

# W.S.G. Isaac Newton Internship Booklet

2021

W.S.G. Isaac Newton  
8th of June

# Introduction

Dear reader,

In your student life there eventually is a point that your study comes to an end. To prepare yourself for what comes next and to already get a taste of what it is like to be a real “burger”, an internship is conducted. In a three to four month period you learn how it is to be working fulltime and to be a part of really awesome projects. This is a great opportunity to see what you like and to work at really cool companies, all over the world. To make a wise decision, we have already gathered a lot of information specially for you! In this booklet, a great overview of experiences from students from different internship assignments at very diverse companies is presented. Well, what are you waiting for? Go and find your perfect internship!

In case you want to know more companies after your internship, the study association has created the Shadowing Days project for this. During this day you can tag along with an alumnus Mechanical Engineering for a day to see what it is like to work in a certain kind of field. Please take a look on the website, or ask the commissioner of educational affairs.

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5th edition

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## Alliander

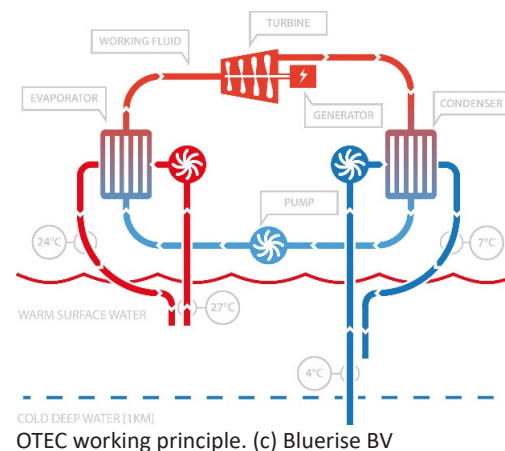
At the internship of alliander he had to work in the team of Klant-strategie. The first is focussing on what kind of development can be expected at the clients of Alliander. With this all the developments that involve the electricity grid or gas grid in the Netherlands are investigated, from solar, EV, wind and electrification of the industry. This gave him the option to see a lot of the energy business and the sector within the Netherlands.

The internship was done mostly in his own room due to Covid-19. However, in the beginning it was possible to sometimes work in the office in Arnhem. He worked on multiple different subjects and experienced the internship as really interesting. It was a great experience that both benefitted him and the company!



## Alseas Engineering BV

Allseas Engineering BV, development of an OTEC heat exchanger. Ocean Thermal Energy Conversion (OTEC) can generate electricity by using the thermal difference between cold deep ocean water and warm surface water. As the temperature difference is small, large seawater mass flows, and big plate heat exchangers are required to generate a meaningful amount of electricity. The combination of seawater and the working fluid lead to titanium as a heat exchanger plate material. As titanium would make the capital expenditure prohibitively large, a substitution is sought in graphite filled polymer plates. The through plane thermal conductivity of these plates is very influential in the performance of the OTEC system, but is difficult to accurately measure. In addition, the thickness of the plate is also important to contain the pressure difference between the seawater and the working fluid. The additional thickness and thermal resistance of polymer plates requires increased heat exchanger area. This reduces the flow velocity and turbulence, and therefore the heat transfer coefficient. The overall feasibility of this substitution was investigated by updating existing models, while taking into account the production, the thermal performance, and financial aspects of this change to polymers





## AmperaPark

The intern was assigned for the project of evaluation of different solar systems that can be implemented in a Solar Carport. The assigned three-month project mainly focussed on evaluating which PV system can be integrated with carports. It also estimated the percentage of energy demand these systems can suffice along with charging the electric vehicles parked in them. Due to the pandemic, he had work from home and we had a weekly meeting at AmperaPark on Tuesdays and Thursdays. During these meetings, we always had coffee, tea, biscuits, etc. It was a good experience and Mazhar often pays us visits at the AmperaPark even after project completion.



## Aziobot B.V

The internship at Aziobot mainly focused on optimization and production of an autonomous floor cleaning robot (as seen in the picture). The bot was in the step of shifting from prototyping to production phase. The major work was on studying the bot and understanding the underlying principles which help in the functioning of the bot and then plan for the production for the next few batches of the bot. To ensure this was possible the record at each step of the production had to be recorded and the bottlenecks had to be identified. Post identification of the issues, it would be much easier to lay out a production plan and set up a shop setup plan to adhere to the optimizations in the production plan.

In addition to this, the other tasks included fixing of issues which arise during the testing phase of the final prototype and brainstorming on various ergonomic aspects of the bot for a professional presentation before the customers.



## Boikon

Boikon in Leek, the Netherlands, is a company specialised in production automation. During the internship one will have to work within a multidisciplinary team. You will get your own tasks and responsibilities and will have to present some steps of your work during meetings. Based on the results, engineering decisions will be made. It makes you feel like the performed work is appreciated and taken seriously. A lot of aspects are in the tasks that have to be performed during the internship; research, engineering, communicating, presenting, theory and practice. You will be received as a full colleague from the first point on throughout the whole internship. The flat organizational structure makes it easy to get help, all doors are open and one can walk in and ask their questions.



## Bond High Performance 3D

Bond3D is a company situated across from the UT where 3D printers are developed for producing PEEK parts. PEEK is a high performance polymer that is used in high-end applications like the medical and aerospace industry. It has great material properties, but is a tough material for 3D printing. A lot of innovation is still happening around the development of better printers and a better controlled printing process. The internship that was performed involved the use of system identification and machine learning for monitoring the life expectancy of the nozzle. As the nozzle ages, material accumulates on the inside resulting in a higher required force, which influences the printing process. Interesting departments for a mechanical engineer within Bond3D are: Hardware, mechatronic system, process, application & sales and software.



## CCS energie-advies company

ICare4Farms internship project aims to reduce the conventional energy share by increasing the use of solar thermal energy systems in farming in the North West Europe region. The duration of this internship was 14 weeks (24 Aug – 30 Nov). Unfortunately, due to the covid-19 situation, the last month of the internship was work from home. However, even under those circumstances and with the aid of the supervisors, the internship project was important and helpful. Due to the implementation of the theoretical background knowledge in the solar energy sector into real world cases. Also, in order to make the implementation of the STE systems to the NEW agricultural sector more feasible, the suit point among the lifetime cost and the performance of the total system was a key factor.



**Interreg**   
**North-West Europe**  
**ICARE4FARMS**  
 European Regional Development Fund

THEMATIC PRIORITY:  
 **LOW CARBON**

**PROJECT AREA**

Project objectives: ICARE4Farms intends to boost the use of solar thermal energy in farming in NWE, to contribute to reduce GHG emissions and increase the share of renewable energies.

