



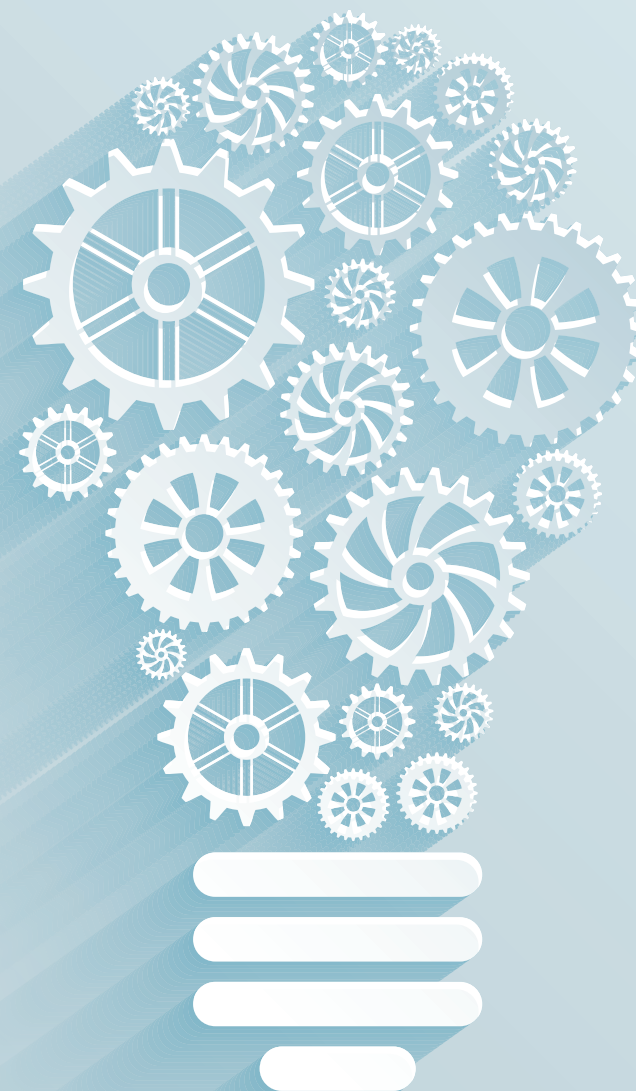
Student Projects Catalogue 2021-22

Student Projects catalogue



2021

2022



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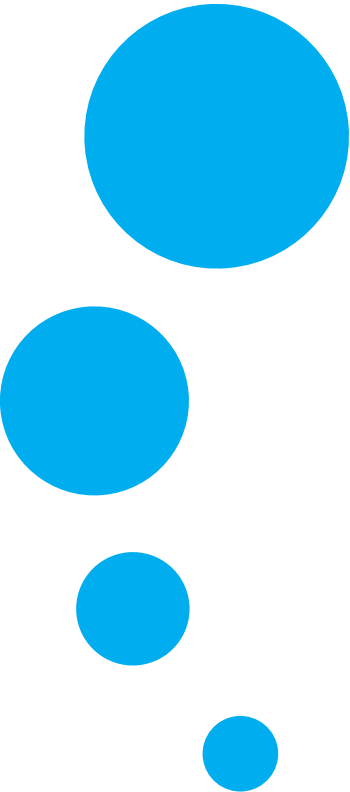
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Message from the Director

One essential element of the activities of any engineering school is the maintenance of partnerships with businesses and institutions in the local community and beyond. Thanks to its close ties to such organizations, Polytech Orléans can guarantee the employability of its graduates (of which 90% find a first job within three months of receiving their degree), accurately adapt its programmes to respond to the changing needs of the business and scientific community, and acquire the most up-to-date equipment, materials and software.

Our partners also benefit from these exchanges by receiving high-level scientific expertise as they welcome hundreds of our students in internships each year and avail themselves of the educational facilities and equipment we can provide.

To prepare for their entry into the professional world, fifth-year students at Polytech Orléans are required to prepare and complete a project according to the specifications established by an engineer working in the field. For Polytech, these projects validate the body of technical and managerial competencies acquired by students during their years in our programme. For our industrial partners, the students’ projects permit them to test systems, confirm new ideas, and create prototypes, among other valuable research outcomes.

Publishing a yearbook that brings together in one volume the overviews of all fifth-year industrial projects is a concrete way of presenting the entirety of the fields of activity in which graduate engineers of Polytech Orléans will work. It is also a way for our business partners to evaluate the assistance which Polytech can bring to them. Our ambition is to highlight the achievements realized in collaboration with businesses and institutions and to encourage development of new industrial partnerships.

Regine Weber-Rozenbaum,
Provisional Administrator Polytech Orléans



Civil **Engineering**



Adaptation of the sewerage network in Colombes (92) due to the extension of the tramline

Civil engineering



Company/institution : SADE Travaux Spéciaux

Helena CARMONA GONCALVES

Academic supervisor : Christian DEFARGE
Industrial supervisor : Rémi SUBRA



OBJECTIVE/MOTIVATION

In order to maximize my knowledge in engineering and develop my career in this area, during my 5th year of studies, I've joined the company "SADE Travaux Spéciaux" whose major competences include underground works, civil engineering, pipelines construction and rehabilitation. Furthermore, I could be involved in the project of adaptation of the sewerage network in the city of Colombes attached to the Hauts-de-Seine (92) department, which is the project owner. The aim of the project was to adapt, divert and rehabilitate the wastewater and stormwater pipelines interfering below the T1 tramline. While acting in construction

site management alongside with certain roles of a construction engineer, I could enhance some skills as leadership, group work, resolution of documents procedures, construction planning, among others.

RESULTS

My period on this construction site lasted 7 months from June to December 2021 acting as a construction site manager. My duties included conducting daily tours in order to write the reports; verify the safety measures and ensure the proper execution of works; contact the material suppliers; manage the teams and lead weekly presentation sessions of safety procedures in 15 minutes. Moreover, as an engineer, I conceived some documents related to the end of the construction, such as feedbacks and price analysis, the attestation of work completion and the final document of the executed structures. As a result, my period acting among the engineers and the construction workers made it a complete experience in a French civil engineering company and as an international student I could experience an immersive experience in a cultural and professional way.

KEYWORDS :
sewerage network, sanitation, wastewater, stormwater, rehabilitation, adaptation.



Gallery opening and support with wooden planches



Placement of ovoid concrete elements



Installation of reinforcements



Tunneling machine

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Analysis of deformations on reinforced concrete structures to take in consideration the specific constraints of fragile elements

Civil engineering



Company/institution : EBI, group Egis

Oussama ABOUMAJD

Academic supervisor : Naïma BELAYACHI
Industrial supervisor : Némèse RAHARONDRA



OBJECTIVE/MOTIVATION

During my year in a professionalization contract with the structural design office, EBI Orléans. I had the opportunity to work on one of the most common issues in modern construction projects, the limitation of harmful deflections.

Until now, there are no rules and DTU that treat this issue. Moreover, the Eurocode 2 doesn't mention how to determine the harmful deflections from short-term loads and long-term loads, but it defines a method by interpolation between the non-cracked state and the fully cracked state. This method is imprecise because it does not take into consideration the cycle of the loading and we cannot solve the problem by using the counter deflection. The professional recommendations have a more precise method that follows the cycle of the loading.

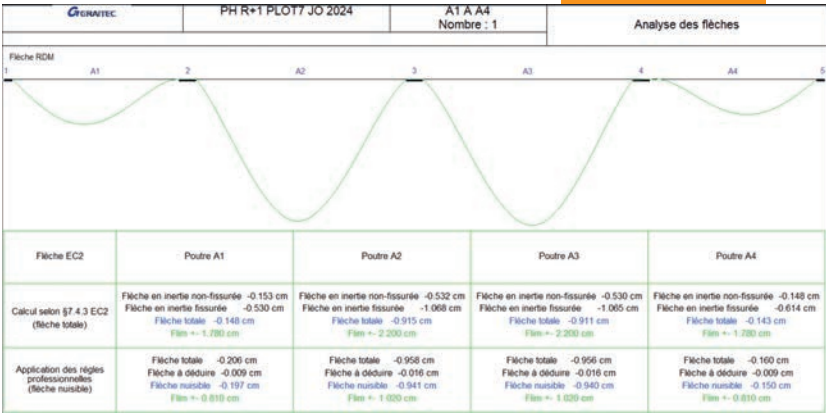
RESULTS

When we design the structures affected by these deformations, we have to make a difference between the total deflection according to Eurocode 2 and the total deflection according to professional recommendations, which is more unfavorable.

To design a structure with a calculation software, it is necessary to enter the loads separately and to update the parameters of creeping and shrinkage of concrete in the short term and in the long term so that the software takes into account the cycle of the load.

The notion of the harmful deflection is very important in the case of building a fragile element (Curtain Wall, floor covering, etc.).

In addition to this mission, I worked on the



designing of the various structural elements such as foundation beams, beams, columns, flat slabs, concrete shells...

I worked on these subjects in a different project like : The campus of PSG and the Olympic Games 2024...

KEYWORDS : deflections, deformations, professional recommendations, eurocode 2, cracked state



Olympic games projects

Campus PSG projects

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Application of the numerical tools on the stability analysis and optimization design of 3D printed concrete structure

Civil engineering



Company/institution : Polytech Orléans

Souvesthi BERGEN
Academic supervisor : Duc Phi DO



OBJECTIVE/MOTIVATION

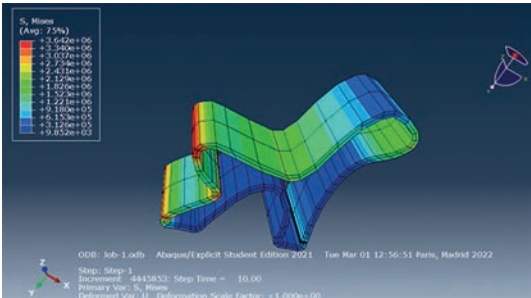
The objective of this project was to study the elastic and elastoplastic behaviour of printed concrete in its hardened state in the ABAQUS software. The study focused on the resistance and the deformation of the printed chair due to the weight of a human.

Firstly, by synthetizing the characteristics of the concrete in the hardened state, I had to apply to the chair the property of the material to simulate in the Elastic model. Afterwards, I had to do the same thing with the Mohr Coulomb model. Therefore, I could notice the deformation of the chair as well as the traction. To go further on the study and I have enough time, I was asked to simulate the chair with the Drucker-Prager model. This model will give us more detail about the propagation of the cracks in the chair.

RESULTS

While working on this project, I could simulate on the elastic and Mohr-Coulomb model. Unfortunately, I did not have much time to work on the advanced model. During this project, I could observe the deformation and traction after applying a load on the chair (human's pressure). The Mohr Coulomb model helped me to have the load for which the crack will appear. Besides, the elastic model is the stress from which a material stops deforming in an elastic reversible way and therefore begins to deform irreversibly. Thanks to this, I could also analyze what sort of impression is favorable as well as how we can improve the chair's shape to optimize it.

