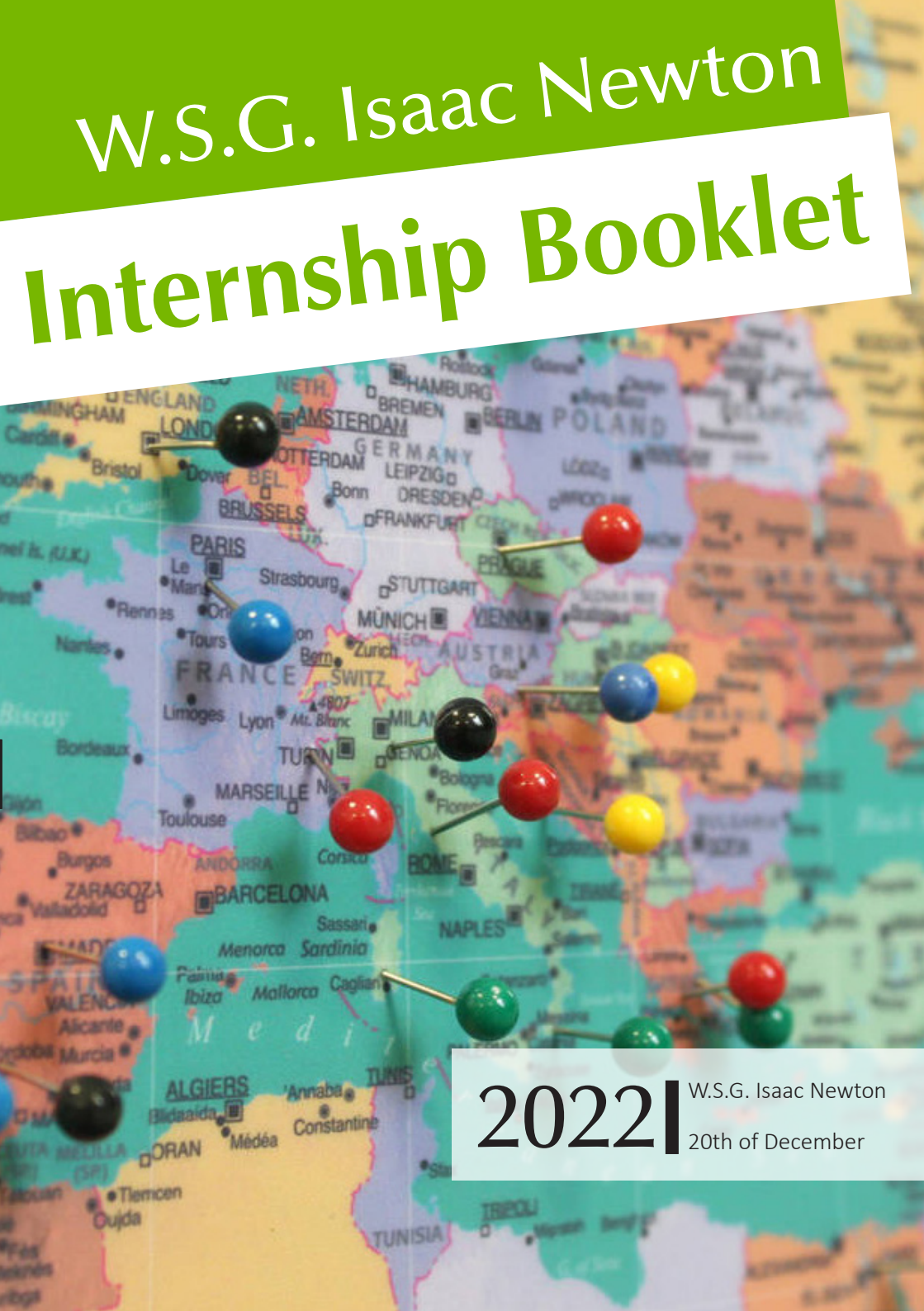
W.S.G. Isaac Newton

Internship Booklet



2022 | W.S.G. Isaac Newton

20th of December

Introduction

Dear reader,

In your student life there eventually is a point where 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 Mechanical Engineer, an internship is done. In a three to four month period you learn what it is like to work fulltime and to be a part of interesting projects. This is a great opportunity to find out what you like and to work at companies all over the world. To help you pick a suitable internship, we have gathered a lot of information! This booklet contains the experiences of students who did their internships assignments at a range of different companies.

Kind regards,

Roel Schoorlemmer
Commissioner of Educational Affairs of W.S.G. Isaac Newton
Nil satis nisi optimum

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8th edition

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2-B Energy

For my internship at 2-B Energy in Hengelo, I looked into constructing a simplified wind model in order to predict the wind field upstream of a wind turbine. Modern wind turbines react to the incoming wind by altering their blade pitch in order to reduce the forces on the blades. Wind gusts can cause peak loads which dictate the turbine design. Being able to predict incoming gusts could help in reducing these peak loads from sudden gusts. A Light Detection and Ranging system (LiDAR) is able to measure wind speeds in the oncoming wind field. These measurements must be correctly propagated to estimate the incoming wind. Therefore, a model has been designed based on the incompressible Navier-Stokes equations. As the predictions must be made in real-time, simplifications and assumptions are applied to reduce the computation time. The resulting equations are the two-dimensional nonlinear advection equations assuming Taylor's frozen turbulence hypothesis. These are discretized and computed using an Unscented Kalman Filter. The filter is able to adapt to the discrepancy between the model and the actual measurements and therefore improve the estimations. To improve the stability or the coupling between the velocities, corrections on the inflow boundaries and mean wind direction are applied. The model is implemented in Python and tested on some simplified cases. The model is generally able to capture the correct wind behavior, but some limitations are made apparent. Gusts with high inflow angles compared to the mean wind direction prove to be problematic. Finally, recommendations were made to further improve the model.

Aeronamic

Aeronamic is a manufacturer of high-speed rotating components and sub-systems for the aerospace industry. There are production and MRO facilities in Almelo (NL), Woensdrecht (NL) and Sibiu (RO). Producing these high-tech components requires many different special tooling (e.g. custom-designed fixtures for machining). The current systems for management of this tooling must be adapted to the increasingly higher standards required in the aerospace industry. As such the goal of the internship was to evaluate the current scenario and propose an improved system for tool management.

The internship at Aeronamic was a very enjoyable experience. The guidance from the internship supervisor was clear and useful. The manufacturing engineers provided very insightful information related both to the assignment and to production in general. It was also great that I could walk on the work floor to see the production taking place and talk to the operators. Aeronamic showed me the practical applications of the theory studied during the courses at the university.

AmperaPark

Designing an energy system for the sustainable neighbourhood of the future

The Dutch residential sector accounts for 13.4% of the national energy consumption, meaning that reducing its emissions has a significant impact on the energy transition. Even though solar panels are already a widely applied sustainable energy technology in neighbourhoods, grid congestion makes integration of PV and therefore realization of sustainable neighbourhoods challenging. Furthermore, the government will decrease financial compensation in the netting arrangement in the upcoming years, making solar panels without storage less financially attractive for home owners. Therefore, it is useful for the climate goals and financial reasons to make neighbourhoods as energy self-sufficient as possible.

This research aims to design a sustainable energy system for a neighbourhood with 80 houses. Since the neighbourhood will be designed for wealthy residents (considering the location and price), self-sufficiency should be mainly reached with technological solutions, as these type of residents are reluctant to change their energy consumption behaviour. To design this energy system multiple technologies are explored and assessed on their contribution to self-sufficiency, cost factors, influence on the residents' comfort, the ease of ownership, the taken up space and sustainability.

