely or at the office. Even though it was quite a long commute, I worked at the office often because for me it was a good environment to be productive. However, if you can be more productive at home you were free to do so.

Radboud UMC

Redesigning an adapter-socket connection of FDM-printed transtibial prostheses

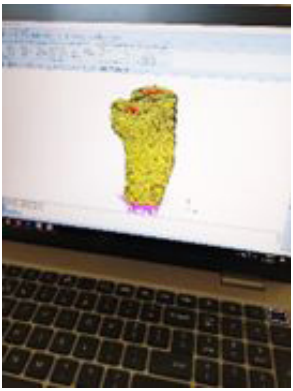
In recent years, the 3D Sierra Leone project at the Radboud University Medical Center has been investigating the use of 3D-printed prosthetics in low- and middle-income countries. In 2018 a pilot 3D Lab was set up in the Masanga Hospital in Sierra Leone, multiple prostheses were successfully produced by applying 3D scanning and 3D printing (Fused Depostion Modeling). One of the transtibial (below knee) prosthesis failed at the socket-adapter interface due to repeated loading, a typical fatigue failure. Therefore, the goal of this internship was to redesign and improve the fatigue resistance of the socket-adapter connection. A list of design requirements was generated and several connection concepts were developed, of which two were chosen and further detailed. A finite element analysis of both concepts was done using Solidworks Simulation. The concepts were tested in a tensile test machine using the ISO 10328 static ultimate strength test. This test mimicked the most critical instance during a gait cycle: toe-off. Both designs passed the test by resisting loads of more than 4000 N. However, other parts from the test setup failed first which made it difficult to distinguish between the strength of both concepts. More tests are needed to assess the fatigue resistance of both concepts. The ISO 10328 cyclic test would be the benchmark test for this. The internship provided the opportunity to apply a methodical design process in a small project team. Internship progress was discussed during weekly project meetings and the student was allowed to freely execute the assignment within the boundaries of the project.

Test setup mounted in the tensile test machine

Radboud UMC

For my internship at the Orthopedic Research Lab in the Radboud university medical center in Nijmegen, I worked on finite element models of the knee joint. My task was to create models of the tibia (lower leg) and examine the effects of using poly-ether-ether-ketone (PEEK) and titanium as implant material on the micromotions the implant could make. Those micromotions are a measure of how well the implant is fixed to the bone. With a dataset of CT data and corresponding patient data, and a workflow to create similar models, I started the internship. During the internship, I worked out a workflow to automatically create the 400 finite element models out of the available CT data. Then, all models were simulated and I had to process the results of this population of patients. So, this internship was a combination of data analytics, programming, working with segmentation and finite element software and statistics.

My internship supervisor was very nice and helped me when necessary. It was nice to work in a hospital, in an academic environment with a direct link to the patients. Overall, the internship was a nice experience.

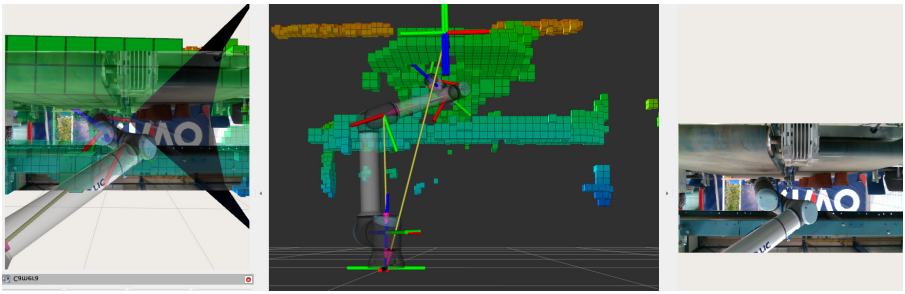


Reden

Reden B.V. provides consulting for a wide range of engineering problems. Many of their solutions are based on modelling and simulation which is a core part of the company. One of these engineering problems is particle contamination control, which is a relevant topic in for example the health sector and the semiconductor industry. One of the tools used to check if a design meets its contamination requirements is particle tracing. To achieve a certain particle tracing accuracy, it is important to know the accuracy of the model and which mechanisms influence it. During the internship, the accuracy of the particle tracing model developed by Reden B.V. was investigated. Moreover, recommendations for future improvements were given.