KEYWORDS : printed concrete in tis hardened state, chair, mohr-Coulomb, material properties, resistance, deformation, load, elastic.



Chair simulation

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Block release training as construction site supervisor

Civil engineering



Company/institution : SOFLACOBAT

Mathis BRACHET
Academic supervisor : Laurent JOSSERAND
Industrial supervisor : M. JANEQUIN



Complex aerial view

OBJECTIVE/MOTIVATION

During my fifth year in Polytech Orleans, I decided to undertake a professional training contract as a construction site supervisor to heighten my skills. The premature integration in the working world is a perfect way to anticipate the start of a budding career, it allows us to face responsibilities as workers. My contract has lasted 5 months, allowing me to learn in the field at the same time as finishing my courses at Polytech Orleans. My goals are to gather my technical knowledge, learned during my school curriculum with my savoir-faire, then I want to acquire professional knowledge, social skills, communication, or organization.

RESULTS

The construction of housing in France has an big place in civil engineering, in fact we can systematically see many tower cranes in our towns, showing the growth in housing demand. The construction site I worked at during my professional contract is a construction of 58 accommodations divided in two apartment blocks and eleven

individual houses. This kind of complex is more and more in demand because it allows us to create a diversified and lively space. It was therefore assigned to me during the construction to make a global monitoring of structural works but also to supervise the whole of the trade part like the painting for example. One of the interesting issues that I must deal with is the construction of building with constraints on three of its sides, indeed it has been placed between two existing accommodations, and this restrains the possibilities and method of construction. It's therefore important as site supervisor to find solutions for each problem while respecting the technical specifications.

KEYWORDS : building, concrete, construction site.



Picture of building



Beginning of work

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Characterization of thermal properties by inverse analysis on concrete test tubes. Characterization of resin used for chemical reinforcement sealants

Civil engineering



Company/institution : LaMé Laboratory

Ali AWADA / Rim KADAOU
Academic supervisor : S. Remond / D. Hoxa / B. Ismail
Industrial supervisor : L. Aubry



OBJECTIVE/MOTIVATION

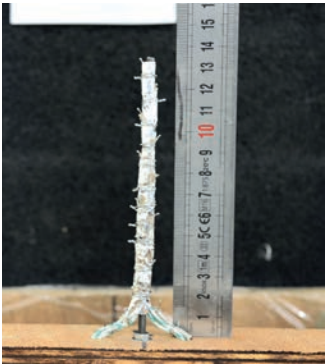
1-Many conditions can influence the good behavior of the concrete and its performance regarding high temperatures. Its thermal conductivity depends on the respective thermal conductivities of the phases constituting the material. Our project aims to analyze and study the thermal properties by inverse analysis on concrete. This study is carried out in order to understand the behavior of a facade or a building on fire.

2-Rebar installation can be performed in cured concrete by bonding the rebar using polymer adhesives. This technique allows a fast and easy structural gluing of rebars into already existing concrete structures. At ambient temperature, the load bearing capacity of these bonds is similar to the one of classic steel/concrete connections. However, studies show that the bond resistance decreases rapidly with temperature.

For this reason, it is necessary to study the mechanical behavior of these bonds in a fire situation. The goal is to establish a design method in order to ensure structural safety in fire conditions.

RESULTS

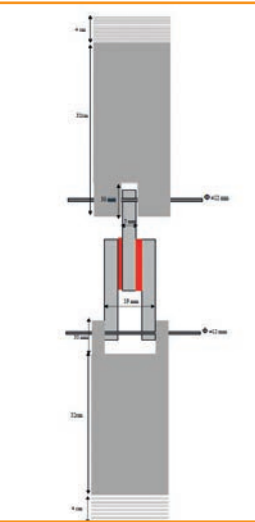
Concerning the first project, we conducted tests on five pairs of



Thermocouples to be inserts into concrete tubes



Concrete cube + thermocouples



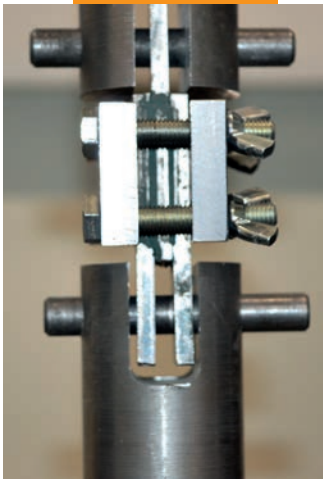
Shear test equipment

concrete blocks which were subjected to different states of humidity: 0%, 33%, 76%, 98% and 100%, in order to determine their conductivity in each state mentioned. We measured it using the experimental device called "Hot wire method" and the wire conductivity software. The tests went well and we managed to determine the thermal conductivity of concrete in its different states and understand its behavior regarding humidity.

Regarding the second project, we have adopted several solutions to avoid the problem of poor adhesion between the resin and the metal plates, in particular the use of an equipment that exerts a horizontal force to prevent the plates from breaking.

This device allowed us to succeed in the shear tests on the resin. However, the stress value reached remains low compared to the one given by the resin suppliers. The same results were obtained by using different types of resins and also under a temperature equal to 100°.

KEYWORDS : Concrete, Thermal, resin.



Resin shear test

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CO₂ capture through concrete : state of the art and modeling

Civil engineering



Company/institution : Polytech Orléans

Ali FAKIH / Marwan OUALHAZI
Academic supervisor : Hamidreza RAMEZANI
Industrial supervisor : Hamidreza RAMEZANI



OBJECTIVE/MOTIVATION

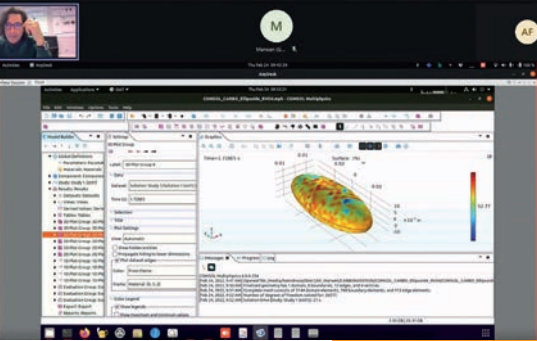
Studies have shown that, among the various constituents of concrete, cement represents the main source of environmental impacts and greenhouse gas emissions. Indeed, the significant quantity of CO₂ emitted in the construction industry is mainly due to the production of cement. The reduction of CO₂ emissions is easily achieved by reducing the dosage of clinker in cement while simultaneously increasing the dosage of mineral additions like limestone fillers, pozzolanic addition, hydraulic additions. Moreover, it has been shown that the clinker can also capture CO₂ by a natural phenomenon called carbonation of concrete. An in-depth study of this phenomenon is therefore necessary to better understand and optimize its treatment. Therefore, we were provided with some documents that presented a variety of predictive models on the carbonation of concrete, but those for cement structures with mineral additions are still rare. The objective of our study is to understand the mechanism of CO₂ capture via carbonation through cement structures having those additions.

RESULTS

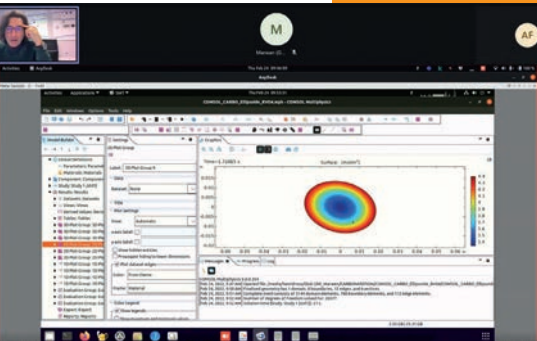
An in-depth study was conducted to understand the carbonation of concrete and how it can be used to capture CO₂ with recycled structures. After reading and analyzing all the articles provided by our academic supervisor, we started by writing

the multi-reactive chemical equations needed in our simulation while verifying every parameter and variable that we found important in the phenomenon. Six equations were found in the beginning, but were then reduced to 5, one for each chemical molecule. Hereafter, we simulated the accelerated carbonation numerical model using the software COMSOL and we finally predicted a 1D, 2D and 3D assumptions while estimating the quantity of CO₂ captured through different shapes of concrete and cement structures (cube, ellipsoid, sphere) having all the same volume.

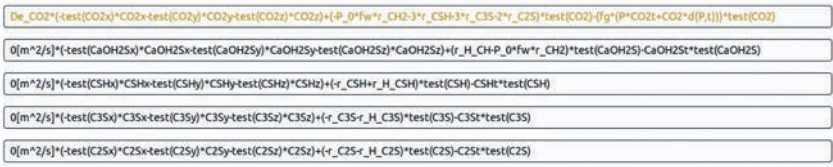
KEYWORDS : civil engineering, concrete, cement, carbonation, 3D simulation.



3D model showing the CO₂ diffusion inside a concrete ellipsoidal structure



2D model showing the CO₂ diffusion inside a concrete ellipsoidal structure



The five chemical equations used in the carbonation phenomenon on via comsol

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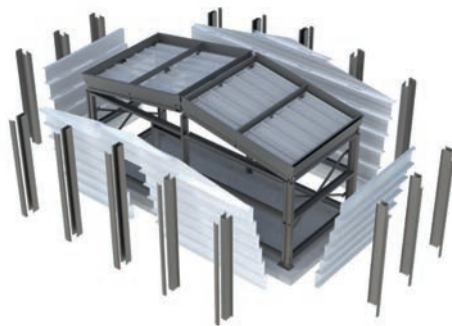
Comparative study of the thermal performance of different bio-based insulation materials

Civil engineering

Akram BAHAR / Mohamed HABAB
Academic supervisor : D. HOXHA



Company/institution : Polytech Orléans



OBJECTIVE/MOTIVATION

Our work on this project will be a continuation of a previous project carried out under the responsibility of the LaMé laboratory, which concerns a small industrial building with a well - defined metal envelope. The professor previously provided us with documents that explain the measurement system used for temperature and relative humidity to compare the thermal and hydric response of the insulators. The final goal of our project will be to monitor and update this system and perform an interpretation of the obtained results.

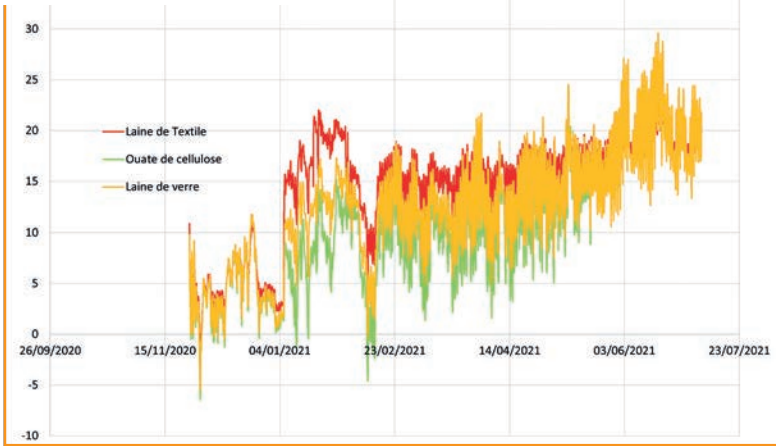
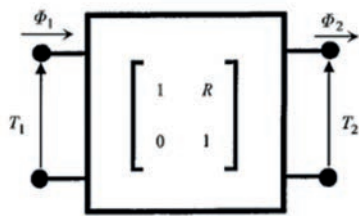
RESULTS

In the beginning, we studied graphs which visualize the evolution of temperature and relative humidity over time. We worked on different types of classic bio-based insulation materials : glass wool, wood fibers, rock wool, cellulose wadding, textile wool.