Total budget received from Interreg North-West Europe (2014-2020):  
**€2.02 million of ERDF**

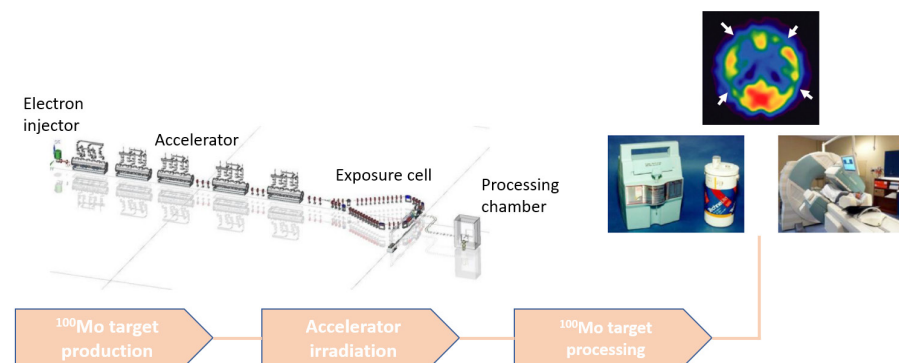
Total project budget:  
 €3.37 million

[www.nweurope.eu](http://www.nweurope.eu)



## Demcon Multiphysics

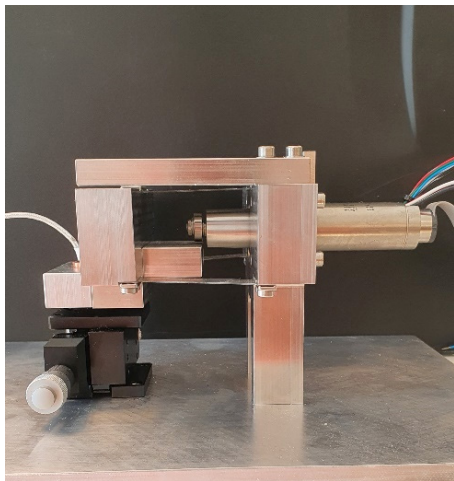
Demcon Multiphysics, formerly known as Demcon Bunova, is an engineering department within Demcon, Enschede. The team has high-end expertise in the area of heat transfer, fluid dynamics, structural mechanics, acoustics and electromagnetism. Demcon Multiphysics supports a wide variety of market sectors by providing detailed analysis using simulations; contributing ideas on the improvement of products or systems; and custom solutions. The goal of the internship was to perform a CFD sensitivity analysis in order to verify the "baseline" simulation. The effect of mesh refinement, influence of boundary layer, an idealized worst-case contact and the effects of various tolerances were investigated. Employees at Demcon and Demcon Multiphysics are open, friendly and helpful, which made the intern feel welcome and appreciated. All in all, the intern really enjoyed his time at the Demcon Multiphysics department.





# Demcon Advanced Mechatronics

Demcon Advanced Mechatronics in Enschede develops advanced mechatronic systems for its customers. One of its recent developments is an eccentric shaft z-actuator that is able to drive an position a pre-tensioned body with high precision. During the internship, a position control strategy had to be designed for the eccentric z-actuator. A challenge for this design is that the system dynamics are changing along the range of motion. However, along the whole range of motion the same controller should be used to make the system robustly stable. The nonlinear system is transformed to an equivalent linear system using feedback linearisation. However, for feedback linearisation, the system parameters are needed to cancel all nonlinear terms. This is not the case for the test setup, so research is done to the effect of feedback linearisation when the system parameters are estimated exactly the same as the system parameters and when they deviate from each other. The found solution with feedback linearisation is validated on a test setup in the laboratory of Demcon Advanced Mechatronics. V



# Eneco

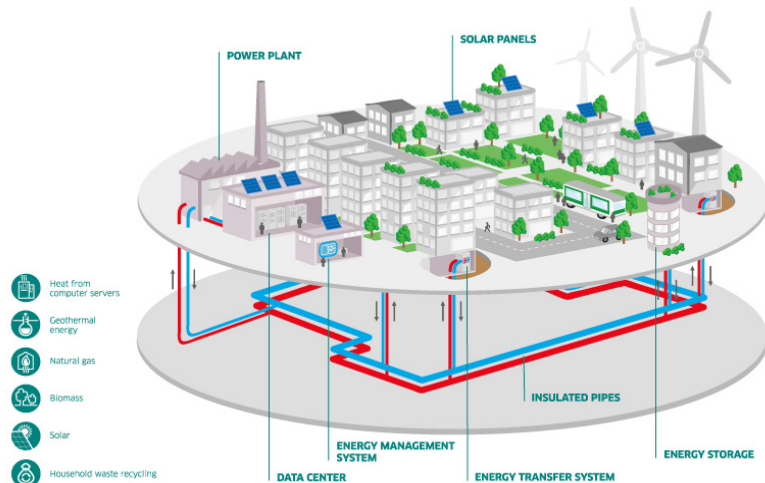
The internship was done at the offshore wind department of Eneco in Rotterdam, the Netherlands. This department participates, among other things, in offshore wind tenders (auctions), in which the best bid wins the tender and thereby gets to build the windfarm. This bid is created by a large team, and this internship was focused on a small part of the bid, namely the innovation criteria. This internship consisted of creating a shortlist from Eneco's longlist. The second part of the internship was focused on a market research into floating foundations for offshore wind turbines. All in all, the internship gave insight on how it was to work on a big project in a large company, and on the importance of offshore wind.



# Energy Watch

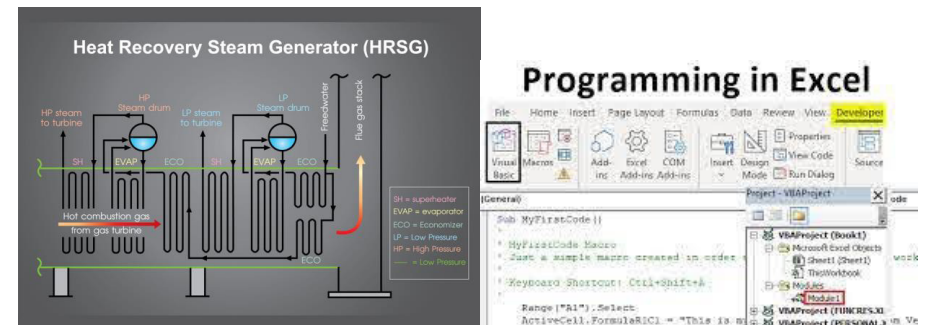


Energy Watch in Holten is a small consultancy working for authorities, companies and investors. For questions regarding the energy transition or other energy related questions Energy Watch provides product-market-technology and energy analyses. A problem they are dealing with is how to get rid of natural gas before 2050, the target in the Netherlands. Three main solutions are able to replace natural gas in the built environment: all electric (heat pumps), green gas and district heating networks (DHNs). For densely populated areas, DHNs are an interesting option. In Enschede a DHN provides heat to 8500 households and 200 companies, with 95% renewable heat. During the internship DHNs have been studied for the complete value chain (from heat production to household consumption), including distribution, costs aspects, CO2-emission, social impact and technological analysis.



# EPC Boilers Products and Services

The organization is EPC Boilers Products and Services which is situated in Den Haag, The Netherlands. The internship was carried out as work from home due to COVID-19 from Enschede. The aim was to develop a program which takes in operational parameters of the corrosion loop of heat recovery steam generators (HRSGs) and gives in the output the types of degradation mechanisms which can happen and that was the main objective. Along with this, predicting the risk factors of each mechanism and making a checklist for maintenance which will be given to the client before a visit was made. Finally a report was created to explain the spreadsheet/program.