From the technologies with a sufficient assessment, 3 scenarios for energy systems are designed. Each scenario has a trade-off in for example self-sufficiency, price or comfort. The best scenario is therefore dependent on the factors which are identified as most important. To develop the concept of the sustainable energy system further, the plans should be discussed with governmental institutions, technology experts and potential residents.

AmperaPark

Estimating key performance metrics for solar carports

Amperapark is a technology startup based in Enschede that develops and build intelligent solar carports combined with electric car chargers. The sales team needed a tool that allows for rapid testing of various carport configurations, to reduce the workload and speed up the conversation with clients. I developed this dashboard in Python. For the back-end, I developed a simulation tool that accepts a wide array of inputs. The tool can also estimate the results for an entire year using a novel sampling algorithm. For the front-end, I built an interactive user interface using the Dash package in python. In discussion with the team at Amperapark I came up with a design that provides all of the most important results in an intuitive manner. The resulting dashboard works well and allows for rapid prototyping. It is a good basis for the future. Higher quality and more diverse data inputs and validation are still required.

ENSCHEDE

AmperaPark

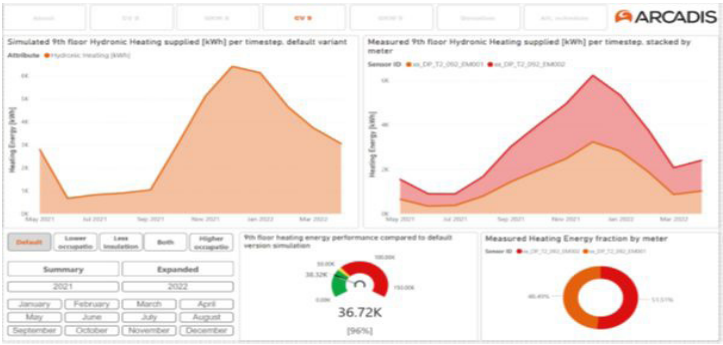
For the internship, I was tasked with analysing and evaluating novel ways of getting electric vehicle (EV) user flexibility information to use in an Energy Management System (EMS). The work included analysing data of and evaluating an existing location (SlimPark) where EV-user flexibility information was gathered. Also, a new test location at the Provinciehuis Overijssel is set up where an alternative way of gathering EV-user flexibility information, this can be seen in the photo. Next to that, I was tasked with complementing and developing the existing EMS.

Arcadis

For my internship, I worked at the division Sustainable Building Services & Physics of Arcadis Nederland. Arcadis is an international engineering and consultancy firm, established in 1888 in the Netherlands. Arcadis is the world's leading company delivering sustainable design, engineering and consultancy solutions for natural and built assets.

For the internship assignment, I researched the data collected by the digital twin of the heating-, cooling- and ventilation installations of Arcadis' office in the Delftse Poort in Rotterdam. This digital twin is a live digital copy, based on measurement data from sensors installed in the office and a 3D-model of the building. The measurement data included, amongst others, room temperature-, air quality-, flow- and heating & cooling energy measurements. I performed several analyses using the data, including a thermal comfort assessment and an energy analysis. In this energy analysis, the measurement data were compared to results of a simulation model, which I made during the internship. I also created several dashboards for analysis using Power BI, which visualise the data extracted from the digital twin.

Arcadis also allowed me to attend an external project meeting and visit the construction site for this project, which was a really cool and educational experience.



ZUTPHEN

Aurubis

Aurubis Zutphen is a factory that casts, rolls, anneals and slits brass and copper strips. The process used is unique, because it the only continuous brass casting processes worldwide. During my internship I have focused on improving the thickness profile and strip shape in order to improve the overall yield. During my internship I studied some literature, analysed some data in VBA and did some experiments. However, due to the limited literature on the cold-rolling of brass most of the work was practical. During my internship I have gotten a lot of freedom to perform my experiments, although in some cases it was at the cost of production. Furthermore, there are relatively little process engineers for the size of the process. So there is a lot of potential for improvements and optimization.

Figure 1: The 25 000 kgs coils produced at Aurubis.

Bond3D

Bond3D is a young, dynamic and fast-growing company located at Kennispark in Enschede. The company 3D prints functional parts with high-performance polymers, with unprecedented strength. To enable the manufacturing of these high-end parts, the company fully developed their own 3D printers, including all the related software. Bond3D offers a variety of internship assignments in different fields of engineering, ranging from CFD simulation to production management assignments.

During this internship, a new printing material with short fiber reinforcement was tested. This was done within the process development team. The main part of the assignment consisted of printing parts with different printer settings and performing different tests on these prints. The result is knowledge on the printer settings and mechanical properties of the printed material. The data from the printer and tests were processed using python. Overall, this was a very interesting manufacturing and material science related assignment.

ENSCHEDE

Demcon Advanded Mechatronics

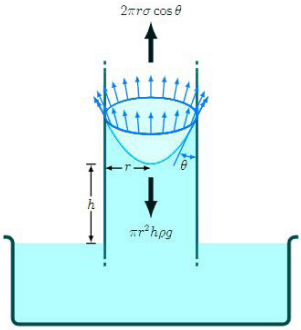
The internship is performed at Demcon Advanced Mechatronics (DAM) in Enschede. DAM is one of the currently 16 Demcon companies. The companies all have its own specialisation and type of projects or market, but also do work together to combine knowledge for projects.
The assignment involved a drone that should autonomously perform a task. This should be done indoors, so for example without gps. This assignment was mostly focussed on the software and control, not specific on the drone itself. Testing in both simulations as with the real drone resulted in an assignment that also had many practical parts.
The assignment was individual, however the office was shared with both employees and other interns, so you get to know others quickly. Just as the UT, Demcon has an open door policy and colleagues are willing to help, so the working environment felt great.

Demcon Multiphysics

During this Internship, the possibilities of numerical modeling in capillary-driven flows in microfluidics are analysed. First the theory behind Microfluidics is discussed. Elaboration on terms such as Surface Tension, Contact angle and Capillary action is given. Furthermore, the important Dimensionless Numbers are discussed. These numbers are the Reynolds, Ohnesorge, Capillary, Weber and Courant Number.

I used the CFD program ANSYS Fluent to perform the numerical simulations on multiphase flows. The optimal settings within ANSYS Fluent are found by analysing four test cases. The four test cases are based on a water droplet placed within two plates. Within these test cases, the contact angle of the water is changed. I personally found the test cases realy helpfull to understand the flow behaviour and way of working with ANSYS Fluent.

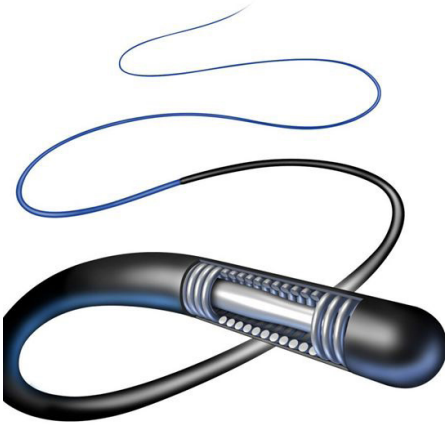
In a later stage, a comparison case was designed to find the accuracy of a CFD simulation by comparing the results with analytical solutions. This was done by comparing the rise of water inside a capillary tube with the Jurin's and Washburn equation. Within this comparison case, a mesh sensitivity analysis was performed as well. I found the comparison case to be quite fun, because it represents a situation which can be observed in real-life as well.