Afterward, we carried out bibliographic research to find a method that would calculate the thermal resistance of a wall in a transient state. We found information about the quadrupole method which is very effective in obtaining an analytical solution to the problem of thermal diffusion in a non-steady

state. It is based on the matrix relation between the vectors made up of the Laplace transforms and the conduction flux density. We noticed that we can found the value of the temperature on one side of a wall using the temperature and heat flux values on the other side. In our project, we already have the values of the temperatures of one side, so we tried to implement an algorithm of Laplace transform in MATLAB. As this task is completed, we started to write a complete script for the quadrupole method in the software.

KEYWORDS : insulation, quadrupole, hydric response, bio-sourced, transient state



```
Ztransform.mlx x +
1 clc;
2 close all;
3 clear all;
4 syms 'z';
5 nf=0;
6 nl=1000;
7 x=importdata('Temperatures.xlsx');
8 syms 'm';
9 syms 'y';
10 f(y,m)=(y*(z^(-m)));
11 k=1;
12 for n=nf:1:nl
13     answer(k)=(f((x(k)),n));
14     k=k+1;
15 end
16 disp(sum(answer));
17
```

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Concrete thermo-physical properties variation during cooling phase after fire exposure

Civil engineering

Pierre AUGER / Martial VIALA
Academic supervisor : Sébastien REMOND / Brahim ISMAIL



Company/institution : CSTB-Lam2

OBJECTIVE/MOTIVATION

Pierre AUGER and I, Martial VIALA, decided to put the subject "Concrete thermo-physical properties variation during cooling phase after fire exposure" in our list of important subjects to study because we handle or observe concrete on a daily basis. We therefore found it interesting to choose this topic to deepen our knowledge of it. Concrete was already used in the time of the Egyptians, Romans..., but has undergone strong evolutions. We have ordinary concretes, high performance concretes, ultra-high performance fibre concretes... We have already studied all of them but during our studies, we never studied the characteristics of concrete when it is set on fire. So, this subject was chosen out of curiosity because we had no knowledge of it. During this project, we were surprised by what we learned so we did not regret choosing this subject.

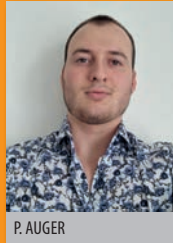
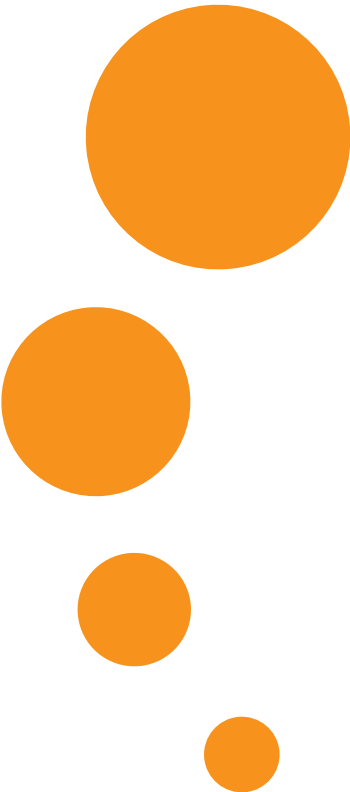
RESULTS

In the last year of our engineering course, we had to choose a topic from a list of projects. We got

the topic on the impacts of heat on concrete. After we had our first appointments with our teachers, we analysed the effects of heat and fire on concrete with the help of documents. The damage can be irreversible and thus change the mineralogical structure of concrete. During the cooling period, the temperature increases and the heated portlandite crystallizes. The crystallisation of the portlandite increases the volumes and creates additional damage. We used Matlab software to determine or even anticipate the heat that we could have depending on the depth and the point where we are in the concrete. In this way, we can know precisely the heat at a point X, determine the

characteristics of the concrete and therefore know whether or not the structure is damaged. Obtaining the temperature would allow us to know which elements have been transformed in a reversible or irreversible way. Thus we can know if the structure needs consolidation, repair or demolition.

KEYWORDS : concrete, thermics, heat, matlab



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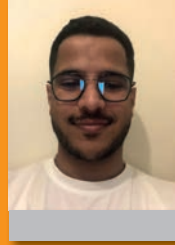
Construction of a building in its shell phase

Civil engineering

SABARD
Entreprise générale
de bâtiment

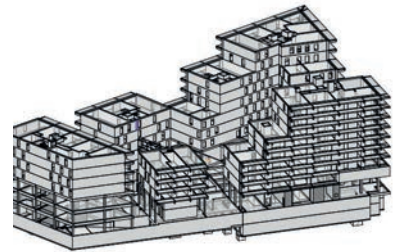
Company/institution : Sabard

Mohammed Ramzi WAFIK
Academic supervisor : Kevin Beck
Industrial supervisor : Jacques Sivignon



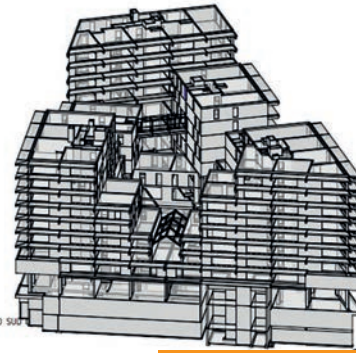
OBJECTIVE/MOTIVATION

In September, I rejoined the company where I have finished my internship, and I had the chance to continue in the same worksite where I have been during my 3 months of internship. The objective of this experience was to discover a bit more of the building field with all the administrative documents that are needed, and to see each stage of the building construction from its beginning to the end. During this experience I had to manage the workers, we had approximately 30 workers on site with each one his main domain.



RESULTS

This experience changed my vision about the professional world and how actually companies work under big pressure, so I had to manage the pressure from the client that was always requiring that we should work faster, and I had the opportunity to work in a specific condition that is the pandemic where we had to manage the non-attendance of the workers that were positive to COVID. Second, I had the experience to see everything I learned about in the university during these 3 last years, and learn some tips in order to accelerate the production. I was the responsible of the security in site, so I had to be very careful with the workers when they might be in a potential danger.



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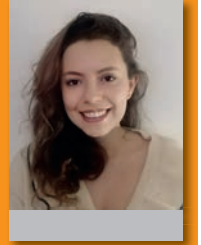
Construction of the underground station of Porte Maillot in Paris

Civil engineering



Company/institution : Bouygues Travaux Publics

Josephine LISANDRE
Academic supervisor : Elise REMOND
Industrial supervisor : Marine RUIZ



OBJECTIVE/MOTIVATION

In order to get closer to the professional world, I decided to do a professionalization contract during my fifth and last year at Polytech' Orléans. After having done my 4th year internship in a design office, I thought it would be a good idea to complete my curriculum with an experience as a works manager. Working on such a large-scale site as the Grand Paris with Bouygues Travaux Publics is a unique experience.

The Porte Maillot station project is part of the EOLE project, which consists in extending the RER E to the west of Paris. For this, a tunnel between Haussmann Saint-Lazare and Nanterre is being built and 3 new stations are being created, including the Porte Maillot station. This emblematic underground station is located under the old Porte Maillot roundabout. It will be bathed in natural light thanks to its large pedestrian canopy on the surface.



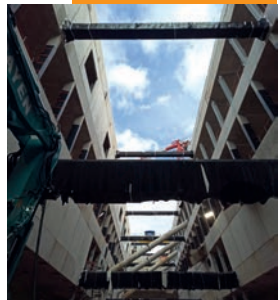
Overall view of the site

RESULTS

My professionalization contract started at the end of the civil engineering phase of the site. My role as the works manager for the installation part of the station (INS MAI project) is the smooth running and operation of the works carried out by various subcontractors. Indeed, during the second part of the construction site, several participants will take part in the creation of the lots. It is thus essential to set up an effective and structured logistics system. Numerous logistic documents are thus written to centralize all the information of each intervening company. The other main missions of the project are to ensure the proper delivery of each area (lighting, electrical access and water point), the cleaning of common work areas, the handling of supplies, the delivery and maintenance of the site-facilities and the creation of a new remote storage base in Nanterre.

KEYWORDS : grand Paris, underground station, installation part, smooth running, structured logistics system

Model of the finished under ground station



The underground station during the construction phase

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Design of the new headquarters of the Orléans territorial agency

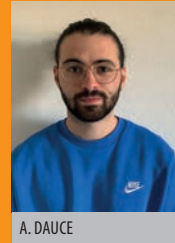
Civil engineering



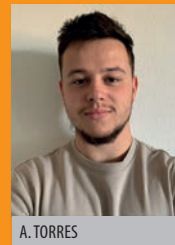
Company/institution : Département du Loiret

Antonin DAUCE / Adrien TORRES

Academic supervisor : Elise REMOND / Laurent JOSSERAND
Industrial supervisor : Jean-Baptiste PÉAUD



A. DAUCE



A. TORRES

OBJECTIVE/MOTIVATION

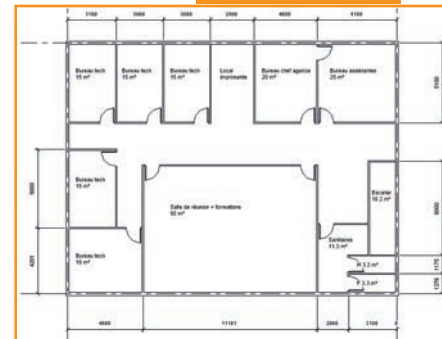
The main goal of our project is to work with the department for the design of the new Orléans regional office and its work center. This center will be the merger of two current centers. This kind of center is intended to work on the project management of road maintenance works, the upkeep of green spaces and the winter road maintenance. Our objective is to propose some solutions for different elements of the site design, such as buildings, drainage system for rainwater and wastewater, exterior layout of the parcel by taking into account the space requirements for heavy goods vehicles traffic and interior layout of the office buildings. We also have to estimate the cost of the operation using ratios and generate interior and exterior plans.

RESULTS

We started our project by checking how practical the site was thanks to the verification of the sensibility, such as geotechnic features or risk

areas. Then, from the definition of a typical center, information provided by the department and our own reflexion, we were able to define all the necessary surfaces for all the elements. Thanks to this study, we created interior layout plans on Revit and various exterior layout plans on AutoCAD. After that, we used these exterior layout plans on Mensura to do a gyration pattern to check the circulation of heavy goods vehicles. We also determined rainwater and wastewater networks dimensions at the plot exit for the connection with a retention pond and the public network. Therefore, at the end of the project, we delivered a report presenting several solutions of layout plans, with the features expected by the client, as well as an estimate of the global cost of the operation.