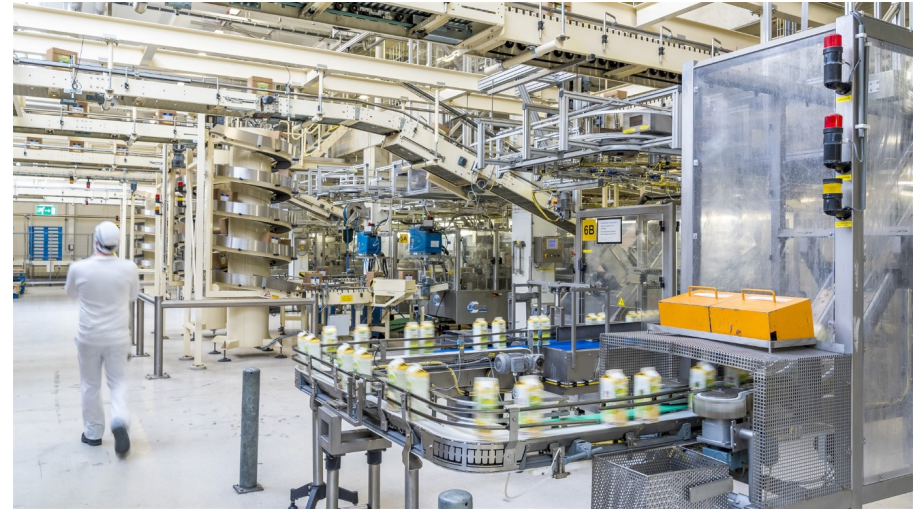
## Food Technology

Food Technology Noord-Oost Nederland in Almelo, the Netherlands, is a company that designs and produces machines for the food processing industry, including steamers, dryers, washers, peelers. The aim of the internship carried out was to gain more theoretical knowledge about one of the steamers, the Dynamic Cloud Control steamer for vegetables, pasta and petfood. This included CFD-modeling of the steamer with an open-source software package. Several problems that the customers and company were facing were simulated and possible solutions were proposed based on the results of the simulations. During the internship, which was largely from home due to Covid-19, especially the multiple meetings with experienced co-workers were very valuable.



## FrieslandCampina

An internship at FrieslandCampina in Maasdam. The internship took place at the maintenance department and the assignment was to create a dashboard and show information from two databases. The data was about the total production of the factory and about the work of the maintenance department itself. For the dashboard two different programs were used for the design of the dashboard. Each person can create his or her own dashboard. The dashboard gave the maintenance department more insight about the functioning of the department and the factory overall. To make the dashboard future prove a person was also trained to make new dashboard. With this knowledge the company itself has the ability to use the data and come to new insights.



## Energie van Noordoost-Twente

The internship was executed at Energie van Noordoost-Twente, The Netherlands and was centered around writing the Energy vision which gave direction in the energy transition of Noordoost-Twente towards 2030. The change in energy demand and supply was also analyzed and what possibilities were available and required to ensure grid balancing and to increase cost effectiveness. These results were also valuable input for the Energy vision. During the internship, the student gained insight in the processes of government agencies and considerations during policy making such as social consensus and technological considerations.



## HeatTransformers

HeatTransformers installs heat pumps. They aim to improve the efficiency of the heat pump as well as reduce the amount of negative feedback on heat pumps. As of now, a lot of people think the heat pump is very loud and expensive. Research is done to decrease the sound, as well as a good placement position is chosen to reduce the sound in critical areas, like bedrooms. HeatTransformers mainly installs hybrid heat pumps, which heat a residence in combination with the boiler. Because of this, the gas can be reduced by an average of 50-60 percent, and only costing a fraction of an “all-electric” heat pump.

Most clients have a return on investment in about 10 years. As the heat pump will last for about 15, this can be a great investment for the cost, as well as for the reduction in carbon dioxide emissions. For my internship I made a model predicting the gas savings of clients, looking at their type of house, insulation grade and size. Using these parameters, a correlation was found, and a model could be set up to give an indication in gas savings. This can be used to persuade clients into purchasing a heat pump, by eventually guaranteeing these savings.

This project needs to be continued, and extra research is to be done to the sound issue.



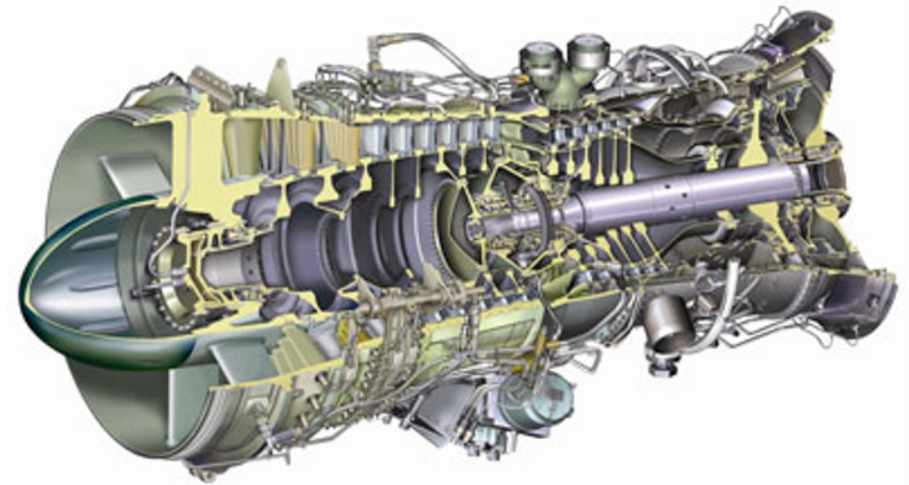
## Heves Engineering B.V.

Heves Engineering is an engineering firm based in Duiven, Netherlands. The company develops products for the manufacturing industry, and recently a demand for an automated casting machine resulted in this internship. The objective of this internship project was to design a molding equipment for an automated casting machine. Since the casting machine was undergoing development by few other teams, the project included close collaboration with employees and other interns. Weekly follow-up meetings were carried out with the student and the external supervisor to present what was done during the week and what was planned for the next week, as well as to ask project-related questions and to receive feedback. Interaction with the supervisor and employees was professional and friendly, and the student was very well received at the company.



## Holland-Controls

The internship was done at Holland-Controls, a company located in Hengelo. Holland-Controls specializes in gas turbine control systems. The internship focused on a gas turbine located in Munster, Germany. The goal of the assignment was to provide an algorithm which could be used to calculate the temperature of combustion of this gas turbine. It focused mostly on thermodynamics and heat transfer. The company involved the intern at the project, and everybody in the company was very helpful and friendly. There were a lot of possibilities to ask questions and learn about specific topics. There was also an opportunity to visit the facility in Munster, which was both really fun and instructive.