RIWO

Robots such as robotic manipulators or Automated Guided Vehicles (AGVs) are unaware of the obstacles that are around them. In order for them to be able to plan paths to a set point, they must account for these collision objects. This can be done by creating occupancy maps which represent down-sampled point clouds as voxels of a specified resolution. This can be done using Octomap which is an efficient probabilistic 3D Mapping Framework based on octree data structure. This was specifically to be applied to a pot picking Universal Robot located in the RIWO robotics lab. The implementation of the robot control and path planning has been done via Robot Operating System (ROS2) and MoveIt. The internship gave access to use of relevant hardware such as a depth camera and the UR10E universal robot. It was focused on software development and programming predominantly in C++. Therefore, it was a good experience to develop problem solving, debugging, research, testing and programming skills in the field of robotics.



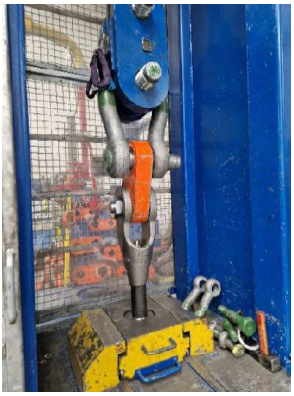
Universal robot inside view of camera with generated 3D occupancy map

Ropeblock

Ropeblock is a developer and manufacturer of lifting and rigging hardware located in Oldenzaal. One of the products of Ropeblock is spelter sockets. Spelter sockets are end terminations of wire rope. For some applications of Ropeblock's sockets, costumers request their sockets to be proofload tested before use. The standard proofload test, according to ISO standards, is performed at 40% of the Minimum Breaking Load (MBL) of the socket. Ropeblock is going to increase the MBL of their spelter socket range. Consequently, the proofload at which the sockets need to be tested will also increase.

Ropeblock has its own 300 ton testbench which they use to perform these tests. They also designed their own test attachments to temporarily mount the sockets in the testbench. The stresses in the test attachments were calculated and it was concluded that the current sets of test attachments are not able to withstand the increased proofloads. Therefore, a new set of test attachments, able to withstand the increased proofloads, needed to be designed.

Several concepts were created and their feasibility was analysed. It was chosen to reinforce the existing set of test attachments. A proposition is done to harden 30CrNiMo8 steel by quenching and afterwards tempering at 200°C to improve its mechanical properties. This should result in sufficiently strong test equipment. Companies which are able to perform the heat treatments and machining of hardened steel were contacted to discuss the possibilities. Besides the improvement of mechanical properties, also a change in design of some of the test attachments was proposed to improve performance and durability. Prototypes of these improved test attachments were ordered to test the new design. Unfortunately, these parts did not arrive in time and therefore could not be tested during the internship.



Royal Kaak

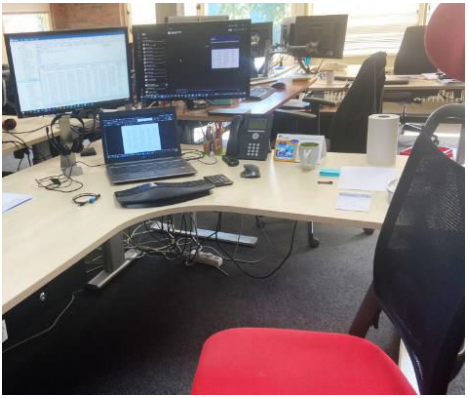
Royal Kaak has provided automatic bakery lines since 1846. Considering that the food industry traditionally has intense fossil fuel consumption, it is essential to consider more sustainable solutions. This report has two main goals: First, evaluate if Concentrated Solar Power (CSP) would be a feasible solution to replace natural gas in thermal oil ovens. For this analysis, a comparison among the available technologies in the market was carried out to select the most suitable ones. After that, the software named System Advisor Model (SAM) was used to simulate the performance of CSP power plants using different technologies, allowing us to understand the performance of these technologies under different latitudes to understand if they would work in different atmospheric conditions. Four regions were compared: the Atacama desert (Chile) as a reference for having very high Direct Normal Irradiation (DNI) levels throughout the year, Toledo (Spain), Nairobi (Kenya), and Terborg (Netherlands). The second goal was to evaluate a prototype developed in the facility. Then, a model to estimate the main energy losses in the system was created, and from this, it was possible to suggest improvements. This assignment made it possible to develop programming, communication, and modeling skills, among other lessons.