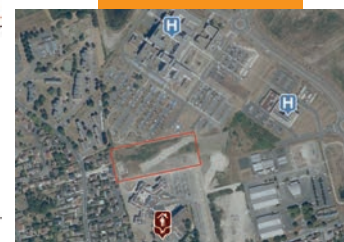
KEYWORDS : consulting engineers, design, layout, drainage system, budgeting



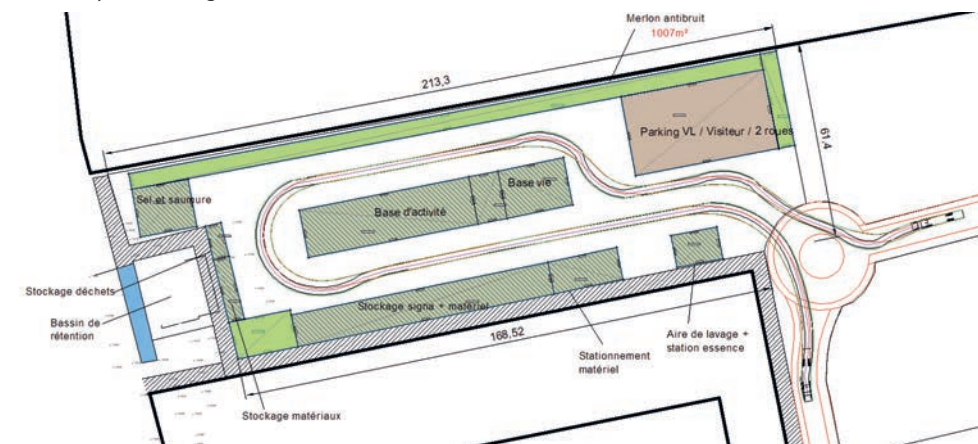
Interior layout plan on Revit



Example of warehouse in the current center



Plot location



Gyration pattern for one exterior layout plan on Mensura

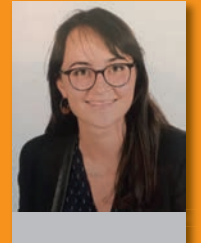
Contact : antonin.dauce@etu.univ-orleans.fr ; adrien.torres@etu.univ-orleans.fr

Development of the intersection of Rue Casimir Perier and Rue de la Saulzinière with the creation of a roadbed

Civil engineering

Chloé VENTURINI

Academic supervisor : Elise REMOND
Industrial supervisor : Adrien CHAUSSE



Company/institution : Eiffage Route

OBJECTIVE/MOTIVATION

The aim of the worksite at the crossroads of Rue Casimir Perier and Rue de la Saulzinière in Nantes is to create a roadbed to slow down motorists, and to develop the pavements. This is a public contract with the Nantes metropolitan authority as the project manager and project owner. Once the contract was obtained, it was necessary to carry out a counter-study of the site. This consisted of rechecking all the quantities in the contract, drawing up a schedule and determining the material and human requirements per day. This then allows us to evaluate the financial cost of the project and therefore to know how much money we can expect to earn. Then we can place orders with suppliers and finally draw up the PPSPS, a document describing the preventive measures to ensure the safety of employees on the site.

RESULTS

This project, which began in mid-January 2022, was carried out in four phases. The first three phases correspond to the three pavements of the intersection. The fourth phase corresponds to the planing and the creation of the roadbed on the roadway. Each phase took about a week. Various development works were undertaken on the pavements: the laying of grassed concrete paving stones and granite paving stones, the installation of kerbs, the creation of water inlets, the installation of urban furniture such as bicycle racks, the pouring of concrete slabs for the laying of asphalt, etc. Some of the work was subcontracted: the laying of the asphalt, road sign and the shot-blasting of the asphalt on the platform. This work was completed in mid-February, one week ahead of schedule.

KEYWORDS : roadbed, pavement, crossroad, counter-study, subcontracting



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Energy calculation of buildings in the case of thermal rehabilitation

Energetics, materials



Candice MARMIN / Carla SAIS
Academic supervisor : Naima Belayachi
Industrial supervisor :

Company/institution : Laboratoire De Mécanique Gabriel Lamé (LaMé)

OBJECTIVE/MOTIVATION



The aim of the project is, first of all, to establish the heating needs and the energy consumption of a 17th century half-

timbered house located in Orleans. Using an excel sheet provided, we must compare the energy consumption after and before rehabilitation, with a synthetic material and with a bio-based material developed by researchers of LaMé Laboratory. We also need to look at the differences between the Excel sheet and an architectural practice software. This study requires some work to improve the Excel sheet to take a half-timbered structure into account.

Then, in the second part of the project our work focus es on the processing and analysis of data (humidity, temperature and heat flow) related to the demonstrator built near Polytech Orléans. The purpose is to test the performance of new bio-based insulating materials, developed as part of a research project within the Gabriel LaMé Mechanics Laboratory.

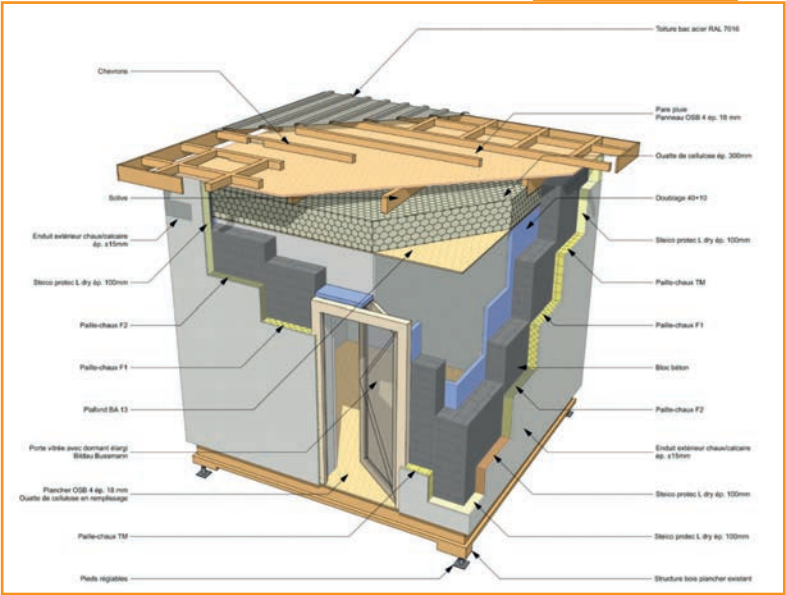
RESULTS

The demonstrator showed that biobased materials have an equivalent performance to STEICO, a natural insulation already on the market, made of wood fibres.

The comparison between the Excel sheet and the architectural practice software showed us that the

Excel sheet is a reliable tool for carrying out the energy study of a building. Applying the example of the 17th century house based in Orléans, we also found that bio-based materials have an interesting performance for the interior insulation. However, for the same energy performance, the thickness of the insulated wall will be larger with a bio-based material than with a synthetic material. In order to ensure good insulation while keeping a reasonable wall thickness, it is preferable to combine a bio-based insulation with a synthetic one until a better performing insulation is developed.

KEYWORDS : insulation, bio-based materials, energy efficiency



Demonstrator

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Genesis of a highway project : A154

Civil engineering



Company/institution : Sologne Ingenierie

Antoine LEVIEUX / Celian GROSS
Academic supervisor : Xavier BRUNETAUD
Industrial supervisor : Amir ROTAT

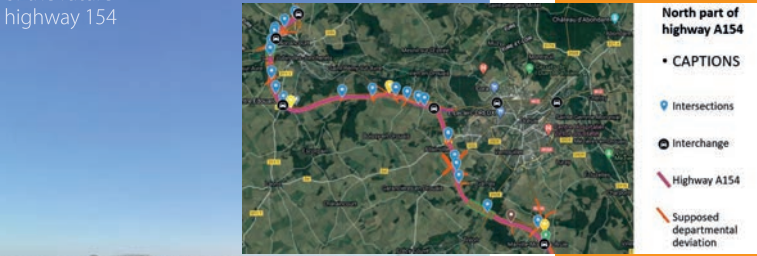
OBJECTIVE/MOTIVATION

The objective of the project is to set up a highway from the north of Nonancourt to Trancrainville. It will make the link between A road 154 to highway A10. On the way, there will be some exits to Dreux and Chartres. To do that, we need to identify the B roads that cross the highway and then to figure out what to do with them. It means the reorganization of the road network in the department and so the suppression or the deviation of the intersection of these B roads with highway 154.

RESULTS

The project is split in three parts. First, the identification of the different B roads and determining their importance and their role. This part is considered as a diagnosis of the current situation. After this first analysis, we have to set up a first plan which includes the construction zone and and, moreover, this plan will explain in detail what to do with the B roads that enter in conflict with

Example of the result of the future highway 154



North part of highway 154

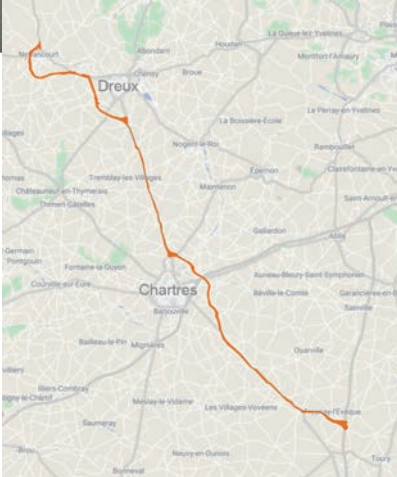
Route of highway 154



Example of an overpass

the future highway. This plan will be made on the software Autocad. Then the last part of this project is to analyze the plan and to improve it. The result of this study will be, on a final plan, describing the new network of B roads according to the construction zone of the new highway.

KEYWORDS : consulting, assistance, analysis, training, projet management



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Intermodal Urban Mobility and Reduction of Impacts

Environment engineering



Company/institution : Polytech

Melih SAGLAM / Florian HUNAUT
Academic supervisor : Chantal PROUST

High scholler's choice
16th annual final year projects forum



OBJECTIVE/MOTIVATION

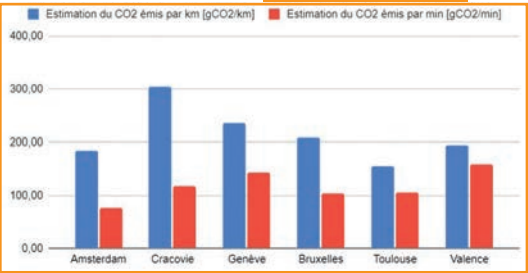
The main characteristics of the subject are to study different ways of moving (walking, subway, bike...) to see their impacts in terms of costs, time and carbon dioxide rejection. The finality is to find the best way to travel within the city from point A to B, without paying too much or travelling too long and with the minimum rejection of gases within the atmosphere. The subject is an extension of what has been done last year by other 5th year students. Indeed, they treated the subject focusing on two French cities : Orléans and Nantes. This year, we are widening the range of cities by studying bigger international cities. Then we have chosen European cities for different reasons and we will do researches about them. The cities are Amsterdam, Brussels, Krakow, Geneva, Toulouse and Valencia.