The final part of the Internship was to perform microfluidic simulations for a company named Micronit. Micronit provided a 2D geometry of a chip on which they are working on. The question from Micronit was: It is possible to perform complex 3D CFD simulations on this geometry and how large is the error found by these simulations? To answer this question, several simulations are performed and compared with a video which shows water flowing through the geometry in real-life. It was found that it is possible to obtain results that show quite a same flow behaviour as found in the video. The part were I was able to discuss my findings with Micronit was the most interesting for me. I experienced that the contact and discussions with a client was in much of my interest and I would like to have more projects / assignments were I could work further on these skills.

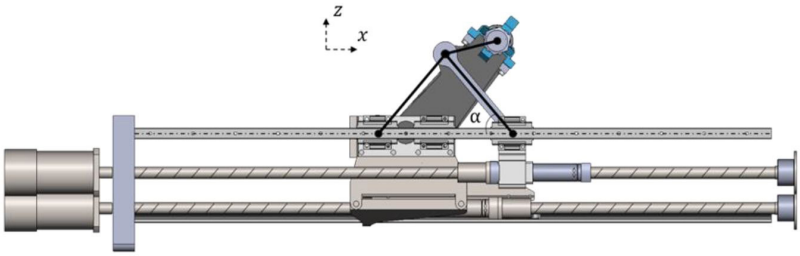
Demcon

During my internship I reviewed friction which occurs during endovascular operations between the guidewire and a blood vessel. The guidewire is made of a super flexible material called nitinol. Because of friction between the guidewire and the blood vessel, but also because of contact between different components of the guidewire itself, more forces are added in the system. Since nitinol is highly flexible, this causes for elongations, damages and a decrease in system accuracy. One of my tasks was to execute a research to see if these downsides could be used with the help of coatings. I started by researching into different type of coatings, and their additional effects. Secondly I finished a research around how to apply these different coatings, and what the advantages and disadvantages were of the different coating methods. At last I also executed a research into what additional advantages could be reached by applying a coating: For example making the guidewire a drug delivery device, or increasing its radiopaque so its better visible during operations. Overall I gained a lot of insights in the DEMCON way of working. I met many interesting people and it was fun to be part of a multidisciplinary team in the guidewire project. I learned a lot about the medical devices coating industry and learned that the way of executing research for a company, can differ from approach in comparison to executing research for a company. I would advice DEMCON as an internship provider!



Demcon

The Lambda mechanism is one of the components of the Lighthouse project started by ASML and the Institute of Radioelements (IRE). The Lambda mechanism is a high precision pick and place manipulator tasked with moving and sorting pellets of irradiated Molybdenum. One of the key features of the Lambda mechanism is the lack of sensors on the end-effector as a consequence of the target being radioactive. Due to the lack of sensors at the end-effector it was imperative to obtain system dynamics for the Lambda mechanism that were as accurate as possible. In order to realize this goal, a newly launched extension of Ansys known as Ansys Motion was explored. Several Ansys Motion and Simulink models were built to investigate the suitability of Ansys Motion for the modelling and analysis of the Lambda mechanism for large displacements and small deformations. Controllers were designed for the Lambda mechanism and were used to perform reference tracking for large displacements. The same controllers were used to perform system identification using 'Three Point Identification' with the aim of obtaining bode plots that represent the dynamics of the system. A simplified version of the Lambda mechanism was also built and all the bodies of the multibody system were made flexible. A step analysis was then performed on this simple Lambda mechanism with flexibility to excite the flexible eigenmodes of the system and analyze their effect on the motion of the Lambda mechanism.
I had a great time doing my internship at Demcon. My supervisor was very helpful and always made time to answer my questions and provide guidance whenever I needed it. The colleagues I sat with were also very welcoming and offered a helping hand whenever they saw that I might need one. I learnt a lot about working in a company along with other skills ranging from communicating effectively to making a good planning.



Dow

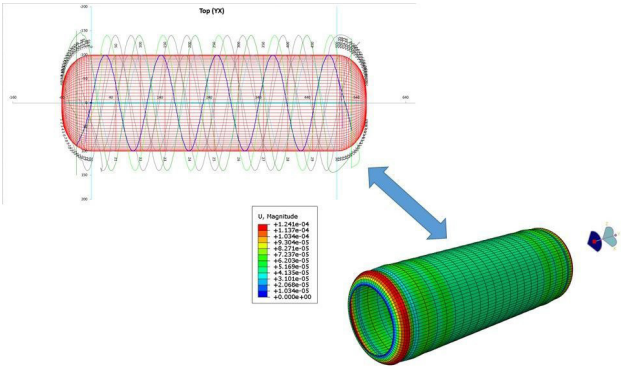
I conducted my internship at Dow Benelux B.V. which is located near Terneuzen, Zeeland. This site was developed in 1964 and continues to grow. The Terneuzen site hosts 3.550 out of the 35.700 global Dow employees, is the second largest Dow production site globally, and is considered the main operating center for the Europe, Middle East, Africa, and India (EMEAI) region. The Terneuzen site consists of 16 factories that can produce over 800 products, all varying forms of hydrocarbons, chemical intermediates, polyurethanes, and plastics. Dow's purpose is to deliver a sustainable future for the world through their materials science expertise and collaboration with their partners. Dow has ambitious goals related to sustainability and the health of the community.

The objective of my internship was to support the roll-out of an Electronic Safe Work Permit replacing a paper document. This new digital tool can reduce the time it takes to issue a safe work permit, thereby increasing the productivity of maintenance workforce. During this internship, I monitored the time to permit, which allowed me to identify improvement opportunities. In addition, I supported the operational team to define and implement solutions. These solutions were based on data analyses, which were statistically tested by using comparing groups. I linked the results of these analyses to field observations made during the actual Safe Work Permitting process.

During my internship I learned a lot about organizational process analysis and visualization techniques, such as Value Stream Mapping. I also applied new data analysis techniques that I never applied before and used new methods to test data, which I did in a software package I never used before. Furthermore, I experienced a completely new world, the world of contractors and maintenance workers. It was very revealing to analyze the Safe Work Permitting process from their perspective as well.
I really enjoyed my time at Dow, from day one I was fully included in the team. Within Dow there is an open and friendly company culture, people were always ready to help me or answer a question. From a scale from 1 to 10, I would give my internship experience a 10/10. I would totally recommend applying for an internship at Dow!

Fokker Aerostructures

Fokker Aerostructures is a company located in Hoogeveen, which designs, develops and manufactures components for the aerospace and defense industry. The Product Group Missiles of GKN Fokker focuses on the Engineering and Development of Defense application like subsonic and supersonic missile airframes and canisters/ launching tubes with mainly fiber reinforced thermoset materials. The Filament Winding process is the main automated production process for the composite missile airframes and canisters/launching tubes. For this process, Fokker developed their own Excel program FokkerWind in VBA to generate winding patterns and machine movements to wind products. During this internship, the task was to design an interface between FokkerWind and FEA in order to shorten the development (design, manufacturing and testing) time of a Filament Wound product. At the end of this internship, knowledge of FEA, VBA, Python and composite manufacturing was obtained. Overall, the project was fun and challenging. Colleagues were always available for questions and they would make time to help. In the image below, a result of the algorithm written during this internship is shown. In the top left, a winding path generated by FokkerWind can be seen and on the bottom right, the created FEA model of this winding path is shown.



HOOGEVEEN

Fokker Aerostructures

During the months of februari, march and may of 2021 I have completed my internship at GKN Fokker, location Hoogeveen. The goal of the internship assignment has been to analyze, perform, optimize and ratify the DSC testing procedure used at Fokker. This has been done by using the established DSC procedure used at Fokker and using it to investigate the influence of sample mass on the accuracy of DSC samples. Additionally I have participated in a company wide investigation into the consistency of DSC tests performed within the company and the knowledge accrued during my internship has resulted in recommendations regarding sample mass and calibration procedures. The feedback I have gotten from my external internship advisors has been very helpful for me. They are very positive about my performance and were happy to work with me. I am happy to have performed to their expectations and am now more confidant about future work relations.