Royal Kaak

Technological Investigation of Thermal Energy Storage

The first component of the internship is focused on the investigation of a short-term daily buffer storage technology materials & it's system operation for a thermo-oil bakery oven production line buffer planned in Spain. The potential of different thermal energy storage materials were investigated and at later stage, the critical challenges and limitations have decided "Concrete block indirect energy storage" as a right fit for Kaak's in-house construction where the hottest day needs 190 m^3 & coldest day 420 m^3 material volume alone for 1 MW power & 5-15 MWh storage capacity range. Several In-house challenges were addressed and KaaK's made a plan to work on development executing "Magnetite % in Concrete". The "Redox Flow Battery" with vanadium has been chosen as an alternative battery option for next stage of development. At the last stage, suitable commercial suppliers were approached for Quotations.

The second component is focused on the investigation of a Seasonal Thermal Energy Storage material & it's system operation along with their 1st stage base calculations for Royal KaaK, terborg plant's central heating (Space heating & domestic hot water). For the In-House central heating, several different scenarios were investigated along PV/CSP and "water tank" with thermal collector seems as viable and effective option for KaaK. Furthermore, the potential of High temperature heat pumps was also addressed with "process", "operations"," base material calculations", "critical challenges". The suitable commercial suppliers has been contacted for the real time performance and cost.



Workplace at Royal KaaK R&D

Saietta

Design and Feasibility study of an Independent Suspension In-Wheel Motor Drivetrain

SAIETTA Electric Drive is an E-drive automotive drivetrain manufacturer with a range of e-drive solutions from lightweight last-mile systems to heavy industry truck and bus drivetrains. The Dutch branch, located in Apeldoorn, has over 30 years of experience in the development of in-wheel drive systems and has developed a proprietary in-wheel heavy-duty in-wheel drive system called TheWheel, with an integrated inverter aimed at the bus market. Combined with the in-house development of matching axles, SAIETTA has a unique collection of expertise and capabilities grouped together in one location. My internship assignment comprised the feasibility study and conceptual design of a complete independent suspension in-wheel motor drivetrain. One of the reasons I chose this internship assignment is because I think electric drivetrains are a very relevant topic in a sustainable future. However, this topic was treated to only very little extent throughout my studies. This assignment as well as the knowledgeable and supportive working environment allowed me to expand my understanding of electric drivetrains from the fundamental electromagnetic mechanisms, through the industry standard automotive development process and thermal management of electric motors to main design parameters and considerations. During my internship, I developed analytical tools to optimize suspension frame geometries structurally, validated and optimized designs using FEM, designed and optimized a motor to match the suspension system and performance requirements, and proposed novel methods to improve the motor cooling system. I learned new CAD and FEA tools and various automotive processes and standards. Looking back, I enjoyed interning at SAIETTA because of the very open, supportive, and broadly knowledgeable team, the freedom given to co-shape the project, and simultaneously the directed guidance in the for me quite new world of automotive e-drive engineering.

The figure does not depict my design as the internship was conducted confidentially, but rather shows SAIETTA's current retrofittable TheWheel drivetrain solution, producing over 10kNm of torque per wheel and achieving overall drivetrain efficiencies of around 94%.

ENSCHEDE

Saxion

Fabrication of a stiffness tunable thread by applying thermoplastic coating on conductive yarns

This internship is an assignment with Saxion University of applied Sciences and University of Twente. Where, a thread has been coated to make it stiffness tunable. This is achieved by applying a thermoplastic coating on the conductive wire. As the thermoplastic materials gets softer on heating and hardens on cooling, this property is used to vary the stiffness of the thread on which it is coated. A conductive yarn is chosen as the wire or thread to be coated upon so that by passing electricity, the heat generated around the wire can be varied, which is used to melt the thermoplastic coating, hence the stiffness is tunable. Various available filament coating techniques are studied along with their pros and cons of which the extrusion process is chosen for its advantages. A simple extruder prototype is built to coat the conductive yarn with a thermoplastic material. This extruded coated wire is later tested for its thermal behavior by passing an electric current through the conductive wire. The coated wire is then coated with an insulation layer, and its thermal behavior with stiffness tunability is tested. The coated wire is weaved into a piece of cloth with a plain weave technique to visualize the stiffness tunability with a load test. Overall, my internship experience was enriching as I acquired new knowledge and skills that not only enhanced my professional capabilities, but also positively impacted my personal conduct.