## HoSt

HoSt is a company that makes Bio energy plants and digesters to make Biogas. These digesters are stationed at different locations where biowaste is generated, for instance at farms. The fermentation of the biowaste is most efficient at temperatures around 40 degrees Celsius. In order to reach these temperatures, heating inside the digester is, up until now HoSt always neglected the generation of heat during digestion, but recently they noticed that some digesters are able to run properly without the use of a heating system. The goal of this internship was to make a model that calculates the heat generated during the digestion process. This is done in two ways. The first way focuses on the difference in formation enthalpy of the reactants and reaction products. The second method looks at the difference of heating values of the input and output. The first method required too much work, the second method turned out less precise than was hoped, but it can still be used to give an indication whether cooling might be necessary.



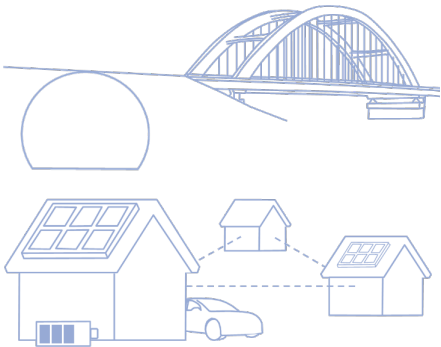
## Koninklijke Marine

The Internship was done for the Royal Netherlands Navy (RNLN) located in Den Helder at the department Data for Maintenance. This is a relative new department that is focusing on implementing maintenance based on sensor data. This is also a relative new way of working for the RNLN because in the past they did not store data for security reasons. Currently this department is focusing on an Ocean Patrol Vessel Zr.Ms. Groningen and if it is possible to implement this on all the current vessels. Research was done on the mechanical parts to see if there are enough sensors to predict the state of the machines.



## LochemEnergie

LochemEnergie is an energy cooperative in the municipality of Lochem, the Netherlands. The energy cooperative represents the local community in the field of renewable energy and carries out projects that benefit the local community. During the internship, research was conducted into the possibilities for LochemEnergie to carry out a community-based virtual power plant pilot study (cVPP) in 2021. This is a local energy market in which the local community can trade locally generated energy and receive many rights in the energy market. This research explores the technical, social, institutional, and economic aspects of the cVPP and the energy transition and provides a glimpse into the future of energy cooperatives in general.



## Bureau Marine Engineering

The purpose of the internship assignment was to design a replacement permanent pressure system for the permanently running service pump. At first research is done into different systems that are able to pressurize fire fighting systems. After that, a simulation of the chosen pressure system had to be made to determine all dimension and capacities. At last, a design for the permanent pressure system had to be made.

The assignment is provided by bureau Marine Engineering of the Defense Material Organization, which is located in Utrecht. However, most of the work had to be done from home due to the COVID-19 measurements, which was not ideal but doable. The internship was nice to do since the knowledge gained at the university could be applied in a real-life problem.



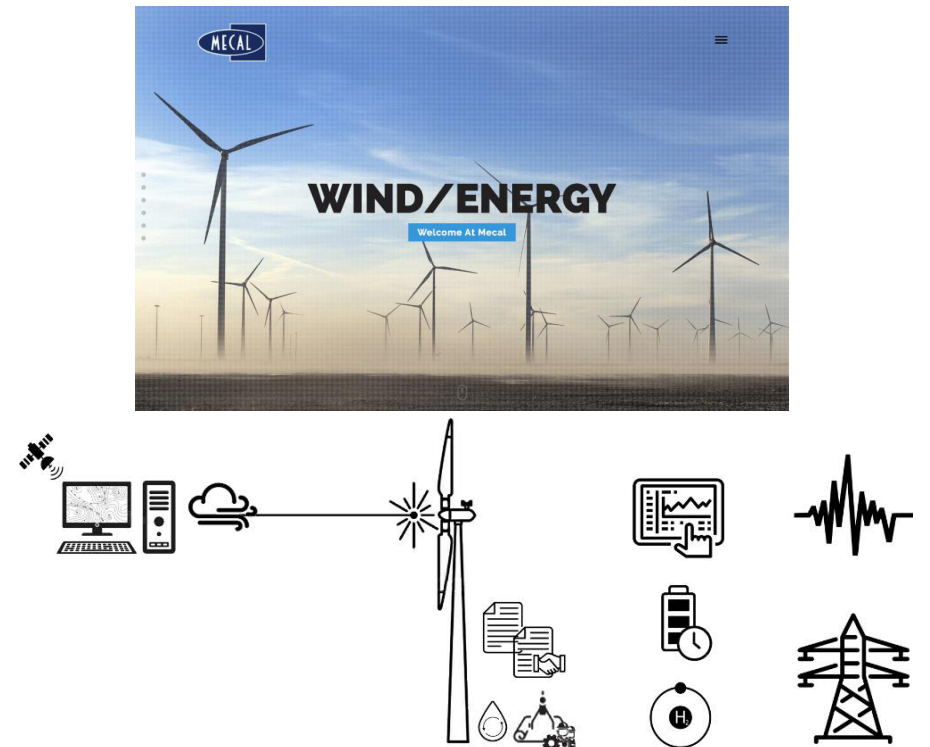
# MECAL

MECAL is an engineering consultant, mostly active in the Wind/Energy and High-tech systems markets. MECAL's headquarter is in Enschede in the Netherlands, but they are also active in Denmark, the USA, China and Japan. MECAL thrives to be on the forefront of technological development to help their customers develop and analyse their products in the best way possible. In order to stay on the forefront it is necessary to invest in new techniques and keep track of promising developments. Therefore an investigation has been performed in Structural Optimization techniques, capable of creating optimized structures, based on a particular goal and the techniques able to create these complex optimized structures, namely Additive Manufacturing. With this current capabilities and limitations of these techniques are found and understood.



# MECAL

As the wind turbine becomes taller nowadays, the towers are required to withstand more load. MECAL wind turbine design department has many advanced tower design projects focusing on modeling, simulation, and safety standards. Besides wind turbine tower design, MECAL is also interested in the LIDAR applications in the wind energy industry. The purpose of this internship was to investigate the LIDAR-assisted control in a wind turbine to increase the energy yield and reduce the structural loads. Colleagues at MECAL are helpful and friendly, which made here a nice environment to learn and apply your knowledge while experiencing a professional workplace.