Fugro

Digital Twin Modelling of Power Train System & Investigating The Use of Onshore Power Supply on Fugro's fleet

Digital approaches through digital twin simulations have been increasingly developed and used to cope with these challenges and offer new opportunities throughout the life cycle of a vessel within the marine industry. Digital twin enables a visual representation of physical assets under various operating conditions in a low-cost and zero-risk environment. This project aims to present the modeling and simulation activities on the complete Fugro-owned fleet's power generation system performed on the Simcenter Amesim platform, to understand and develop more efficient and environmentally vessel systems. In total, 16 out of 25 diesel-electric vessels base models were built, in which can provide a good start for future work in validating and simulating the models to good use. The second study was to investigate the technical feasibility of shore power connection on Fugro's existing fleet and to study the readiness of the market to provide on-shore power supply, mainly in the North Sea region. Shore power has the potential to reduce emissions associated with energy consumption while vessels are at berth. This investigation serves as a preliminary study, hence all sort of information may be useful for the implementation of shore power connection on Fugro's complete fleet in the future. Technical and potential emission reduction were validated at the end of this
study.

Gable Systems

Human Foot Tracking Using Vision And Deep Learning

This research aims to test different real-time segmentation algorithms for human feet segmentation and make a final algorithm for feet segmentation on the Gable CORE. To reach this goal multiple methods for real-time segmentation have been studied and tested. From these multiple methods the most promising method has been futher developed. The proposed algorithm of this research involves a combination of U2-net and YOLO. First YOLO is used to detect the human foot within the camera frame after which U2-net is used to mask the detected foot. If no foot is detected by YOLO, U2-net will not be used. The algorithm can perform at a speed of 15fps with an NVIDIA GeForce RTX GPU. From this research and the tests that have been done within this research, it can be concluded that the algorithm can detect the feet. However, YOLO is not able to detect the difference between two feet. For example, when the patient is standing in the Gable CORE and an extra foot also comes into the camera frame YOLO just detects two feet with a high confidence score and is not able to distinguish between the patient's foot and the extra foot. Furthermore, YOLO has also some trouble detecting the foot when it is not placed parallel with the robot but is rotated. This is mainly caused by the dataset that is used for training YOLO and U2-net. However, the results of this study shows a good first step is taken for real-time human feet segmentation for the Gable CORE.

GGM Gastro

GGM gastro is a German company, one of the Europe's largest suppliers of catering equipment. In GGM, devices are procured on a ready-to-sell basis from suppliers all over the world who create high-quality, low-cost devices. Over past few years, even though the company has seen tremendous growth in sales, the failures were also increasing proportionally. To counter this problem, the company formed a Quality department whose main focus was to reduce the failure rates and also prevent the present failures from happening in the future which in turn reduces the company's financial loses and also increases customer satisfaction.

During my Internship, I was part of Quality department. Working as an intern in the quality department of the company, the main goal of the assignment is to perform failure and risk analysis on the company's critical products and create maintenance reports for them which helps in increasing the quality of the product and improves customer satisfaction. I analysed a total of 100 products during my time at the company. I have analysed and reported many important products with suggestions and had discussion with the suppliers. The outcome of the assignment can only be determined in the future when the failure rate of the new product with implemented changes is compared to the current failure rate.

Groen Recycling

I had my internship at Agterberg B.V. which is situated in Groenekan near Utrecht. Agterberg is a commercial company divided in four separate branches that do all sorts of job in the public outdoor spaces in cities and villages. These jobs range from maintaining road infrastructure and de-icing in the winter to constructing public parks and building sports accommodations. I worked at the Groen Recycling Utrecht(GRU) branch situated, as the name says in Utrecht. This branch focuses on taking in Lignocellulosic biomass waste and transforming it in useful product that are required for the environmentally friendly construction projects. To make this transformation happen they have a large composting pile, between 8.000 and 12.000 m^3 in which aerobic assimilation transforms the biomass into compost. This process is an exothermic process which heats up the composting pile to a maximum temperature of about 60 to 65\celsius. Currently all this energy in the form of heat is lost to the environment and is not used. My assignment was to investigate whether this energy could be collected and how it could be used. To achieve this task I first investigated which options there were for extracting the energy out of a composting pile. From these concepts the best was chosen. With the concept known a heat transfer model could be constructed in Ansys which provided an insight in the amount of energy that could be extracted. Finally with the in mind it could be evaluated if this whole process was financially feasible for the GRU. What I liked especially about my internship is the amount of practical and hands on work that had to be done. I myself had to gather temperature data and we had to move countless tonnes of compost for my research to be successful. This made me feel very involved in the company and that I was truly contributing to the company.

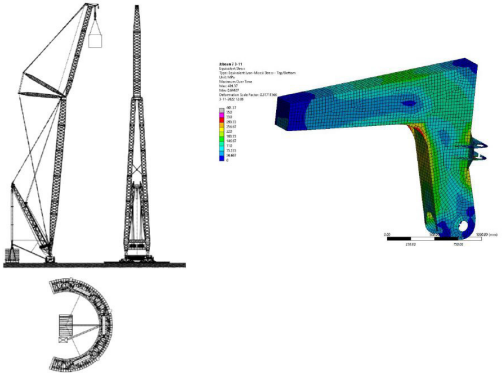
HoSt

HoSt biogas is a company that provides total solutions for bio-energy systems. HoSt biogas focusses on installations that use fermentation of biomass to produce biogas. HoSt has a couple of methods with which they track the total production of biogass in all of their installations and they monitor a lot of different parameters to see if the fermentation process has the optimal performance conditions. Currently HoSt has a biogas production model that is used to predict the production of biogas from their installations. This model is currently based on a steady state model, which means a steady input of bio material over time, but this is not always the case. Especially in the start up phase of the installations. The fermentation process needs some time to reach full operating conditions. The dynamic model that I developed during my internship can give an accurate prediction of the total biogas produced with an unsteady input flow of biomass.

ENSCHEDE

Huisman Equipment

Huisman is a frontrunner in the engineering and production of offshore as well as onshore machinery such as cranes, drilling equipment and pipe laying systems. During the internship the student was part of an engineering team. The team consisted of 6 members, including the student, and involved more structural focused engineers as well as more design focused engineers. The engineering team is responsible for designing and analyzing mechanical components used for several products of Huisman. The student was involved in the development of several parts for a crane that will be used for the installation of windmills. A full design process was walked through starting with the concept phase in which several sketches were made and ending with a technical drawing in which every detail is dimensioned. During the different design phases use was made of different CAD programs such as AutoCAD and Inventor for 2D and 3D drawings. Besides designing, the student was also involved with structural analyses including manual calculations and making FEM models. In addition, practical knowledge about different manufacturing processes such as welding, cutting and 3D printing was acquired. The support throughout the internship was sufficient while maintaining a high level of freedom in the different design decisions that could be made. Overall, a very pleasant working atmosphere was perceived at Huisman and is therefore highly recommended.



Hulst Innovation

The assignment for the internship at Hulst Innovation was to design a new tower for an existing wind turbine. The company already sells wind turbines from the company Solid Wind Power, but more request arrived to build a wind mill at large height, this could not be supplied by Solid and is therefore decided to design one in house. The goal was to optimize a truss structure to minimize the weight of the tower and therefore also minimize the material cost. The optimization was performed with MATLAB and a Finite Element script. Once an optimum design was found, an fatigue and dynamic analysis were done to prove if the design was suitable. The final design was further detailed and drawn in Autodesk Inventor.