Spectro-AG

Spectro-AG is a company that uses AI to develop solutions for processing multi-spectral and hyper-spectral data. One of their products is the Hyperslit sensor, which uses spectroscopy technology to study the interaction between matter and electromagnetic radiation. The Hyperslit sensor is drone-compatible and can be used to create spectral libraries of geotagged spectra and co-registered RGB images. It can also be used for underwater applications, such as detecting the absence of microalgae or nitrate in water. In this project, I worked on designing and prototyping the housing, interface, and electronics needed for collecting data with a hyperspectral sensor and an RGB camera in a waterproof and informative manner. This included selecting the right light sources in terms of specific wavelengths and intensities, and finding a power source that could power the system for at least two hours. The final product designed to be mounted on a remotely operated vehicle (ROV) and will be able to withstand operating conditions at a depth of 200 meters underwater.

Sunrock

Sunrock is a Dutch solar energy company based in Amsterdam. They develop and deploy large scale solar energy projects mainly on large industrial roofs. Their systems can also be found on land and on water (floating). Sunrock is currently the market leader when it comes to roof-tied solar parks. Next to developing solar assets, innovation in energy systems is a large part of Sunrock's operations. These include developing smart algorithms to manage energy systems which include solar panels, large batteries, and charging poles.

My internship was about finding out how large-scale solar energy could be combined with hydrogen production via electrolysers and what the requirements are, technical and financial, to make such a project viable. Financial and technical data had to be gathered on electrolysers as well as the performance of PV-systems in order to make a proper analysis. In the end I constructed a model which used PV-output, electrolyser capacity, and PV-system capacity as input to calculate the levelized cost of hydrogen in EUR/kg for any given configuration. This made it possible to predict the hydrogen production costs based on the scale and set-up of a potential project.

The office is a pleasant working environment where the company treats interns just as any other employee. The people are very kind and fun to be around. You can ask anyone any question and they are happy to help you.

SUNROCK

Technolution

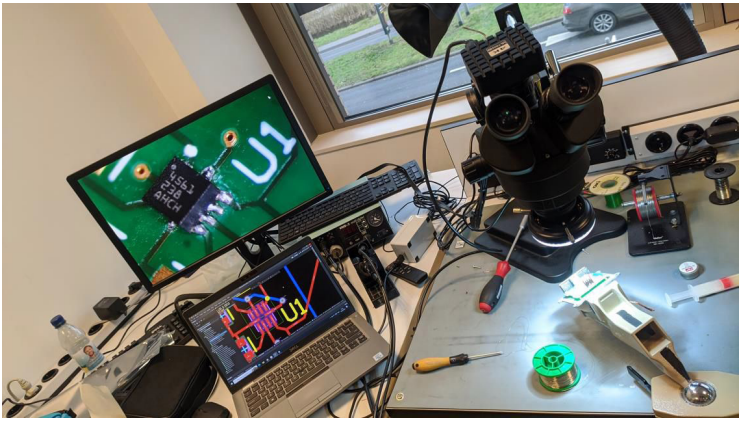
Development of a Prototype Contactless Voltage Measurement Device

For my internship at Technolution in Gouda, I worked in the development of a prototype that would be able to measure the voltage based on a contactless technique.

Technolution is a company focused on developing smart software- and electronics-based solutions, with a presence in multiple industries. The company size is in the range between 200-500 employees.

During my internship I worked independently in the different stages, including conceptual modeling, simulation, manufacturing, and testing. The assignment involved putting in practice complementary areas like electronics, mechanical design and system analysis. A very practical assignment where I could have real hands-on experience, I was able to use the company software and all the laboratory facilities to do so.

Moreover, I had weekly meetings with my supervisor and during the literature review I could work remotely.



Tesla Motors

Tesla Motors Netherlands BV is a remanufacturing facility of battery packs of model S/X, Y, 3, power walls, and motors of all models. During your internship as a mechatronics engineering intern, you will act as a production support for all departments. Since this facility is still young in its operations, there are a huge number of projects you could work on, primarily designing and optimization of production tools. You will be provided with some projects initially, but after some time, you must be proactive in finding your own projects. You should frequently have meetings with various department heads asking about projects you could work on. I have worked in multiple projects starting from conceptual design to manufacturing the components. This may involve using in-house manufacturing methods like CNC milling, 3D printing etc., or you will have to find other manufacturing methods to produce your part which can be injection molding, laser cutting, casting etc. You will be responsible for finding vendors, finalizing design choices with the vendors as well. Experience with automation and logic controls will also be helpful in this internship.