# MECAL

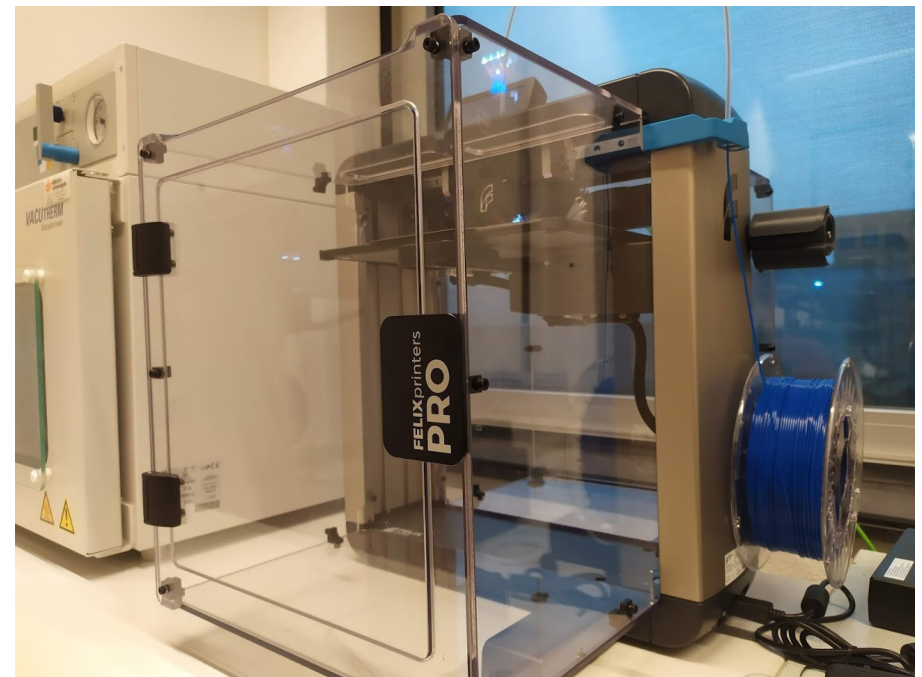
During this internship at the Wind Turbine Design department of MECAL in Enschede the viability of a damage tolerant design was investigated for wind turbine towers. Damage tolerance is the property of a structure relating to its ability to sustain defects safely until repair can be effected. It can lead to cost reduction if the reduction in required material for the structure is less than the required additional inspections and maintenance.

At MECAL a lot of knowledge regarding wind turbines is present amongst its employees, and plenty of resources are available in the form of literature and in-house software that can be utilized. The open and collegial working atmosphere provides a pleasant environment where questions are encouraged, and you are valued equally to all other employees.



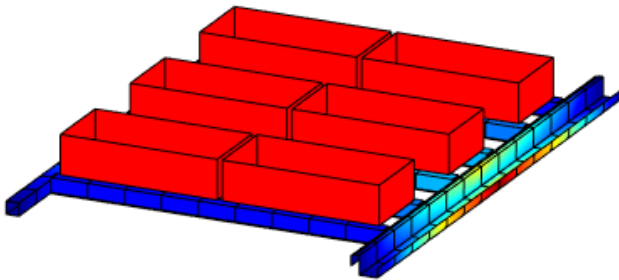
# Micronit Microtechnologies

During 5 months internship at Micronit Microtechnologies, which is located in Enschede, Netherlands, main assignment was the Optimisation of additive manufacturing processes for Lab on a Chip devices. For this assignment, 3D printing was chosen to be the main manufacturing process, which was used to create different parts for Lab on a Chip devices. Alongside the creation of parts, 3D printer use protocols were written, which included instructions and configurations for different printing materials. 3D printed parts were tested by using them for intended microfluidic applications.



## NEDCON

NEDCON is a company located in Doetinchem, specialized in designing and producing storage systems. The Design Principles department, at which the internship took place, is tasked with assuring the systems integrity as well as assisting other departments. Among other things, complex failure mechanisms, such as fatigue and buckling, are being modelled and tested within the testing facility. The internship, focused on the storage systems integrated within greater automated systems, in which shuttles perform pick-and-place operations to retrieve the stored goods. The goal was to look at how the storage system and its stored goods behave, when subjected to the (dynamic) loads caused by the shuttles. This was done by establishing an analytical model of a single storage compartment, see figure, and looking at and comparing systems with different parameters.



## TNTS NORMA FOR D&E

TNTS Norma makes machined products and mechatronic assemblies for different industries like the semiconductor industry, aviation industry and optical instrument manufacturers, this is done while keeping in mind strict tolerances specified by the customer. During this internship it was the goal for the student to design a tool that is to be placed in a clean room and partly under a vacuum for a helium leak test for two types isolators. This is bound to some challenges because little particles are to be produced in a clean room. Not all materials can because corrosion of metals and degassing of polymers is not allowed is to be kept as low as possible. At the same time for the vacuum special design rules apply because one does not want virtual leaks in a vacuum system. These are typically large cavities hidden behind a nearly sealed part of the construction e.g., a thread.

The isolators are used to isolate vertical movement with a pneumatic system and formed like a cylinder to allow only vertical movement of a piston inside the cylinder. They have a planar stage inserted inside to allow precise planar movement as well, which makes them essentially part of a bigger stage that is to be moved precisely.

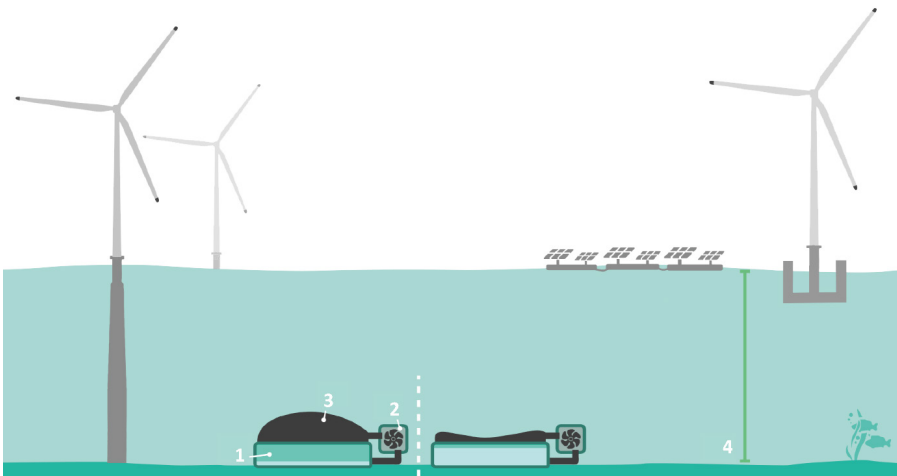
The final product are CAD drawings and bill of materials for the prototypes of two of those leak tests. One is done to test the housing seals of two different types of isolator units and the other is to test the spacer plate that will be placed below one of the isolator units. The internship itself was quite challenging. If one is looking for freedom of work, nice colleagues, can show initiative and is open to contact other people, do not hesitate to contact this company. It is very likely that they have a spot for you.



## Ocean Grazer BV

The internship was done at Ocean Grazer BV. The company is a spin off from the university of Groningen that is currently developing a sustainable energy storage system, called the Ocean Battery. The Ocean Battery will be placed on the sea bed and stores energy using a pumped hydro method. During the internship design aspects of the rigid water reservoir (1) have been investigated. Several phenomenon which could affect the efficiency and the total capacity of the battery where analysed using analytical and numerical models.