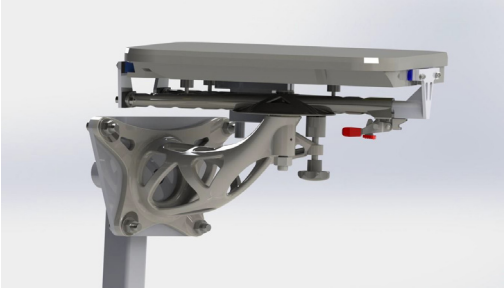
NS

The Dutch railway company NS (Nederlandse Spoorwegen) has about 770 train sets, which they use to transport about 1.3 million travelers per day. Cleaning the outside of the trains can be a big challenge, the trains should be cleaned every 6 to 12 days which is often not achieved. Currently a lot of the trains in the NS fleet are dirty, to improve the cleanliness of trains a project is started to redesign the external cleaning process: HURT (Herontwerp Uitwendige Reiniging Treinen). In this project all options to improve or redesign the external cleaning process are considered and tested. A part of this project is the option to coat the trains, where suppliers have been selected to test this concept. The goal of this test is to investigate if it is possible to extend the cleaning period of trains to 12 weeks. In my internship I wrote the research plan on how the test with coatings should be executed in order to get the desired result: the pollution pattern of a train over time with and without a coating. My internship at NS was a very positive and nice experience, the project team was very welcoming and helpful. I would recommend anyone to do an internship at NS, but it could be challenging for international students since the communication language is Dutch.

NTS Norma

During my internship with NTS Norma in Hengelo I was tasked to design a tool that can be used for powder extraction of residual powder in the process of Selective Laser Melting (SLM). The main aim of this report is to answer to following research question:" What are feasible options for powder removal of metal powder in Selective Laser Melted products and how can it be applied?"

During the printing process of metal parts with SLM, metal powder can remain in internal structures of the printed part. An example of these internal structures can be cooling channels. This powder needs to be removed before the part can go to the next step in the production process. This powder is currently removed by tapping, with a hammer, on the plate on which the parts are printed. This is labour-intensive process and not all the powder is removed. A study showed that only 27% of the powder is removed using this technique. Furthermore, metal powder can be harmful to the health of the operator.



During the internship, a tool is developed for the powder removal using a pneumatic vibrator. This tool is designed using the aid of topological optimization and generative design. The main parts of the tool is made from 3D printed stainless steel. The tool is assembled and evaluated during the internship. However, there was not enough time to properly test the tool and determine its effectiveness. This can be determined during future studies. Also, there are optimizations that can be made to the tool since this is only a test tool. Finally, there are recommendations made to further improve the production process in terms of further reducing labour time and increasing efficiency.

Oceans of Energy

Oceans of Energy is the world leader in development of offshore solar energy and is currently located in Katwijk, near Leiden. In 2020, their first offshore solar farm was deployed, and by the end of 2022 they aim to have a 1MW solar farm installed on the North Sea, where waves can reach over 10 meters in height – a very challenging environment for testing their product. During the internship, focus was laid primarily on hydrodynamic analysis of the floating system. The internship involved learning offshore hydromechanics theory, applying this to analytical calculations of real wave-slamming problems, and doing hydrodynamic modelling and result interpretation of the actual farm. In addition, various structural designs were made, which were also manufactured and are now part of the offshore solar farm. Apart from the analysis and design tasks, some hours were also spent in construction and helping in deployment of the solar farm, which is a very nice experience for the typical mechanical engineer. During the internship, I was involved in various projects and brainstorms, and got handed tasks that allowed me to have a really large impact within the company. The atmosphere in the office can be described best as a perfect balance between hard work whilst maintaining an open-minded, relaxed environment in which you are encouraged to fire ideas and articulate what is on your mind. In addition to tasks that were assigned to me by the company, there was always room for bringing in ideas of your own and working on those. The company employs a lot of very talented, young people and a substantial amount of interns and people doing their graduation. Consequently, Friday afternoon drinks and other social activities were great for bonding and really enjoyable.

If you are interested in doing your internship at Oceans of Energy, have a look at their website:
https://oceansofenergy.blue/team

Parthian Technology

Parthian Technology aims at creating value for society and organizations, entrepreneurs and individuals in different markets by creating innovative polymers and composites, using the high potential of composites (fibre reinforced plastics) and other materials to add functionalities to these materials. Parthian has excellent knowledge and experience in material science and chemistry, though they preferably work together with partners, to combine their technology with applications and markets (application based research & development). The internship assignment consisted in continuing an on going project at Parthian alongside one of their customers who produce foam core sandwich structures for the construction industry. The customer wants to reduce CO2 production emissions by using an alternative method such as microwave and radio frequency technology. The main goal was to write and carry out a test protocol for foaming polymers using radio frequency technology. As well as finding an alternative biobased material for the same application, broadening knowledge in the composite field. The company works alongside Thales NL as well, having the opportunity of working with experts in the subject and involvement with material suppliers. Parthian, although a small consultant company, allows the intern to collaborate with their customers and the liberty to propose new ideas and directions in how to tackle a project. If you want to get a grasp of materials science, Parthian Technology is the correct place. Having the opportunity of research in composite and biobased materials as well as direct application in the field, whether it is in the construction industry or other end applications. Parthian is also a company that will let you expand your networking and communication skills with potential and/or current partners.

Parthian
composite excellence

PCV Group

PCV Group, also known as People Creating Value is a product development and consultancy company. Their head office is located in the Van Heek villa in the centre of Enschede. They do engineering and development in a range of high tech fields, such as medical, industrial, but also consumer products. Their expertise mainly lies with dispensing and dosing, embedded systems, product development and mechatronics. The internship consisted of contributions toward a couple projects, such as reliability testing of small membrane pumps, medical product testing and contributions to development of a stable foam dispenser without the use of propellant gas. This involved CAD sketching, Arduino programming, testing and reporting. It allowed me to see many of their projects and get a good view of the work involved in the product development industry.

Quooker

Quooker sells tapsystems that deliver instant boiling, sparkling, cooled and filtered water. At their facilities in Ridderkerk, they design, test, and manufacture their products. This internship was carried out for Quooker's quality team, and the objective was to optimize the water pressure inside the Quooker 3L bellows boiler. The bellows boiler is an innovative product, designed to reduce the rise in water pressure that occurs when the water is heated. The design is not optimal yet, hence this assignment. Using Python, the design was optimized for three different situations. First is a situation in which only the machine settings can be changed, providing the opportunity to test the solution with various samples. Second is a design that will fit inside the shell that is used for insulation around the bellows, so changes to the production process are limited. Thirdly, the design parameters were found that will bring the water pressure down to a desired value. The results of the first optimization were tested using Quooker's test facilities. The other two optimizations were used to give insight in the design directions and to determine what the options are to get to the desired pressure.

Royal HaskoningDHV

Royal HaskoningDHV advises and helps municipalities and industries in their strategic planning and project development within the energy transition. One of their activities is to conceptualize feasibility studies of collective heating systems in the built environment. GIS-tools and Excel models are used to produce and combine the technical and financial parameters required to set up a business case for the project. The business case model calculates the required energy infrastructure, performance and cashflow analysis and is able to compare various scenarios and system configurations. The assignment aimed to improve the existing model and extend it with various points of developments that touched upon the fields of energy conversion technology, thermal storage, energy infrastructure and business case analysis. Functionalities that have been implemented include solar thermal and PVT calculations, aquifer and water tank storage, and a new cost-pricing method for the project owner. My experience with Royal HaskoningDHV has been great. I joined a multidisciplinary team of engineers who work on projects within both the built environment and industry. This allowed me to get a good picture of how various fields within the energy transition are translated into practice. It has been a great learning experience and it is nice to know that my model will now be used in the workplace.