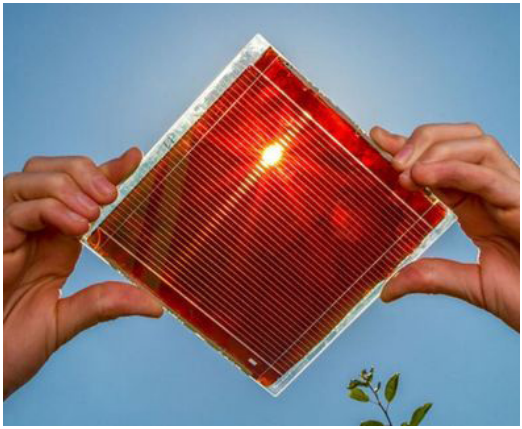
Thales

My internship at Thales was working on establishing a relationship between changes in their product such as technical changes, and operational improvements to their product roadmap. I worked with the product management, production, supply chain, and procurement departments. And the study was performed on TACTICOS combat management system their best selling product. The working environment in Thales promotes clear orientation and supplies to achieve your internship goal. Communicating and staying focused under pressure are 2 key factors you need to have and they helped me very well with my progress. I had to take alot of initiative at the start and planning from the begging really helped get through with my progress. The employees are very helpful and collaborative, and they provided me with a lot of context and feedback regarding my case.

TNO

Post-Mortem Analysis of Perovskite Solar Cells

The TNO Solar Technologies and Applications department is in the High Tech Campus, in Eindhoven. The internship project consisted of the post-mortem analysis of perovskite solar cells, specifically in the defect characterization and classification of cells. During my time in the company, I worked on developing a protocol for the safe delamination of perovskite solar cells and a catalog of defects and their impact on the performance of the cells. In the first weeks of my internship, I got to know about my assignment and my role in it, I received laboratory training which included a safety test. The company had scheduled weekly meetings with the interns, with the perovskite team, and of course with the people involved in the project. There are multiple projects running at once in different areas and in most of them, there is an intern or student working on their graduation assignment. During my time there I got to meet interns from Germany, France, and students from various universities in The Netherlands. TNO in my experience was an innovative, open-minded company, and the people there were welcoming, helpful, and committed to their work. I got to learn a lot about perovskite solar cell technology and other research projects involving solar energy technologies.



TPRC

During this internship 2 main tasks are done, improving the robustness of temperature measurements in the Laser Assisted Fiber Placement (LAFP) and improving the material characterisation of the material needed for this process. The holder by which the IR camera is attached to the machine is improved. This camera records infrared thermal video which tracks temperatures in the process. The camera was shaking during the recording, therefore a new design was made and a new aluminium holder is produced and mounted. This greatly reduced vibrations and in a dedicated test, the fluctuation in the temperature was significantly lower than with the old holder. The material characterisation was improved by improving the current setup for the collection of optical properties of unidirectional fiber reinforced thermoplastic tapes. This setup works by shining a low power near infrared laser, which has the same wavelength as used in the LAFP process, on the tape. A fraction of the laser light is reflected on a screen, of which the reflection pattern is recorded by a camera. The camera holder and the material holder are redesigned and produced by the means of 3d printing. With these modifications a measuring procedure is established and a collection of measurements are done on different tapes, both unprocessed and processed. These tapes have been inspected with a confocal microscope which is able to make microscopy images and also measure the surface heights. With this, reflective patterns and roughness are compared to each other. An overall trend that can be observed, is that when the surface is rougher, the light diffuses more, but while still reflecting the same amount of light.