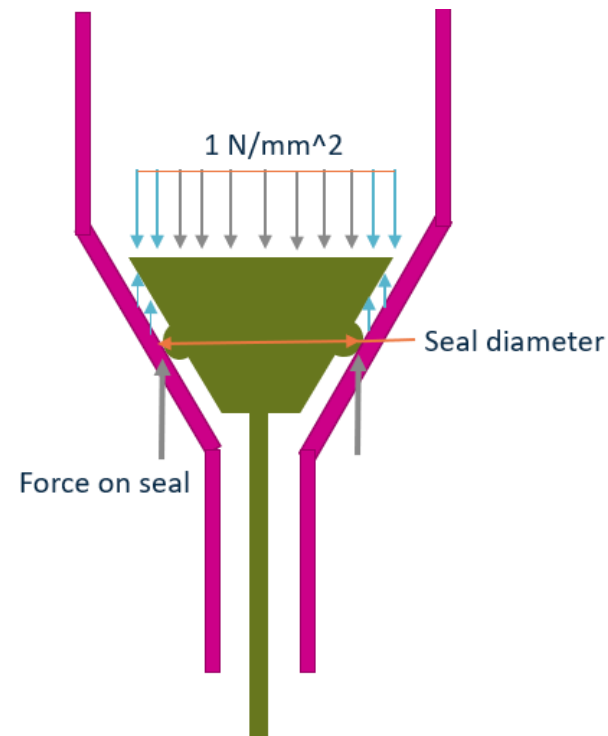
Ocean Grazer is a small and young company located in Groningen, the Netherlands. There is a friendly atmosphere within the company and everyone is willing to help. Because they are still working on the design, the recommendations will be applied in future designs, which makes the assignment very interesting and practical.



## PCV GROUP

This internship took place in Enschede (Netherlands) at PCV Group. PCV is an independent product and technology company which develop and improve components for medical, industry and consumer markets. During the internship at PCV, the supervisors were very helpful and provided feedback on the project work or task within a day. Meetings were also scheduled every week to discuss the progress of the project. It felt as if the PCV supervisors really train the interns to become a junior engineer in the company.

The project consisted of developing an environmentally friendly deodorant dispenser which is competitive with the traditional aerosol can. The project work mostly consisted of developing and testing components of the dispenser. A lot of sketching and CAD work was needed to achieve the project objectives.





## PCV GROUP

The internship contained a wide spectrum of elements within a product development cycle. These included the design and execution of a test-plan, finding causes (and solutions) for encountered problems, competitor (and patent) analysis and the design and prototyping of new products. The PCV Group is located in Enschede and many of its employees are alumni of the University of Twente and WSG Isaac Newton. Their experience with internships, combined with a very pleasant corporate environment makes for an enjoyable and educational internship. Their focus is mainly on consulting clients with their technical and product development issues which leads to a large variety in projects that an intern can be a part of.



## PCV GROUP

For the master Mechanical Engineering I did my internship at PCV Group Enschede. PCV Group is a small technical consultant agency which helps various companies in their development process. During the internship I worked at an internal development project. The goal is to develop a sustainable alternative for the polluting aerosol deodorant spray can. After four months a prototype was made which showed that the dispenser could become smaller and improve its specifications. In total it was a very nice learning experience to be an intern at PCV Group. I was treated as a junior engineer and that gave me the possibility to find out what is interesting for me and what I liked less.



*Office of PCV Group: The Van Heek Villa in Enschede*

## Rijkswaterstaat Utrecht

During the internship at Rijkswaterstaat, the Netherlands, a research was done in alternative energy carriers for the ships in their fleet. Rijkswaterstaat has around 100 ships, varying in size from 6 meters in length up to 100 meters in length. As a governmental organization, Rijkswaterstaat wants to be the 'launching customer' in the sustainable maritime sector in the Netherlands and Europe. The internship was about doing calculations in order to see which alternative energy carriers were possible (for example: hydrogen, methanol, batteries). This internship was very insightful when you are interested in sustainable mobility. The shipping sector is a very interesting case for alternative fuels.



## TNO

The Dutch organization for Applied Scientific Research (Toegepast Natuurwetenschappelijk Onderzoek; TNO) is an independent research organization in the Netherlands that focuses on applied science, bridging the gap between Universities and Companies. Solliance collaborates between several research institutes in the international region between Eindhoven (NL), Leuven (B) and Aachen (D). Its main location is building 21 at the High Tech Campus in Eindhoven. (see picture) Solliance focuses on the development and application of thin film photovoltaics (PV) such as copper indium gallium selenide (CIGS) and perovskites solar cells. Thin film PV has the advantage of flexibility which can be applied to lots of substrates like façade. One of the tasks of the institute is to meet the need for more installed PV to achieve the energy transition.





## TNO - Innovation for LIFE

The intern was assigned for the task involved in Energy Transition Studies (ETS), a part of TNO based in Amsterdam-Sloterdijk. The assigned three-month project work mainly focuses on techno-economic data mining and value chain analysis in the Regional Energy strategies and thereby creating a model-based Regional value creation. The intern was committed, pro-active, and fast with the tasks that are part of the internship. The understanding of the work content is excellent and also show-cased good abilities to differentiate between main aspects and side aspects of the assignment. Due to the current situation of work from home, there are no cool group-selfies. The below image is work desk of the intern.



## Total

For the past 3 months I have been working at Total, in Madrid headquarters. Total is a big French oil company which competes in the oil industry with BP, Exxon Mobile, Shell, and many others. Because of the energetic transition, the big oil companies are turning into green by buying wind and solar farms. This is the case of Total, who has just bought 2 GW of solar PV in Spain. This interests me a lot, as it is fascinating how the core business of the oil enterprises is facing renewables. Moreover, these oil companies have a big capacity of investment.

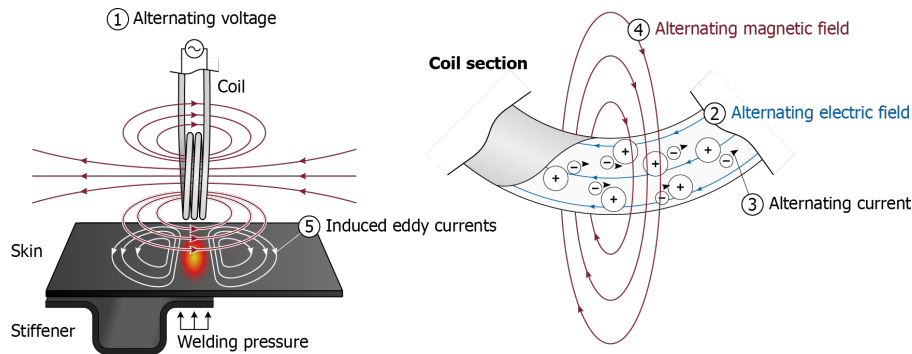
What I have been doing during my time here is to analyse the steps and procedure within a PV project. The technical part, the administrative, legislative, and normative parts, and the environmental assessment. Moreover, I have been very active in some Spanish energy associations, such as UNEF and I have been helping my colleagues with some projects they were handling. It has been a fantastic experience which I hope will continue for many years.





# TPRC

The Thermoplastic Composites Research Center in Enschede is a global pioneer in the field of using thermoplastic composites as materials for lightweight manufacturing in large volumes. While overcoming different obstacles on this journey, determining specific material characteristics of thermoplastic composites is inevitable when investigating manufacturing methods numerically. During the student's internship, the electrical resistivity of thin thermoplastic composite tapes was characterized. This knowledge is used for investigating how electric currents flow through thicker, and more complex parts. Throughout the internship, the student is surrounded by international, professional, and very friendly staff. Everyone is following the dream of a more widespread use of thermoplastic composites. This creates an enjoyable working atmosphere, with everyone being eager to help everyone out.