RWE Generation

Capacity to improve the system

As part of the master Sustainable Energy Technology, I conducted an internship at the Battery Technology department of RWE, a multi-national energy company. This department is involved in the project development of gird-scale energy storage systems from the initial idea up until the construction of the project. During my time in the company, I worked on the ongoing projects as well as streamlining the project development process. This included modelling the price outlook for various types of batteries based on commodity prices, scouting new technologies and creating a tool to assess upcoming energy storage technologies in an efficient manner, and creating business models for battery energy storage systems based on income generated from arbitrage, peak shaving and demand shifting. In my experience, RWE proved to be an openminded company with a lot of friendly and helpful people and a serious drive for sustainable change.

Strukton Rail

My internship took place at the team Shortline within Strukton Rail. Shortline owns, maintains and inspects railway tracks placed on private company ground. They are a very open and welcoming team of eight. I could work from home or at the office, it was up to me. They encouraged me to visit building sites where their workers were performing maintenance to get a feel for the work and machinery that comes into play when building a railway. I also got to visit a railway maintenance exhibition in Germany with my supervisor.

A bit of back story to my assignment, in times of economic recession, materials are more expensive and thus less goods are moved via railways. Couriers have to park their unused carriages somewhere; this is onto sidings. These sidings are becoming more expensive to use as ProRail is taking them down but also when demand for sidings rises during recessions. Someone within Strukton had the idea for so-called pop-up sidings. A siding that is temporary placed on an empty plot of land at for instance a harbour. With a temporary rail connection, the carriages are shunted of the main track onto the pop-up railway.

My assignment was to come up with a design for the pop-up railway and switch. There did already exists some temporary switches aboard and for lightrail applications, but these were not quite what Strukton was looking for. So, I designed a number of concepts for both the pop-up switch and railway. Selected one for both the pop-up switch and railway and developed them into fully functioning concepts. I had a great time doing so, spoke to a number of people inside and outside of the organisation and got to experience what it would be like to work as an innovation engineer at Strukton Rail.

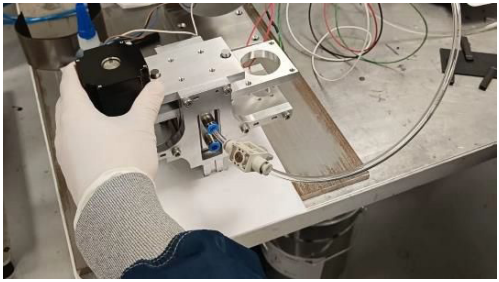
Sweco

I have conducted my internship at the engineering consultancy firm Sweco. I have done this at the team “energie opwek en warmtenetten”. Sweco is an international engineering consultancy company that is acting as a consultant in, amongst other topics, the development of green hydrogen factories. In the past two years they have guided several companies with feasibility studies, engineering and permit & subsidy consultancy towards permit request. The first of these permits have been granted, which means that phase two of these projects can be initiated. However, many new projects towards permit requests are coming in. The production, processing and storing of hydrogen is a new development, so these projects are very non-standard. I have been given the opportunity to conduct a large amount of technical and non technical activities at Sweco and enjoyed my time very much.

Tecnotion

Tecnotion makes direct drive electromotors. They have also developed their own OEM line of products, but also make customer specific motors for in example ASML. During my internship at Tecnotion I was placed in the process engineering division of the company. This division governs the production of OEM-products. My assignment was to create an automated production process for the production plant in China. This was quite a challenge as the process did not take place at the location in Almelo. This required interviews with colleagues in China and other ways to determine the requirements of the process that had to be automated. At Tecnotion I got the chance to develop myself in multiple aspects. I learnt a lot about electro magnetism, industrial robotics ,automation and product development. I was able to make and test a physical prototype of my own design, for the automation of the process. This really created the value for me in my internship. As building a physical prototype requires a lot more consideration than the conceptual design that is mostly done at university. All in all it has been a good experience where I felt a lot of support of helpful colleagues.

The pictures below show the testing process of my prototype and myself doing the testing.



Tesla

As a Sustainable Energy Technology student, I dedicated my internship in working on the goal to speed up the transition from internal combustion engine vehicles to fully sustainable electric vehicles at Tesla Amsterdam. My role in the Charging Department, as a Deployment manager. My main assignment was to create SLDs (Single line diagrams) in AutoCAD for the construction of new Supercharger locations (the charging network for electric vehicles build by Tesla). The single line diagrams are industry specific drawings that present the technical specifications and the connections between different components of an electrical circuit. The assignment required research about the grid connection and transmission lines, understanding the technology behind Tesla's Electric Vehicle charging stations and learning how to use new software such as Autodesk AutoCAD. As a side assignment, I had a support role for the team. I have been travelling to new Supercharger construction zones and had dialogues with the construction companies, I did research for the possible network development locations and I have kept correspondence with business partners. The Internship lasted for 6 months and it was based in Amsterdam, Netherlands.

The Investors Company

The Inventors Company is a product development company in Eindhoven. They develop a variety of products for various markets. The company has a well-structured organization in which bi-weekly sprint meetings are held. Furthermore, daily stand-ups are held in which the teams discuss their Objectives and Key Results (OKR's).

The assignment focused on improving the design of a product using CAD software. Various additive manufacturing printers were available to print and test the designed parts. This included FDM printers which were available on site, as well as SLA, SLS and MJF printers which were available through an external company. The assignment allowed the student to apply previously acquired 3D printing knowledge and gain experience with the additive manufacturing process.

The student was given the freedom to come up with innovative design solutions. The relatively small scale of the company and the fact that the entire development process was done within the company, allowed the student to learn about all the phases of the product development process.

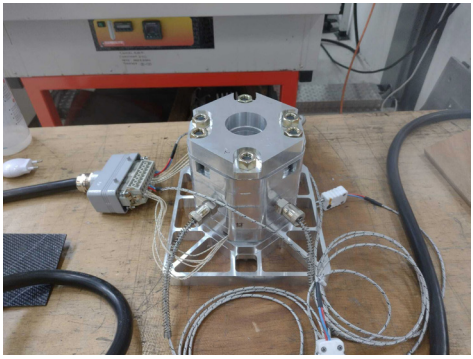
Another aspect of the internship was contacting external companies. This was both to discuss the designs that had to be printed as well as to order off the shelf parts. The student was given a good amount of responsibility and was challenged to find the most suitable design solutions.

TNO

During the period of February until July of 2022 I signed up for an internship at the company TNO's Eindhoven branch. This internship involved contributing to the research concerning the EZRA project, where the end-goal was to design a switch-reflective facade panel able to change optics through an electrical signal. The first part of the internship was getting to know my role as an intern within both the company and the project in question. I had a tour around the laboratories (with the required lab-safety test) and settled in at a designated area where the other interns worked on their respective projects. I worked Monday until Thursday from 9:00 until 16:30 and worked from home on Fridays. In between work, I would have lunch at 12:00 together with the other interns where we could take a breather from report-writing or working in the lab. The High Tech Campus, on which the TNO was located, was a great area to go on short walks to clear my head and it even had a small collection of restaurants and food trucks that I would regularly visit during lunch-time. The first part of my internship-process was spent on literature research, where I would study previous reports concerning the EZRA project and read up on the subject matter. After getting familiar with the content, I would present my current findings to my supervisor (and others). This was done to discuss my progress and receive feedback on how I should work in the future. This included my final presentation at the end of the internship where I fully summarized my work and relayed that to TNO and their partner companies. It was a new experience to be part of a company and I have learned much from working in an environment where your project is part of a larger scale than your average university course-project.