RESULTS

The project is quite ambitious since six cities are involved in it. It is a long process to find all the

data from international websites and to match them all with each other. So far, we have been able to distinguish many categories that we found interesting to talk about and made researches for all the transports means. For every cities chosen, we know for a North-South and an East-West journey, how long it takes, how much it costs and how polluting it gets. The interesting side of the project is to find the best combination of the ways of moving to reduce all at once the travel time, the price and the pollution emitted, and for that, we imagined different scenarios combining for example bike and underground at different proportions. The results will be displayed in a database.

KEYWORDS : mobility, sustainability, time, costs



Amsterdam

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Internship as a business and a research engineer at Arcadia Construction

Civil engineering



Company/institution : ARCADIA CONSTRUCTION

Hala GHAMLOUCH

Academic supervisor : Céline MALLET
Industrial supervisor : Mohammed EL HARFI



OBJECTIVE/MOTIVATION

The opportunity as an intern at "Arcadia Construction" during my 5th year at Polytech Orléans, has helped me enrich my knowledge, especially in civil engineering during both periods (studying and working). Since "Arcadia construction" embraces various projects and offers different services such as new construction and renovation projects, it has prepared me to enter the job market by being responsible for multi-tasking duties such as receiving clients, visiting our different worksites, being responsible for estimating construction projects and scanning the buildings that are

being renovated with a "Matterport" equipment in order to have a Revit model of the different buildings so that we can deliver it to our client.

RESULTS

As an international student, my career as an engineer helped me discover different construction cultures in France and since "Arcadia Construction" works on many construction sites in different cities of the Centre-Val-de Loire region, I noticed that houses have the same exterior designs. The professional and technical experiences that I gained while using different software such as Revit, AutoCad, Recap or Cedreo, are based on the notions acquired at the university to which I referred in order to solve small bugs. Meanwhile, I'm developing my experience in doing construction contracts and during this mission I'm going to be responsible for contacting different suppliers and forward the report to the client so that the latter can take the final decision.

KEYWORDS : renovation, scanner building, estimating construction projects



The 'before' version of one of our worksites



Another worksite

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Immersion in real estate project management

Civil engineering



Fadel TOUKOUROU

Academic supervisor : Xavier BRUNETAUD
Industrial supervisor : Pascal MASSON



Company/institution : OXYLIUM



OBJECTIVE/MOTIVATION

My main objective with this professional immersion was to develop, and above all to put into practice, all the theoretical knowledge that I acquired during my training at Polytech Orleans. Oxylium was a way for me to take on new challenges. Indeed, being a versatile company on a human scale that operates in the field of building, it was the ideal framework for me to gain skills through the various missions that are architectural programming, urban programming, assistance to the management of the project, ordering, piloting and coordination, and the management of the execution. The objective of this first part of my professional immersion was to understand and practice the jobs of real estate project management through the programming mission and the mission of Ordering, Piloting and Coordination (OPC).

RESULTS

In programming : I first had to study the plans to identify the various useful surfaces within the framework of a thermal diagnosis of a primary school. The different data collected on the plans,

coupled with the photographic report of the site, were then used to make a costing proposal per lot to obtain an overall cost per lot for the work to be carried out.

In Ordering, Piloting and Coordination (OPC) : I learnt how to manage a site, lead a site meeting and above all write the meeting minute. One of the operations on which I had to intervene was the Amazon industrial site requiring the daily coordination of the work and a D+1 forecast to avoid planning deviations and, above all, to avoid any disruption in production. An introduction to MS project enabled me to draw up a schedule.

KEYWORDS : programming, OPC



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Management of the sidewalk rehabilitation construction site at the Marechal de Lattre de Tassigny residence in Mourmelon-le-grand

Civil engineering



Anthonin HAUPAIS

Academic supervisor : Laurent JOSSERAND
Industrial supervisor : Maxime DAVERGNE



Company/institution : Colas

OBJECTIVE/MOTIVATION

At the beginning of my 5th year at the Polytech Orléans engineering school, I chose to do this last year on a professionalization contract. I chose to do this type of contract in order to learn more about the public works sector. So, in September 2021, I started a contract of this type at the Colas works agency of Châlons-en-Champagne, until the end of August. My main objective during this contract was to improve my skills and qualities as a future engineer in civil engineering and geo-environment. And more specifically to acquire the many skills and qualities that a construction manager must have. That is knowledge on the preparation and management of a construction site. And also, to acquire knowledge on how to close a construction site and knowledge on the various methods of construction in the public works sector.

RESULTS

To sum up, this professionalization contract has been beneficial and enriching on both professional

and personal levels. Indeed, thanks to this contract, I improved my knowledge and my qualities as a future civil engineer, in addition to my courses learned at school. To this end, I acquired site skills by spending several weeks as a worker with a site manager on the Mourmelon-le-Grand site. On this site, I learned how to lay out curbs and gutters with the help of a GPS stick. I also learned how to lay kerbs and gutters, how to manage trucks and many other things. In addition, during this contract, in collaboration with a works manager, I also learned how to prepare and manage the site, by carrying out measurements, material acceptance files, diversion plans, executed works files and many other site management documents.

KEYWORDS : construction manager, site manager, site, dispatcher



Map of construction site



Sidewalk renovation



Sidewalk renovation



Renovation of a car park (after)



Renovation of a car park (before)

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Management of works for the renovation of civil engineering structures using additional prestressing

Civil engineering

Justin FUCHS

Academic supervisor : Sébastien REMOND
Industrial supervisor : Gaël CHIPEAUX



Company/institution : Baudin Châteauneuf département PCB



Figures of Baudin Châteauneuf



OBJECTIVE/MOTIVATION

Anxious to get closer to the professional world, through my work-study project in my fifth year at Polytech Orléans I wanted to discover the job of works supervisor, which I had never done in my previous professional experience. I was immediately interested in the position offered by Baudin Châteauneuf because of the high degree of technical specificity it offered and the many large-scale projects the group carries out. Indeed, only two companies in France carry out prestressing works such as those proposed by the PCB department. In addition, the high degree of mobility required and the variety of the geographical location of the work sites is a point that motivated me even more. Finally, the great career prospects within a large group like Baudin Châteauneuf finally convinced me to do my last year of work experience in the company.

RESULTS

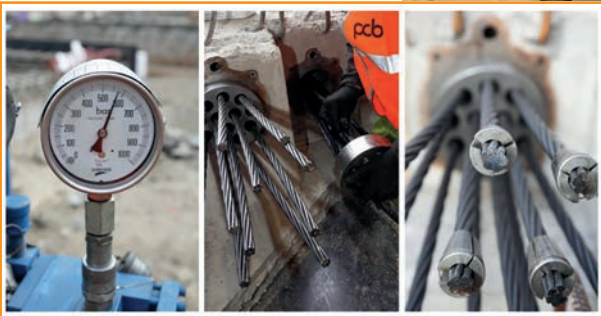
When I joined the PCB department I was assigned to the preparation of an additional pre-stressing site

on a Viaduct. The structure is a motorway bridge near Perpignan that needs to be reinforced following the widening of the road. My first task was to assist the works manager in the preparation of the written documents during the preparation phase. I also took part in the reflection on the methodology of the building site with the realization of models. The second phase of my work-study programme corresponds to work on site from March 2022 for the implementation of the additional prestressing, and all the work that this entails. My role on the site is similar to that of a works manager, with a phase of managing technical problems and a phase of managing human resources.

KEYWORDS: conducting the work, work of art, reinforced concrete, prestressing



Anchor model



Photos of pre-stressing

Contact : justin.fuchs@etu.univ-orleans.fr

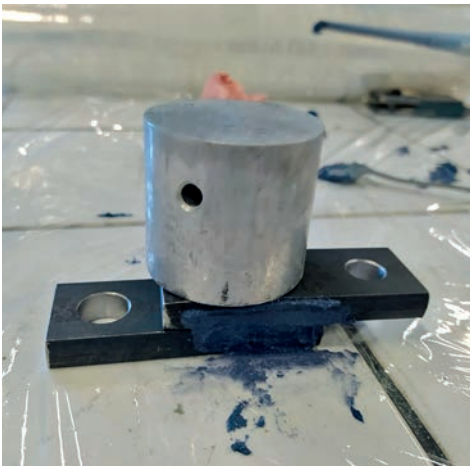
Material characterization of resins used for the chemical sealing of reinforcement

Civil engineering

Lucas CLAUDE / Yanis KHAROUBI

Academic supervisor : Dashnor HOXHA

Company/institution : Scientific and Technical Center for Building (CSTB)



OBJECTIVE/MOTIVATION

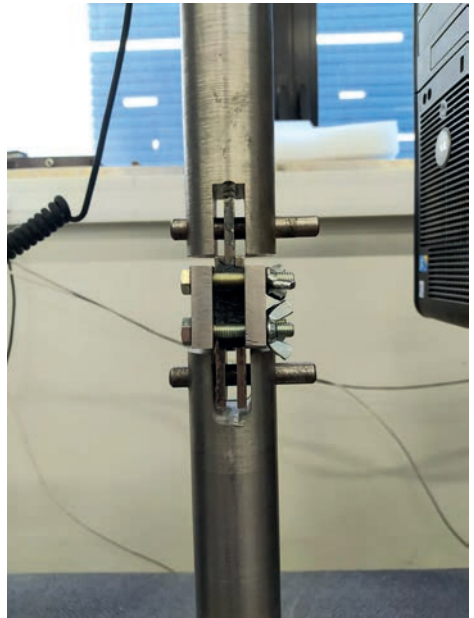
This project was for us a chance to experience even a slight part of the research side of the civil engineering. For that, it was a real chance to work for the Scientific and Technical Center for Building (CSTB). The objective of this project was at first to characterize the behavior of some resins used as chemical sealing for reinforcements in concrete. More precisely, we had to study the tensile resistance of the said resins during heating and cooling phases and compare them. Yet, because we could not get any satisfying results with the specimens of the test, our main goal changed to create a specimen capable of obtaining exploitable results.

RESULTS

At the end of the project, we did not have any result

that would match the data sent by the laboratory of the CSTB. Yet, we are certain that the grip between the resin and the steel plates of the specimens was the cause behind our results. We did observe a little improvement with our last idea, but we only obtain half of the resistance given by the laboratory. So, we thought of a last solution, but the lack of time will not give us enough time to test it out. This time the solution is made so that the resin completely encompasses the steel plate that will be pulled by the mechanical press.