# Tri-O-Gen

Tri-O-Gen is one of the companies that converted wasted heat into electricity. It is located in Goor, Netherlands within 30 minutes from The University of Twente by train. The company uses organic rankine cycle (ORC) processes as a heat recovery. Diesel Engine is one of the applications that can be integrated with this waste heat recovery. Therefore, the company wants to see the possibility of integrating diesel engines and ORC with battery and without battery to stabilize the diesel engine works. Since the lower the capacity of diesel engines runned, the greater the fuel diesel consumption. Thereafter, it can be determined whether the additional storage such as the battery gives more advantages or disadvantages for the whole system. The parameter that is being used for the consideration is battery size, capital cost, fuel diesel saving and footprint.



(a) (b)  
Figure 1. (a) Triogen E-box (b) Process inside E-box

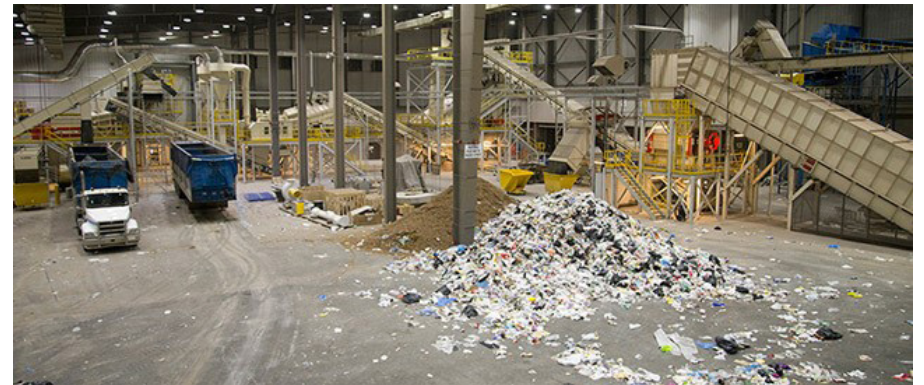
## Twence BV

The internship took place at Twence BV in Hengelo (20 minute bike ride from the UT). Twence is a waste treatment facility that produces energy and raw materials from several types of waste. Most of the (grey) household, Bulky household, Industrial waste and Organic waste is from the Twente area but sometimes waste is imported when supply is too low. The internship was set up together with the supervisor at the asset management department and consisted of several parts that would allow for a good insight to several aspects of the company. The major activities during the internship were the execution of a LTARP (long term asset replacement plan) study for the heat supply system and developing a suitable format for these study. Furthermore it included working out the impact of new legislation for pressurised steam equipment PED (Pressure Equipment Directive) and the renewal of the decision tree to decide if part should be held as stock or not. Besides this there were many opportunities to join meetings, get tours through all the facilities and walk along with the crew doing the actual repairs. Overall the internship was very dynamic, the assignment connected to the wishes of the student and the supervision at the company was good.



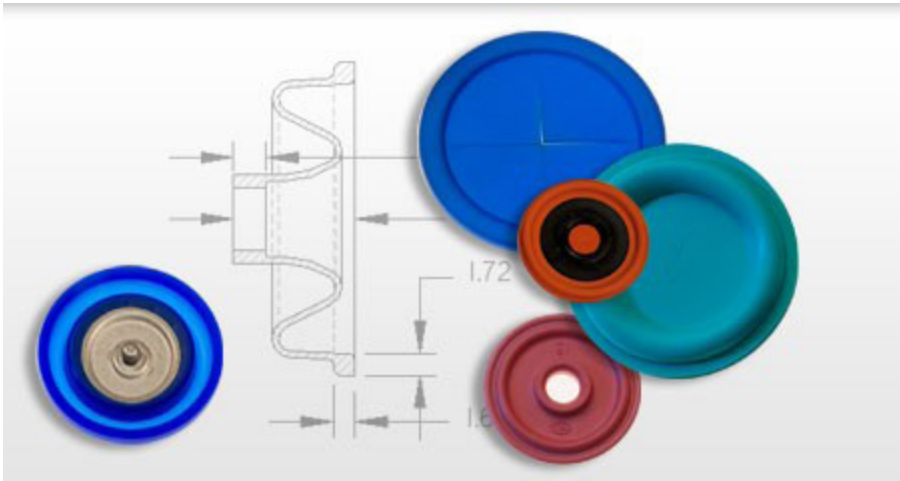
## V.I.T. S.A.

The internship was carried out at V.I.T. S.A., a processing company based in Thessaloniki, Greece. The main focus was the utilization of municipal waste to produce refuse derived fuel (RDF), which is used to cover the energy requirements of a cement production plant. For this assignment, a drying system was designed, in order to reduce the moisture of the product and yield a higher quality fuel. Two different categories of dryers were taken into account and their sizing calculations were carried out. Moreover, a cyclone was considered, in order to remove dust particles from the gas outlet of the dryer, before the drying medium is returned to the atmosphere. The internship was done in an online environment, with frequent meetings with the supervisor and several colleagues.



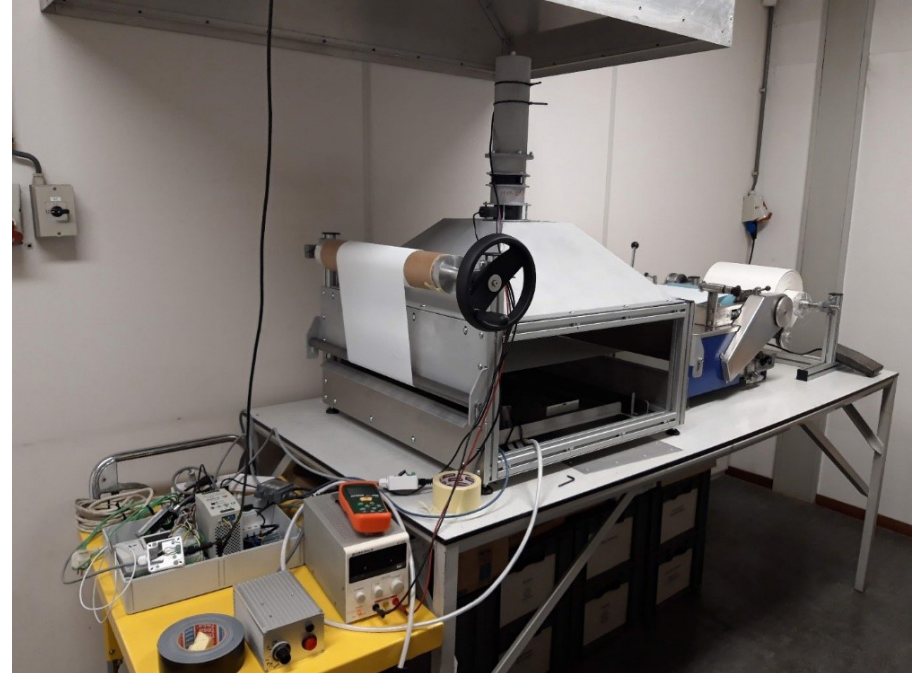
## Vernay

Vernay is producer of high-performance rubber products generally in combination with overmoulding. Situated in the Netherlands in Oldenzaal the company combines the engineering and the production within one building in an organization of around 200 employees. The adhesion between rubber parts and the steel mould surface is not fully understood. By performing ejection force measurements in a production press with different cavity roughness's and rubber compounds a more complete picture could be established. Vernay Oldenzaal provide a welcoming experience and due to its scale as a medium sized business with on site production there are many possibilities for tests and experiments.