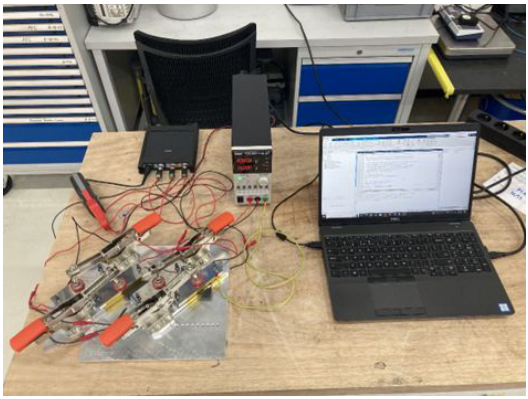
TPRC
THERMOPLASTIC COMPOSITES
RESEARCH CENTER

TPRC

The ThermoPlastic composites Research Center is a research center in Enschede whose aim to broaden the knowledge of thermoplastic materials, improve the product design and manufacturing processes. With goal of enabling a more widespread use of this novel material.

The student was asked to carry out a six-probe measurement and subsequently calculate the interlaminar contact resistance of the tested composite samples. Since, this property has not been characterized before and has a great importance of developing a reliable process window for induction welding. The assignment started with a literature survey to get familiar with the topic. It was followed by manufacturing the specimens for the experiment with a CNC machine, and then actually performing the measurement. Simultaneously, a numerical model was built to evaluate the measurement results.

I really enjoyed my internship at the TPRC. The colleagues were friendly and helpful. I was always able to ask for help when I had questions about my assignment or about some general composite knowledge. I really liked that they gave me actual responsibility during my internship and was allowed to use various machines that were needed to carry out my internship.

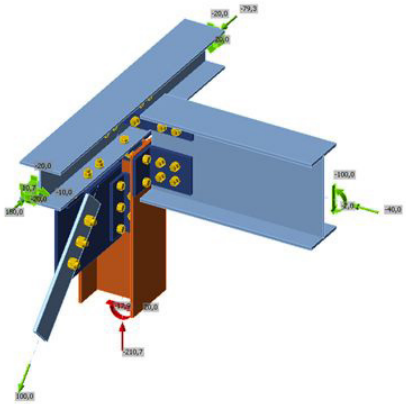


TSA

TSA Engineering is a consultancy company that designs and analyses large steel structures, e.g. distribution centers. During the internship I designed demountable joints for steel structures using the FEM software IDEA Statica.

In most current steel structures the different components are connected by welding. However, with the upcoming goals regarding sustainability in the construction industry, an alternative to welding is desired. An alternative is the so called 'demountable joint'. This joint is designed with connectors such as bolts, nuts, L-profiles, strips and plates and can therefore be disassembled easily. By using demountable joints instead of welded joints most parts can be reused instead of recycled, which is the more sustainable option. The demountable joints were simulated and tested for common load cases with a Finite Element Method software.

TSA Engineering is a small company and has an informal atmosphere. The employees have a lot of knowledge about the construction industry and are happy to explain everything. I really enjoyed the shared coffee breaks, walks during the lunch and the Friday afternoon drink with an occasional game. The assignment I carried out was in collaboration with Van den Brink Staalbouw, which gave a nice insight in the practical side of designing structures.



Twence

This internship dealt with optimising and analysing the low pressure steam system of Twence, a waste treatment company located in Hengelo, NL. Waste and biomass incineration are sources for sustainable heat and electricity. The company sells low pressure (LP) steam and hot water to industry and heat networks. Currently, there is a high demand for sustainable heat sources to redue the dependency of non-renewable sources. Therefore, Twence would like to increase the amount of LP steam by extracting more steam from the turbine and minimising the internal steam usage. The technical bottlenecks of the increased steam extraction were analysed using data from the factory, models and the P&IDs. A few pipelines are not suitable for more steam and would need to be changed. Furthermore, the internal steam consumption can be lowered by heating the condensate with waste heat, for example from the flue gases. There are multiple points in the system where this waste heat can be retrieved, as described in the report. In total, this would save multiple MW. The improvement points are separated between short term and long term possibilities.

VDL ETG

The internship assignment was carried out at VDL ETG Almelo, which is one of the largest VDL companies in the Netherlands, and operates mainly as sub-contractor for several high-tech companies. One of the products that is manufactured is a magnetic plate which is built by placing permanent magnets in a certain array. One of the magnets on the plate is made by gluing together two demagnetized magnets. The gluing process is currently done by an operator using hand tools, because a custom-designed mechatronic tool is not used in production due to high rejection rates and long throughput times.

The assignment was initially about analysing both the hand and mechatronic tool, and propose a (re)-design to ultimately make the production process fully automatic. In order to do a proper investigation, first a statistical tolerance analysis was performed on the magnets and the tools. After that, a new measurement method was designed and validated using a test-setup. At last, the tool analysis resulted in several recommendations for redesigns of both the hand tools and mechatronic tool, some of which were put into production at the end of the internship assignment.