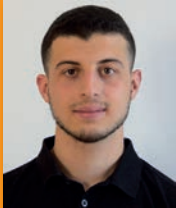
KEYWORDS: resin, reinforcement, resin behavior



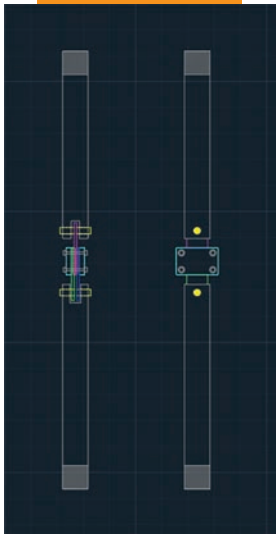
Contact : lucas.clau...@etu.univ-orleans.fr / yanis.kharoubi@etu.univ-orleans.fr



L. CLAUDE



Y. KHAROUBI



New construction of 156 apartments, shops, offices and underground parking in Fleury-les-Aubrais (45400)

Civil engineering



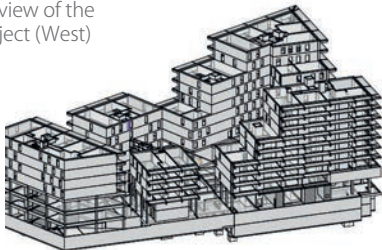
Line ABOU SALEH
Academic supervisor : Kevin BECK
Industrial supervisor : Jacques SIMIGNON



Company/institution : SABARD SAS

OBJECTIVE/MOTIVATION

3D view of the project (West)



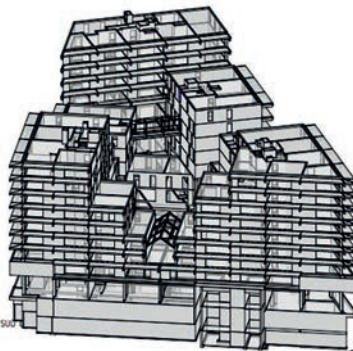
This project involves the construction of four buildings of nine floors and two basements with underground parking, from where we are so far in the infrastructure part (in the elevation of RDC) for two different buildings and in basement elevation -1 for the other two buildings. The main objective is to assist the works supervisor responsible for the site, under the name «Interrives REALITES» at Fleury-Les-Aubrais in Orléans. For this, I was in charge of the day-to-day monitoring of the site since the works supervisor was not present at the site every day. I was therefore responsible for preparing a daily report of the progress of the site, which I presented to him at each meeting with

him for the development of the week. So, our objective is to optimize the various stages of construction of these buildings so that they are carried out quickly and in complete safety.

RESULTS

To achieve our objective, I first participated to the site meeting bringing together the various managers of each lot and the control office to take stock of the progress of the site in order to fully understand all the construction constraints. Then set up site monitoring for the works supervisor, indicating to him on the plans the pre-slabs laid and cast, the double walls and the beams. In agreement with the site manager, we checked the double walls and the electrical reservations when they arrived on the site. In addition, I calculated the time required to finalize a R+1 floor in part structural work thanks to the pre-slabs and double walls plans. Finally, I am responsible for monitoring the water and electricity consumption of the construction site and the base camp.

KEYWORDS : construction site, Interrives REALITES, building, site supervision



3D view of the project (South)



Construction site

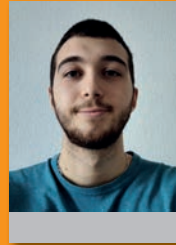


Construction site

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Professionalization contract at ERS Maine

Civil engineering



Bruce SILVY
Academic supervisor : Xavier BRUNETAUD
Industrial supervisor : Miguel GARCIA



Company/institution : ERS Maine



Part of the plans for the site of Villiers-Le-Mohriér

OBJECTIVE/MOTIVATION

As I never have the chance to get an internship as a manager during my former years as a student, I figured out that being under a professionalization contract the final year before being a working man would be best for me. I bet on the fact that this year would be enough for me to acquire the basic methodology, qualities and mindset that are required to be a great leader. The terms of the contract are that, for the first semester, I have to alternate every two weeks between being at school and being at the company. The company I am working for is ERS Maine at Orgères-En-Beauce and its main activity is the burying of electrical network. This is an aspect of civil engineering that I have not experienced a lot at Polytech Orléans so I thought this could be relevant to explore this new domain.

RESULTS

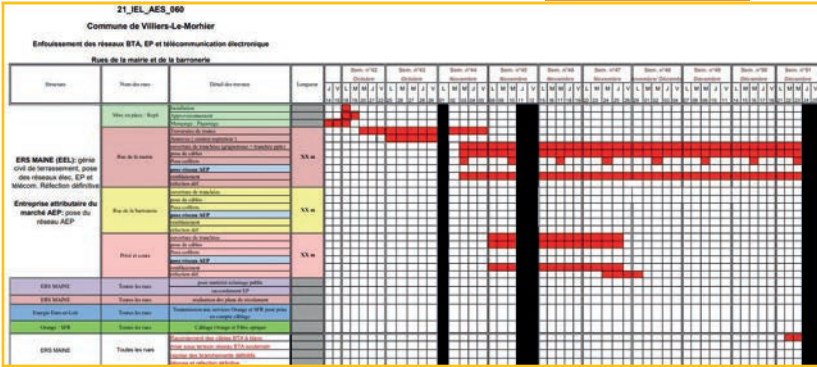
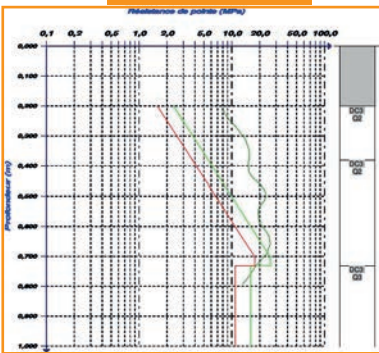
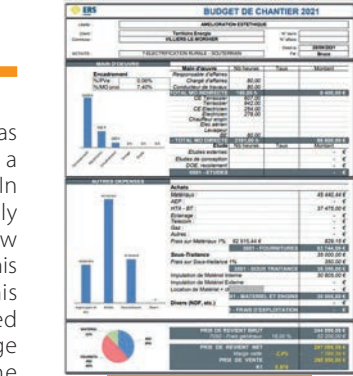
This contract allowed me to get a real work impression for quite a short period of time. However, those two weeks a month were well enough to teach me the basis that I was looking for. Plus, I have learnt how to behave towards clients, workers

and collaborators. I also was taught how to establish a budget and a schedule. In addition, as I work mainly by using plans, I am now used to work by using this tool. Finally, through this first semester, I mastered the way to acknowledge the work done by the company and to ensure that we are paid for it. Unfortunately, at the end of this year, I will

be lacking of some on site experience, which could be a source of trouble for me until I can offset this with experience of my own.

KEYWORDS : electrical network, sites, budget and down payments, plans

Results of a compaction test for the site of Villiers-Le-Mohriér



Planning for the site of Villiers-Le-Mohriér

Contact : bruce.silvy@etu.univ-orleans.fr

Professional training contract as methods engineer at Fayat Bâtiment IDF

Civil engineering



Company/institution : FAYAT BÂTIMENT IDF

Patrycja NOSOWSKA
Academic supervisor : C. DEFARGE
Industrial supervisor : A. BEAUDELLOT



OBJECTIVE/MOTIVATION



the rehabilitation which allowed me to follow the construction of a building site and to visualize concretely the methods of construction methods.

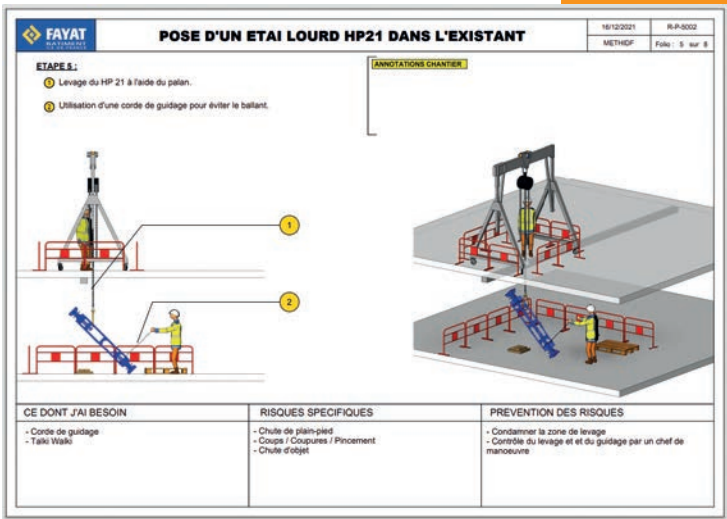
RESULTS

These missions were very enriching for me, because they allowed me to see how a construction site was carried out, the various methods of construction, while focusing on the principal risks and dangers to be taken into account. In conclusion, this experience was for me the best way to start my life as an engineer and I recommend it to all students.

KEYWORDS : revit, autocad, construction site safety

For a few years, Polytech Orléans has been offering final year students the possibility of doing a professionalization work. So, I decided to take this opportunity, because this experience allowed me to have my first long experience in the field of building field, to be able to put my theoretical knowledge into practice and to insert myself into professional life. So, I was hired as an assistant methods engineer at Fayat Bâtiment IDF, a major player in the construction industry.

During my internship, my mission was to develop tools for our department. Indeed, I was first in charge of the making of rehabilitation procedures on the 3D design software Revit 2021. An operating procedure is a technical document which allows to highlight the structure of the tasks, the technical means, the material means, the specific risks and their prevention. I was therefore interested in the safety on the site and the progress of the tasks. Secondly, I conceived a photo library on



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RD400-RD400a creation of a roundabout at Periers-en-Auge, Calvados (14)

Civil engineering



Company/institution : IRIS Conseil and Polytech Orléans

Allassago Djamel DAO / Kouakou Emmanuel N'GUESSAN
Academic supervisor : Laurent JOSSERAND / Elise REMOND
Industrial supervisor : Jeremy LUCY



OBJECTIVE/MOTIVATION

Concerning our industrial project, we are working on behalf of the company IRIS Conseil, which is a company specialising in the management of transport infrastructure and development work. Our project consists in carrying out a feasibility study for the securing of an existing crossroads at the junction between RD400 and RD400a at Periers-en Auge (Calvados 14), then carrying out a feasibility study of this crossroads by studying 3 possible scenarios for the implementation of a roundabout. Furthermore, the aim is that, at the end of our project, we will be able to suggest a geometric and structural design for the rehabilitation of roadways in roundabouts, in accordance with standards.



RESULTS

The realisation of our industrial project, proposed by the company IRIS Conseil, was spread over the



first semester and part of the second semester of the fifth year at Polytech Orléans. During this period, we had to carry out the main tasks of the project, as requested in the specifications. First of all, we had to offer three possible scenarios for our roundabout, taking into account the ecological aspect with zero tree felling. This stage was the most difficult because it took us a lot of time and thought to suggest coherent scenarios. Then we determined the structure of our roadway and studied the road signs. Once all these steps were completed, they allowed us to make a financial estimate of the work in order to make a comparative study of each scenario.