## Verosol

The internship took place at Verosol, in Eibergen, NL. Verosol specializes in the production of high quality indoor blinds with innovative properties. The internship assignment was to investigate the feasibility of a new thermal treatment for textile that has greatly reduced emissions compared to the current process, which burns natural gas to generate heat. A prototype was designed and built with which experiments were performed that analyzed the technical feasibility of the alternative technology. Based on these results an economic analysis was also performed that concluded that the new technology was indeed financially feasible. The internship involved bringing together all kinds of knowledge, from coming up with theoretical models for heat and mass transfer, to validating these models in real, practical experiments, using sensors and MATLAB to perform data analysis.





## Verosol

Verosol in Eibergen (The Netherlands) produces high-quality indoor blinds. In the production process a gas-fired textile drying machine/tenter is used. The aim of the internship is to determine if it is feasible to transition from the gas-fired tenter to a more efficient and sustainable one.

Therefore the efficiency is determined by measuring the gas levels when the fabric enters and exits the tenter.

As alternative infrared emitters are considered. The preliminary results show, the efficiency of infrared emitters is comparable to the current tenter. However, much can be improved by managing the airflows and the distance to the fabric. To determine the effect of both, a professional prototype is designed. My successor will determine with the prototype if infrared heating could indeed be more efficient than a gas-fired tenter.



## We4Ce

My internship has been conducted at We4Ce, which is a worldwide leading company specialised in rotor blade design based in Almelo, The Netherlands. The research that has been done into placing a leading edge slat in front of the leading edge of thick airfoils is continued by placing it in the context of the thick inner root of wind turbine rotor blades. The internship will focus on both the aerodynamic and structural aspects of the slat placement.

The aerodynamic efficiency of these inner root sections are lower than theoretically possible, due to structural reasons. As a consequence the angle of attack (AoA) in the inner blade is too high, resulting in flow separation. The research conducted into the leading edge slat has been performed and confirms the results of earlier research conducted on thick based airfoils on a wind turbine rotor blade platform.

Regarding the aerodynamic analysis, the occurring suction peak has been lowered and moved further along the chord, which have a positive effect on the flow loosening. An optimum slat angle of attack has been found with a larger gap height as proposed in the wind tunnel test setup. Also the tip effects have been analysed and reduced using winglets, which are also designed to fit the structural supports. In the structural part, the suspension of the slat is designed and tested for the normative load used for the corresponding wind turbine class. The slat structure is described and a laminate strength analysis has been conducted. The structural analysis has resulted in a design proposal, which can be utilised in further extensive CFD modelling or wind tunnel experiments.

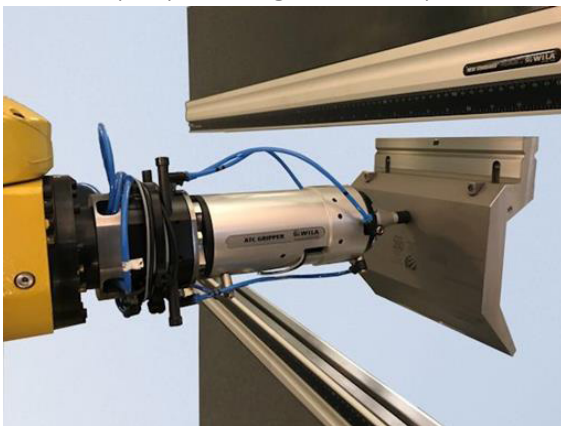
My internship has been a nice period where I've explored a lot of tools and skills in a relatively short amount of time. I also got the opportunity to work at the company's office and get the right internship feeling, which is not assured during the pandemic.



## WILA B.V

The internship was with the press brake company WILA, Lochem Netherlands. The company produces and develops tooling and tool holders for press brake machines (like Safan Darley, LVD or Amada). There is a demand for automated handling of press brake tools for several years now. Batch sizes decrease, the trend of mass customization of sheet metal products is growing and there is a shortage of skilled labour. Therefore, bending companies try to minimize setup times and avoid errors in the setup process. The market consists of a handful of successful concepts that are completely tailored to the view on press brake automation of the specific manufacturers. The assignment is concerned with enhancing the automated setup in their tool management platform. Specifically, the tool change process.

The student analyzed the current process flow, understood the system requirements and developed a new design setup with a modified process flow to overcome the delay in setup times and improve overall process. The meetings and discussions happened at their location in Lochem, which is the main office of WILA and is also one of their production locations. Although the time spent was limited due to corona the assignment was challenging to come up with a new solution, valuable feedback was received and was fun to work at the company with a good atmosphere.



## Wiredworkers

WiredWorkers is a company based in Doetinchem, the Netherlands, that specializes in cobots (collaborative robots). They offer complete solutions for implementing these cobots, including for example the delivery, installation and integration in the current process. The company has a young team and an innovative character, wishing to make cobots accessible to small and medium-sized enterprises.

The internship was focused on the dynamics of such cobots, and the main goal was modelling the behaviour in Matlab and Simulink. The created script forms a tool to translate different physical properties of the cobot (like the number and the dimensions of the links), and performance properties (like the velocity or acceleration of the end-effector) to requirements for actuators. For a specific application, components of actuators were selected.



# Xsens

Xsens is a company in Enschede which produces motion trackers. In these motion trackers are multiple sensors involved that need to be calibrated. One of the sensors is the magnetometer. This magnetometer is calibrated with help of reference magnetometers that are perfectly calibrated outdoor. The reference magnetometer was manually calibrated. The goal of this assignment was to design a mechanism that automates the calibration procedure of the magnetometer. This includes knowledge of electrical and mechanical components to eventually come up with a mechatronic design. The intern had much freedom in designing the device and had the possibility to realize his idea. The final design made by the intern is shown in the figure. Finally applying the theory into practice was a great experience.



# Xsens

This student completed the internship at Xsens in Enschede, Netherlands, which is a company that makes inertial measurement units (IMUs). The IMUs measure motion and therefore can be used to determine motion of the bodies that they are attached to. Current methods of determining their orientation relative to a body requires a very specific calibration protocol and sensor placement. This is undesirable as not every user is capable of performing these motions. The goal of the assignment was to implement a new method of detecting the relative orientation of IMUs placed on either side of a simple joint. This new method requires only two IMUs and only requires arbitrary motions rather than specific ones. The student implemented the new method in MATLAB and validated it with on-body measurements, which were compared to measurements taken by a system using the traditional calibration method. Based on the results, the project was deemed a success.