TPRC

At TPRC I worked on a production method for hollow thermoplastic composite parts. At the start of the internship, I had to read a lot of papers to get familiar with the subject, but I also started working on more practical tasks from the start. This was a very enjoyable experience, because I got to apply theoretical knowledge I learned in the first week immediately in practice and it varied the work I had to do. To test the new production method, I had to come up with tests, carry them out and interpret the results. I got a lot of freedom in what I wanted to do, which was enjoyable, because it challenged me to tackle the problems the way I thought was best. Because the assignment was for a customer of TPRC, I had to make presentations to inform the customer and have discussions with the customer and my supervisor. Based on these discussions, further steps in the process were determined. The results of the initial phase of the project meant that I had to design a new mould to process the composites. I used SolidWorks for thermal simulations for the design process, which was a nice new skill to learn. After designing the mould, the parts were CNC-milled at TPRC and I had to assemble and test the new mould. TPRC is a great place to combine theory and practice, because of all the machines they have available for testing and manufacturing composites. This experience was very enjoyable, because I got to manufacture a lot of parts, which is a very useful skill. I also got to use new materials and machines, that I had not used before during my study.



TPRC

During this internship at TPRC, I took on two related assignments. The first part involved the designing of a press forming tool and the induction welding of L-profile ribs to flat plates. During the design phase, numerous aspects were considered, such as; the expansion of the tool relative to the mounting plates for the press, and the thermal warpage experienced by the part after the forming process. Detailed technical drawings of the tool were made so that a third party could manufacture and deliver them to TPRC. The induction welder at TPRC was then used to weld test assemblies.

During the six-week delivery time of the designed tooling, another assignment was started, concerning the characterisation of the specific heat capacity of C/PEEK using Differential Scanning Calorimetry (DSC). This study was aimed at reducing the spread in specific heat capacity data by varying sample preparation methods. Different sample types and preparation methods were tested. The results of this work can be used to help build realistic simulations which are capable of modeling the thermal behavior of materials during the initial heating stage experienced during induction welding.

I very much enjoyed my time at TPRC. The people are friendly and very helpful if you have questions about your assignment or composites in general. They also give you actual responsibility, which can be intimidating but does facilitate learning. For example, I was responsible for making the technical drawings of the tool which they had delivered; and you also get to use actual machines (depending on your assignment).

TPRC

During DCB testing of co-consolidated Titanium C-PEKK samples, an influence of surface roughness of the titanium on the path of crack propagation was observed. When the roughness in tested samples exceeded specific parameters, the crack propagation deflected away from the interface between the titanium and PEKK and caused residual of C/PEKK to remain on the surface, such as in Figure 1. The crack defelction is hypohtisesd to be caused by stress intensifications in the polymer at surface irregularities in the titanium. This study has implemented a finite element model (FEM) to perform a parametric study of the influence of surface roughness parameters and the stress concentrations. The surface texture was represented with a sine curve. The aim was to observe stress intensification around the crack tip with an increase in surface roughness, so as to confirm the previously mentioned hypothesis. The implemented FEM makes use of a cohesive zone model (CZM), to model the fracture mechanics of the interface. The roughness in the model has been implemented with the use of two specific parameters, H as the height between the peaks and valleys of the sinusoid and λ as a wavelength parameter, both parameters can be altered to represent different surface roughness characteristics of the titanium. Two sets of parametric studies were conducted with this model, one with a constant H and varying λ and one the other way around.

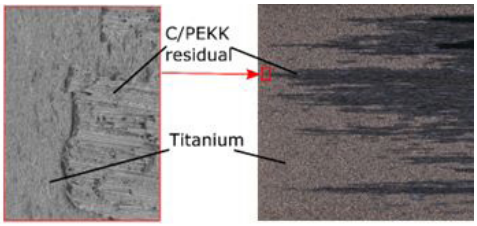
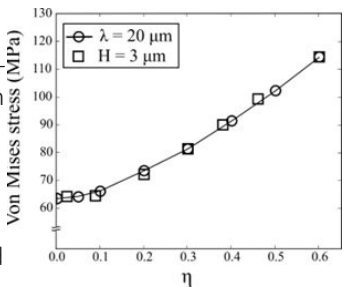


Figure 1: Surface morphology at the interface of a DCB tested titanium C/PEKK sample with crack deflection, causing delamination

The two parametric studies performed for the two different parameters could be captured in one figure by the non-dimensional aspect ratio parameter η. This combined figure shows a clear relation between the maximal observed Von Misses stress near the interface in the PEKK and this aspect ratio parameter η for both the individual parametric studies of amplitude and wavelength of the sinusoid.

Concluding, the parametric study of the roughness parameters at the interface between titanium and PEKK, confirms the increase of stress with the increase in roughness at the interface. This leads the von Mises stresses to locally exceed the yield stress of the PEKK, which would support the theory of crack deflection based on stress concentrations caused by the surface roughness of the titanium. Which would in turn explain the delamination experienced during DCB testing samples with specific roughness parameters.



TPRC

The Thermoplastic Composites Research Centre (TPRC) is a research centre in the Netherlands, whose goal is to enable a more widespread use of thermoplastic composites through joint research and development. At TPRC they are involved in the exploration of what is possible with the latest technologies of thermoplastic composite manufacturing.

The internship was a feasibility study regarding the manufacturing of complex parts using the Coriolis C1 system, an advanced fibre placement machine. The project entitled the characterization of different tape materials and the optimization of the placement process. The internship was primarily hands on experimental work. TPRC has an amazing working environment full of incredible engineers. The atmosphere makes one feel like part of the team. The trust they put on young engineers gives one encouragement to perform to the best of their abilities.

Transavia

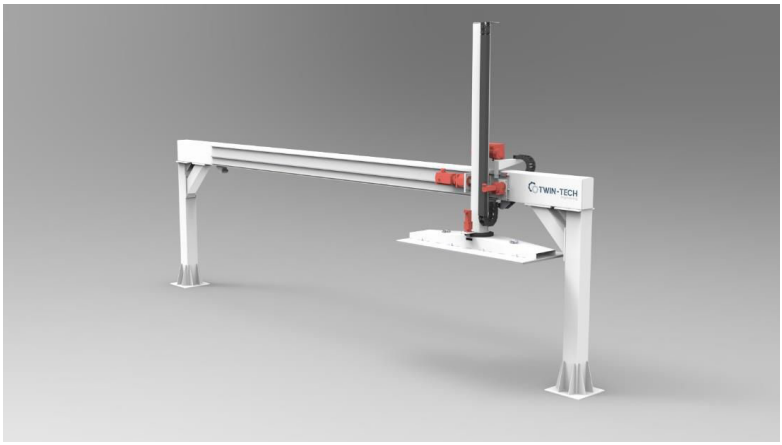
Implementation of Predictive Maintenance

Transavia is the largest low-cost operator in the Netherlands with bases at Schiphol, Eindhoven, Rotterdam and Brussel. Founded more than 50 years ago and has currently more than 40 aircraft serving over 100 destination. The goal of the internship was to investigate the implementation of predictive maintenance at Transavia. The goal with predictive maintenance is to predict when a certain part is going to fail and replace this part just before it has failed based on (historical) data. This reduces unexpected failures and will therefore, among other things, increase the availability and lower maintenance costs. During the internship I focused on the requirements needed to implement this policy and all the side effects it will have on the entire company. As aviation enthusiast it was a very exciting internship. The Engineering teams at Transavia were very welcoming and always willing to help!