KEYWORDS : roundabout feasibility study

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Rebuilding of the Cotelte Bridge over the Loiret River

Civil engineering

Mohamed HAMMAMI / Thomas BALLE

Academic supervisor : Elise REMOND / Sébastien REMOND

Industrial supervisor : Christophe Robert



Company/institution : Orléans Métropole

Selected participant
16th annual final year projects forum



M. HAMMAMI



T. BALLE

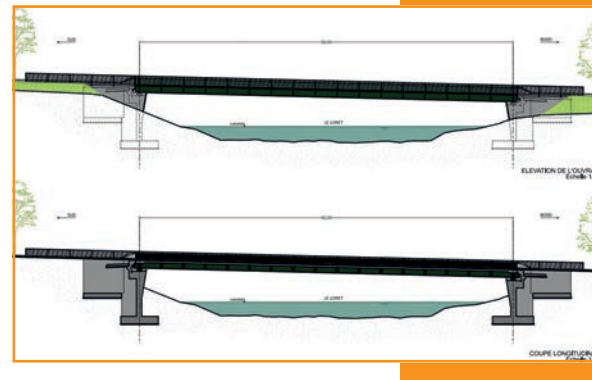
OBJECTIVE/MOTIVATION

The first objective of our project on the reconstruction of the Cotelte Bridge was to verify the sizing of the design office. We eased the parameters in order to be able to use a structural calculation software at the same time as our manual calculations. At the same time, we also tested the various environmental impacts which could interact with the building site during its production or the structure during its life time. Following a more personal optic and based on our future professional wishes, we also had the motivation to see how a bridge is designed to better supervise the realization of the building works.

RESULTS

Thanks to this project, we were able to apply our knowledge on structural calculations on a real bridge project. We went so far as to create a dynamic model of the rolling loads of a 4-wheeled vehicle on a structural calculation software. These calculations complete those carried out by the engineering office in charge of the project and allow us to see other aspects or to simulate other cases, within the limits of the software.

KEYWORDS : bridge, structural calculations, deconstruction, environmental impact



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Recovery of wood waste : Wood Concrete, a biobased and ecological material for thermal insulation

Civil engineering

Antonin LETONNELIER / Timon KESSLER

Academic supervisor : Naïma BELAYACHI

Industrial supervisor : Amandine DIDELOT / Eric DE LA ROCHERE

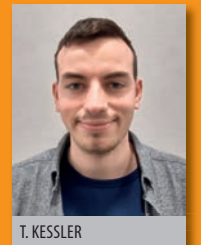


Company/institution : Fibois Centre - Val de Loire

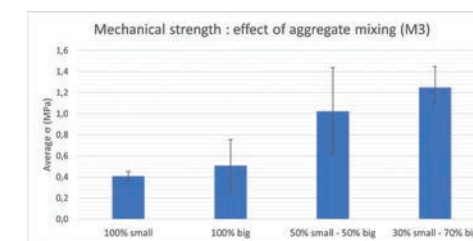
First place
16th annual final year projects forum



A. LETONNELIER



T. KESSLER

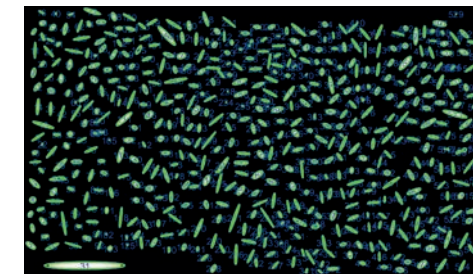


Mechanical test results, effect of the mixing of big and small aggregates

OBJECTIVE/MOTIVATION

The aim is to reuse wood aggregates, considered as waste by the wood industry, to develop building material for the thermal insulation. The concept is to create a brick, without any sand and gravel (non-sustainable resources, used in regular concrete), but to replace it with wood aggregates. The main components of our material are : wood waste, lime and water.

Our motivation can be summed up in three points : to advance in scientific research (involving autonomy, manual experiments, interpretation and exploitation of results) ; to get off the beaten track of school subjects and work on an innovative subject ; to understand circular economy and to become immersed in environmental issues. We are convinced that this topic can have a real impact,



Wood's granulometry characterization with Matlab

especially concerning waste reduction, emissions limitation, resources preservation, energy consumption regulation.

RESULTS

Fibois give us two different types of wood aggregates : "big" and "small". We started working on the characterization of those aggregates properties : absorption coefficient, density, granulometry. Then, we worked on the way to find the mix with the best insulation performance. A first series of samples allowed us to determine the optimum ratios of wood waste, lime and water. With the same ratios, we've made another series of samples with different variations : mixing "big" and "small" aggregates, prewetting of aggregates, add air entrainer additives for improving porosity. Finally, we have done 18 formulations and 72 samples (4 per blend).

Then, we've made experiments to determine four different physical properties of our samples : mechanical strength (compressive uniaxial test), thermal conductivity (probe), capillarity absorption, water vapour permeability. We couldn't find the perfect formulation, but results were acceptable, and extensive research appears promising.

KEYWORDS : wood concrete, wood waste, biobased insulation



Moulds of fresh wood concrete



Sample during a mechanical test



Two of our samples of wood concrete



Samples during a thermal test

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Renovation of the street of Vanneaux

Civil engineering

Bilal AMMAR / Ugo DARDOUR
Academic supervisor : Laurent JOSSERAND



Company/institution : Polytech

Comparison between the design office value and our measurement from the plan

| BILAN DES MÈTRES AVEC POURCENTAGE D'ÉCART | | | | |
|---|---|----|------------|-------------------|
| N° | Désignation | U | Source DCE | Quantité projetée |
| 200 | Dépose de bordures et caniveaux existants et évacuation | m | 723 | 723 |
| 201/204 | Démolition de chaussée | m² | 2389,00 | 2717,88 |
| 208 | Démolition de revêtement de trottoir en enrobé au biton et évacuation | m² | 840 | 840 |
| 400 | Mettre à jour des | m² | 2399,00 | 2799,00 |
| 401 | Travaux en caniveaux sablés 0/4 sur 2cm | m² | 2399,00 | 2226,99 |
| 402 | Reconstruction de trottoirs en enrobé rouge BBSG 0/8 | m² | 9,00 | 6,49 |
| 403 | Reconstruction d'entrées charnières et stationnement en enrobé rouge BBSG 0/8 sur 2cm | m² | 2399,00 | 993,61 |
| 406/1 | P & P de bordure P1 | m | 170,00 | 159,61 |
| 406/2 | P & P de bordure T2 | m | 1125,00 | 1083,99 |
| 406/3 | P & P de bordure A2 | m | 9,00 | 2,91 |
| 406/4 | P & P de caniveau C51 à compter à l'aval jusqu'à l'arrivée de la | m | 739,00 | 686,43 |
| 406/5 | P & P de caniveau C51 pour reprise de saut d'entrée charnière | m | 10,00 | 10,00 |
| 406/6 | P & P de caniveau C51 | m | 9,00 | 3,99 |
| 406/7 | P & P de bordure T2 quart de rond R = 500 mm | m | 30,00 | 30,00 |
| 401/2 | Fourniture et pose de 2 fourreaux d'éclairage public TPC 75 mm | m | 479,00 | 479,00 |
| 402 | Fourniture et pose de clôture de terre en cuivre ou 28 mm² | m | 479,00 | 479,00 |

OBJECTIVE/MOTIVATION

Our project aimed at winning the call for tenders made by the city hall of Olivet for the rehabilitation of the Vanneaux street. Therefore, we wanted to carry out a price study of this construction project in order to make an offer to the city. We had several goals, first we need to establish the price of each operation of this project. In addition, we will quantify the green house gas emission of each task to inform our client. Also, we wanted to give several options to the city hall regarding the technical aspect of the street renovation. The focus will be on proposing a project which lower the green house gas emission. We try to reuse as many materials as possible from the demolition and add it in the new project.

RESULTS

Analysing all the folder's documents was mandatory to understand perfectly what the client's desire was. We determined the different measurements of the street using the plans provided and compared them with the values of the design office. In addition to the price decomposition, we also drew up

a diagram estimating the duration and progress of the project over the 14 weeks. We also added an alternative to the work requested by our client. In order to ensure a role of adviser and a guarantee of quality, we have added a layer of bonding which is not requested by the customer, but which is essential for the sustainability of the road structure. In the end we were able to estimate all the costs and the green-house gas emissions from the different tasks. This project was a way for us to put into practice our knowledge of site management acquired during our studies.

KEYWORDS :
green house gas, price study, measurements



Plan of the street of Vanneaux



B. AMMAR



U. DARDOUR

Example of a cost estimation

| 400 VOIRIES - BORDURES - REVÊTEMENTS | | | | | | |
|--------------------------------------|---|---------|------------|--------------------|---------|-----------------|
| DESIGNATION | U | Q | P.U. | P. TOTAL | kgCO2/u | Total kgCO2 |
| ENGINS | | | | | | |
| Répandeur (3500 L) | j | 0,50 | 500,00 € | 250,00 € | 150 | 75,00 |
| Finisseur | j | 0,50 | 1 330,00 € | 665,00 € | 370 | 185,00 |
| Camion 6*4 15 T | j | 4,45 | 390,00 € | 1 736,43 € | 100 | 445,24 |
| Tandem léger | j | 0,5 | 420,00 € | 210,00 € | 90 | 45,00 |
| Camion semi - porte char | j | 0,5 | 510,00 € | 255,00 € | 120 | 60,00 |
| Pelle hydraulique | j | 3,21 | 680,00 € | 2 180,46 € | 360 | 1154,36 |
| MAIN D'ŒUVRE | | | | | | |
| Ouvrier Qualifié | j | 9 | 185,00 € | 1 665,00 € | 10 | 90,00 |
| FOURNITURE | | | | | | |
| BBSG 0/10 | T | 247,46 | 64,00 € | 15 837,21 € | 55 | 13610,10 |
| Grave 0/31,5 | T | 247,46 | 11,00 € | 2 722,02 € | 20 | 4949,13 |
| Sable 0/4 sur 2cm | T | 52,29 | 60,00 € | 3 137,68 € | 20 | 1058,96 |
| Bordurette P1 | m | 170,00 | 6,00 € | 1 020,00 € | 10 | 1700,00 |
| Bordure T2 | m | 1125,00 | 12,00 € | 13 500,00 € | 10 | 11250,00 |
| Bordure A2 | m | 9,00 | 12,00 € | 108,00 € | 10 | 90,00 |
| Caniveau C51 | m | 10,00 | 13,00 € | 130,00 € | 10 | 100,00 |
| Caniveau C51 | m | 9,00 | 16,00 € | 144,00 € | 10 | 90,00 |
| Bordure T2 quart de rond R = 500 mm | U | 30,00 | 15,00 € | 450,00 € | 10 | 300,00 |
| DÉBOURSÉ SEC | | | | 43 937,99 € | | 35122,79 |

Scenario for a design office in tracing : case studies on the Larcher sources and the Mauves basins

Civil engineering

Ikram DOUKKALI / Mohamed Oury SYLLA
Academic supervisor : Christian DEFARGE
Industrial supervisor : Nevila JOZJA



Company/institution : Université d'Orléans-Cellule R&D CETRAHE

OBJECTIVE/MOTIVATION

It is a question of highlighting, on the one hand the hydraulic connection between the losses of Limère and the sources of the karstic aquifers of Larcher and on the other hand the hydraulic connection between the losses of the Mauve de la Détourbe and the griffons (sources) located in the Mauve de Fontaine (two streams in the same basin at Les Mauves and which would be linked by fractures identified by aerial digital photography) using artificial recognition tracing, which consists of injecting a tracer at the level of losses that is harmless to animals, human beings and the environment (uranine is the tracer used in the context of our project, it gives a green color in water for a few hours maximum after injection) and to monitor its resurgence at the sources using one or more automatic samplers.