VDL ETG offered great support during the complete internship, while maintaining a good level of independency in the assignment. I was part of one of the engineering teams at Almelo, which meant that I joined the weekly progress meetings and helped colleagues out whenever necessary. There is a lot of knowledge and expertise available within VDL ETG, and everyone is willing to help if you have a problem. Though, you have to be assertive yourself to seek help and set up meetings with other people, which is something I found very useful in my development.

Two demagnetized magnet halves joined together

VDL ETG

Implementing an AR operator guidance system at VDL ETG Almelo

During my internship at VDL ETG Almelo, I worked in a cleanroom to implement a semi-automated, augmented reality operator guidance system. In an effort to decrease errors and increase efficiency and traceability, I translated numerous manual process steps into a guided system. To do this, I redesigned a large part of the assembly process to incorporate the process steps into the new AR system.
By using a system of sensors and projectors, I was able to design a process which guides an operator through the assembly process of a large and complex part. Using the projectors, I could highlight key features and locations for specific actions required from an operator. The sensors are able to validate if actions are performed using the correct tools, as well as in the required positions. In combination with automatic nutrunners, it can limit operator input, reducing the chance of user errors. Additionally, it increased the traceability of the parts by saving various amounts of data about the process.

VIRO

During the third module of this year I decided to do my internship at VIRO engineering. VIRO is an engineering office with multiple branches in the Netherlands, Belgium and Germany. The head office is located in Hengelo which is where I was located during my internship. VIRO is present in multiple engineering disciplines ranging from civil and mechanical to systems and software engineering. I was stationed at the mechanical engineering department where I would work as a team member for a specific project. VIRO has acquired a project from a customer in the semiconductor industry for creating tooling used for transporting and building in machine modules in a clean room environment. The project consisted of multiple tools for several purposes. I was assigned one specific tool which was responsible for placing an electronics cabinet on top of a machine in a tight installation facility. The project was still very much in its starting phase so most of the activities during the internship were on investigating the given situation and finding possible design solutions for the encountered problems. This gave me a lot of freedom to come up with a concept and to discuss my thoughts with other project team members. The internship was set up well as during the first two weeks I received an introduction program to get up to speed with the VIRO way of working and theskills required to work in the project team. After these two weeks I joined the project as a full team member with my own responsibilities. However, this did not mean that I was left on my own as everyone at VIRO was very approachable, be it for technical or other questions. This really describes VIRO well as it is a very social and relaxed working environment to be in. If you are a bit tired from looking at your screen just take a coffee break with a few colleagues and when you are stuck just ask anyone around you for help. For anyone wanting to find out what it is like to work in a commercial engineering environment, I would highly recommend to come in contact with VIRO.

VIRO

Vittoria

During my internship at Vittoria S.p.A, a high-end Italian manufacturer of bicycle tires and accessories, I had the opportunity to gain valuable hands-on experience in a rapidly growing company by being part of the accessory team. One of the main tasks that I performed during my internship is an analysis of the manufacturing facility layout and warehouse optimization for one of their new accessories. By taking on the role of project leader, I had the opportunity to oversee the entire project from prototyping to marketing. Through this process, I gained a deep understanding of the various stages involved and the factors that can impact the efficiency and effectiveness of the initiation of a new production process. As project leader, I was tasked with coordinating with various teams, including engineering, production, and quality control, to ensure that the project was completed on time and to the highest standards. Finally, I was tasked with conducting a business case analysis on the potential automation of the production process. This involved evaluating the costs and benefits of implementing automation and assessing the potential impact on the company's operations and bottom line. Through this process, I gained a deep understanding of the potential benefits and challenges of automation, as well as the factors that must be considered when making decisions about its implementation. Overall, my internship at Vittoria S.p.A provided me with valuable insights into the production process and the opportunities and challenges that come with it. I am grateful for the opportunity to have gained hands-on experience in this field and look forward to applying the lessons I have learned in future endeavours.

UNIVERSITY OF TWENTE
Drienerlolaan 5
7522 NB Enschede

P.O.Box 217
7500 AE Enschede

INTERNSHIP OFFICE MASTER ME & SET
internship-me@utwente.nl

www.utwente.nl