Twin-Tech Engineering

During the internship at Twin-Tech Engineering a robot gantry had to be developed. Twin-Tech Engineering is a production line engineering company. The company designs machines mainly for the prefab industry but also has clients in all other industries. The company is relatively small with around 8 full-time employees and 5 part time employees. Due to this it is a very casual working environment where everyone is involved.

For the internship, a potential client requested a robot gantry for its laser cutting operations. This robot gantry needed to lift large sheets of polymer onto a laser cutting bed and remove it afterwards. To do so a vacuum gripper was required. For the project, the whole design process was walked through. The assignment combined design principles, fluid mechanics and statics/mechanics. First, the needs of the client were discussed and set into requirements after which the concepts were made and chosen. After this the detailed engineering started starting from the vacuum gripper after which the frame was designed. Finally, the design was checked over for producibility and ease of assembly. Because Twin-Tech Engineering is a small company the student was also involved in various other ongoing projects with tasks ranging from cycle time calculation to assembly of machines.



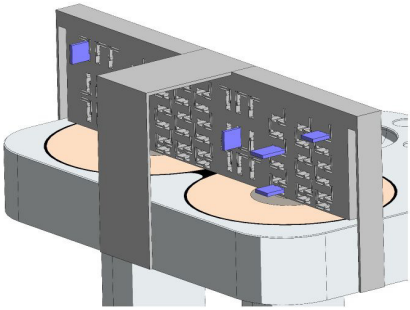
VDL

VDL Enabling Technologies Group is currently developing an experimental setup for superconductive coils in high vacuum and cryogenic temperatures. Among many other variables, the magnetic field intensity and shape of the field must be measured and compared to the theoretical model in order to validate the predicted behavior and continue the development into a practical application.

As part of this project, my internship assignment consisted in developing a metrology frame to hold Halls sensors at accurate locations inside the magnetic field during the tests.

The main challenges of the assignment were the small size of the sensors to be held and the constraint that all components should be mounted at room temperature and have an accurate position after cooling down to 20 Kelvin without creating excessive stress on the sensors.

My solution to this problem consisted in the use of flexural features absorb the deformation from thermal contraction without damaging the sensor packaging while having a deterministic behavior.
The flexural features were used in two different metroframe concepts that satisfy the requirements and may be used in different tests. The design was discussed with suppliers to ensure the manufacturability of the metroframes.

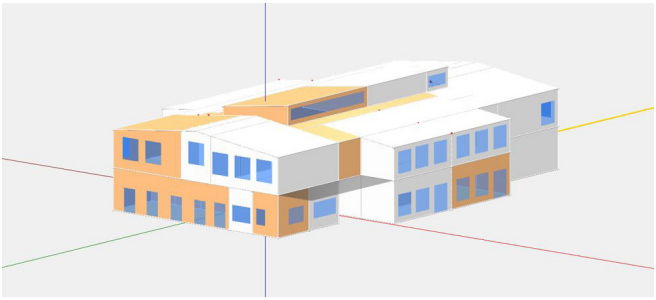


Vintis

As the name suggests, Vintis provides advice about installation equipment. The main projects are focused on schools and other buildings such as residential apartments. These buildings all require proper and justifiable choices to regulate, for example, the comfort temperature. Since my specialisation, Energy and Flow, also focuses on these topics it was great to work with several real world examples where 'energy and flow' play an important role. During my internship I have mainly learned to work with Vabi Elements and gained experience with several other aspects that came along such as material choice and building design.

Thermal energy storage (TES) is important in the building and installation industry because energy demand and supply often do not match. During the night a lot of cold is available to cool a building, however, cold is only required during school or office hours. This discrepancy can be filled with phase change material (PCM). As its term states, phase change material changes phase during, for room temperatures, change over from solid to liquid. This phenomenon takes a considerable amount of energy, e.g. 1 kg of PCM requires about 200 kJ to change from complete solid to complete liquid.

To enable usage within the building and installation industry, it is important that PCM gets recognized by officially licensed programs that use Dutch norms. Currently, it is not possible to model PCM within Vabi Elements. Vabi is a software that uses dynamic simulation to predict whether a building can succeed or fail for specific temperature comfort levels. PCM is a promising technique to improve the energy demands of several buildings. Schools and offices are well suited for this technique, due to their low occupancy during the night, the ventilation can be increased considerably above normal levels. These buildings need to be modelled in Vabi, a building climate research tool. Within Vabi it is not possible to input PCM in a calculation. Therefore, my research focussed finding ways to implement PCM in the current state of the program for a school building.



Wärtsilä

The Wärtsilä division in Drunen is focused on creating innovative solutions for propulsion systems of inland shipping vessels. One of these recent innovations is the creation of container sized battery packs that can be used to power such vessels. The goal is to eliminate the emissions that these ships produce and thus reduce climate change. The current containers are close to having the maximum allowable gross mass for a standard shipping container. Next to this the containers are also costly to produce. With these two factors in mind, it was my task to create a redesign for the base structure of the container. This was done by first analysing the current design using FEM. The next step was to create several concepts based on the analysing. And finally, working out the best concept into the redesign. I had a great time at Wärtsilä and it was a pleasure to work there!

WASTE

I completed an 11-week internship at WASTE, a NGO that works on waste management in developing countries. It works on Faecal Sludge Management (FSM) and Solid Waste Management (SWM). For the FSM part they install and improve infrastructure for sanitation by for example installing septic tank systems or they work on faecal sludge treatment facilities that produce biogas or compost. The SWM is mostly about household waste; The collection but also processing of the waste.

Personally I followed many courses on plastic so my assignment was to design a product to be made from low-value plastics, specifically from multi-layer plastic packaging. First I investigated what would be a suitable product and I ended up designing a waste bin. I also determined the production process so I selected machinery (shredder, extruder, hydraulic press, etc.) and came up with a formulation of different polymers and additives to make the product from. Next to this I designed the product in Solid Works and made a prototype. In the end I worked out a financial study to see if it would financially be possible to create the product. At this point it is looking like the waste bin will actually be taken into production.

WASTE is not a company with many (mechanical) engineers so you quickly become a 'technical expert'. People are friendly and everyone is very approachable. There are also many international partners and colleagues in the field, with which I had regular contact. If you are interested in seeing what it is like to work in an environment with people from different disciplines and if you like to have a direct impact on real problems, then WASTE might be an interesting internship address.

Witteveen+Bos

The work at Witteveen+Bos is all about knowledge, such that together with all colleagues the right expertise is gathered to solve challenges in a sustainable manner. The internship was done in the electrical and process automation group. Due to climate change, more renewable energy sources are being implemented, which results in the design and construction of new high voltage grids. There are two main types of high voltage grids, alternating current (HVAC) and direct current (HVDC). Currently HVAC is the commonly used and only for interconnectors to other countries has HVDC been used in the Netherlands, however there are new plans to implement more HVDC connections. The goal was to investigate why and when it would be beneficial to use HVDC and which technologies are available to implement such a system. Case studies have been performed in order to compare the design choices for the transmission system for offshore wind parks in the North Sea, specifically Hollandse Kust and Ijmuiden Ver. The ambience in Witteveen+Bos is very good, with friendly people who are always willing to answer questions. The office is a great place to work and focus, with a good amount of coffee breaks and lunch walks in between, moreover free fruit and hot chocolate is also provided. The guidance was very good and I would recommend everyone to go and take a look, as they have a lot of different projects in different fields and are very open to your own suggestions and whichever path you would like to pursue.