Samplers installed at Mauve de Fontaine

RESULTS

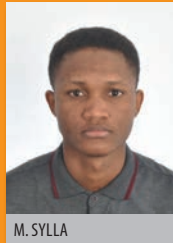
Given the nature of our project, which most often faces certain obstacles such as financial, administrative and meteorological constraints because there is a whole protocol to follow in order to obtain funding from local authorities. and the agreement of the water and environment protection authorities, we could not reach the end of the 1st application and the second could not be completed within the time limit. The tracing of the Limère losses was highly dependent on weather conditions and did not take place due to the non-compliance with the injection condition as this should take place during the flood period. As for the tracing of the Mauves basins, we managed to make the injection on 03/03/2022 and a first analysis of the samples taken will be made after 7 days from the date of injection.



View of Mauve de Détourbe after injection



I. DOUKKALI



M. SYLLA

View of the Mauve de Détourbe before injection

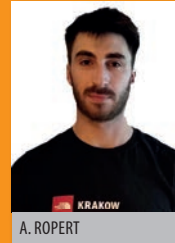
Soil diagnosis of forest plantations in the centre-val de loire region in france

Environment engineering



Company/institution : Plantaclim

Antoine ROPERT / Elisa GIGAULT
Academic supervisor : Michael Motellica Heino



OBJECTIVE/MOTIVATION

This project is part of an interdisciplinary research project called Plantaclim, funded by the Centre-Val de Loire region. The objective is to study the environmental impact of forest plantations in the context of climate change by analyzing the different physical and chemical properties of the soil of poplar, oak and pine plantations (conductivity, pH, coarse elements...). Scenarios for adaptation to climate and socio-economic change will be proposed to meet the expectations of society, limit the negative impacts on the environment and landscapes and encourage the use of local biosourced materials

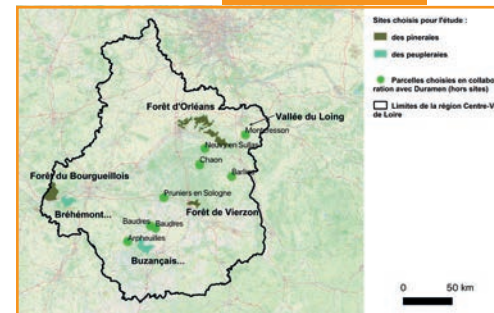
RESULTS

Following the samples taken on site, the analyzes were carried out in the laboratory : we were able to determine those oak plantations are more conducive to biological development thanks to its neutral pH, unlike pine plantations for example. Another group took over our project which was able to continue the analyzes and bring a follow-up to our conclusion. In addition, this project due to end in 2023, there are still many things to do, other plantations to analyze and other criteria to be determined.

KEYWORDS : soil, plantations, chemical, oak, pine



pl5 c3 ouest



sites etudes plantaclim



c1p1 sud v

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Study of an attachment between two elements of mixed concrete-steel structures

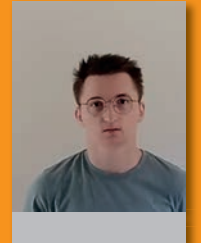
Civil engineering



Company/institution : Baudin Chateaufort

Alexis LESAGE

Academic supervisor : Naima BELAYACHI
Industrial supervisor : François Ludovic MARIN



OBJECTIVE/MOTIVATION

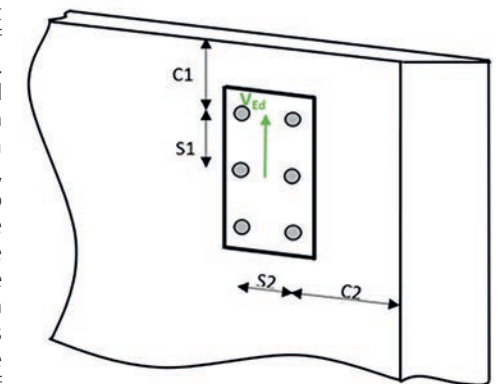
The objective of my professional training contract at Baudin Chateaufort, are to analyse steel structures, to study their behaviour and to calculate the resistance of the different elements. Baudin Chateaufort is one of the most prominent French companies in steel structure. My department at Baudin Chateaufort is specialised in steel construction, which undertakes a complete study containing a price study, the creation of plans and the calculation of the structure. To reach my goal, during the year, I participate in different projects which allow me to discover the different steps required to successfully calculate steel structures. For example, the first step is to calculate the load which is applied to the building. I use many Excel worksheets and software like SCIA Engineer, which made the whole process easier during the different stages.

RESULTS

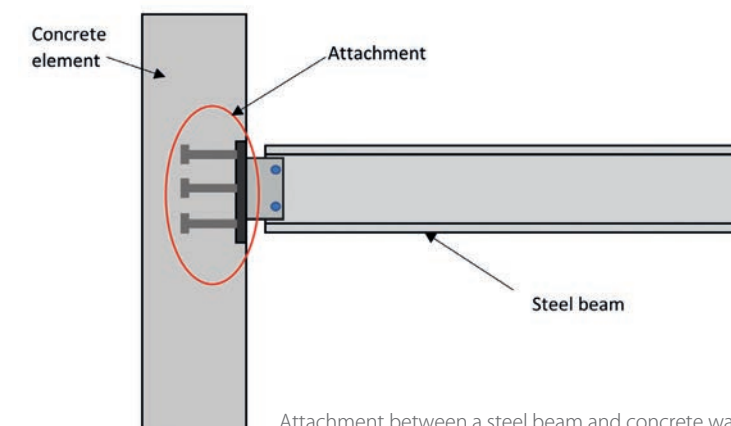
One of my projects during my professional training contract is to develop a tool to calculate

the resistance of an attachment between two elements of mixed concrete-steel structures. The first step is to read and understand the standards given by the Eurocode. After that, with an example given by CTICM, I calculate one attachment to see how it works. When I have understood each part of the calculation, I tried to automate and optimize the calculation in Excel. The worksheet shows the resistance with all possible breaking modes. At the end of my project, the goal is to have different worksheets with different configurations of attachment and that each worksheet is as automated as possible with the smallest amount of values to enter.

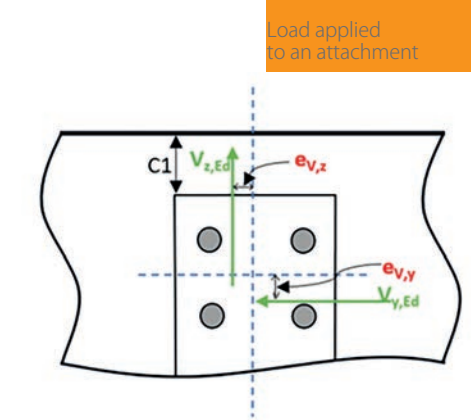
KEYWORDS : steel structure, attachment, calculation, design office



Configuration of an attachment



Attachment between a steel beam and concrete wall



Load applied to an attachment

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Study of the quality of the forest plantations soils in the Centre-Val de Loire region

Environment engineering

Laurene EUPHRASIA / Mathieu JEAN-BAPTISTE-ADOLPHE
Academic supervisor : Mikael MOTELICA



Company/institution : ISTO

OBJECTIVE/MOTIVATION

The study of the quality of the forest plantations soils in the Centre-Val-de-Loire region was a 5th year project and was related to the geo-environment and sustainable city specialty of the course "Civil Engineering, Geosciences and Environment". It was a collaboration between Polytech Orleans and the company ISTO. First, soils were collected from various locations in the forests of Orleans and Tours. Forty samples of soils were collected for this project. The characterization of soils involved making physical and chemical experiments on the samples of soils. All the experiments had to be carried out in the chemistry laboratory of Polytech Orleans.

The samples were used for these six following tests : coarse particles, particle size distribution analysis, bulk density, effective density and porosity, electrical conductivity and pH, cation exchange capacity test and nitrogen and total phosphorus tests.

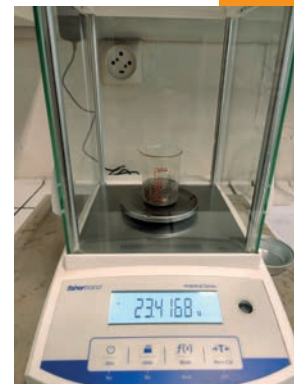
RESULTS

Results were obtained to identify different characteristics of the soils, for instance, to know if a soil is more sandy or more clayey, the acidity present in the soils, their salinity, their ability to retain water, nutrients and mineral elements that are essential for the development of crops that use these soils as a support.

The second part of the project was to make a synthesis and a diagnosis of the soil samples previously analyzed and to

determine some management recommendations of the forest plantations soils in a context of global warming.

KEYWORDS : soil, pollution, test, geosciences, environment, global warming



L. EUPHRASIA



M. JEAN-BAPTISTE

Contact : laurene.euphrasia@etu.univ-orleans.fr
mathieu.jean-baptiste-adolphe@etu.univ-orleans.fr

Study of the stone mortar interface for the rehabilitation of Notre-Dame cathedral in Paris

Civil engineering

Camille TRUCHET / Aurélie GOBET
Academic supervisor : Kévin BECK



Company/institution : Polytech Orléans

Selected participant
16th annual final year projects forum

OBJECTIVE/MOTIVATION

The Notre-Dame de Paris cathedral is one of the most emblematic monuments of Paris and more generally of France. It was built over more than two centuries, from 1163 to the mid-14th century.

On 15 April 2019, a violent fire destroyed the spire and the entire roof covering the nave, choir and transept. This was the most important fire suffered by the cathedral since its construction. President Emmanuel Macron has decided to rebuild it identically in 2020 and has promised its reopening to the public in 2024 on the Paris Olympic Games.



Our work will enable us to carry out a study of the stone-mortar behaviour to provide information on the stones and mortars that are candidates for the restoration of the cathedral.

RESULTS

Firstly, we carried out bending and

compression tests using a mechanical press to test the strength of the 4 candidate mortars (CL 90 air lime, NHL 3.5 hydraulic lime, Tradical grey lime, CEM 1 52.5 N cement). We have seen that cement has the fastest setting time and consequently a very good short-term resistance contrary to other binders. Lime-based mortars have a much longer setting time and achieve good strength after several months or years

Afterwards, the aim is to make samples consisting of a stone core with 1 cm layer of mortar, in order to assess the behavior of stone-mortar interface. Unfortunately, the adhesion tests were not conclusive and did not allow us to choose the best stone-mortar combination.

KEYWORDS : restoration, stone, mortar, adhesion, resistance



Mechanical press test



Compression test



Bending test



C. TRUCHET

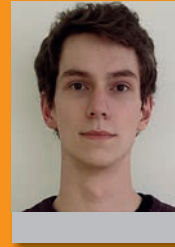


A. GOBET

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Structural engineer in alternating year, rehabilitation of a commercial gallery

Civil engineering



Thomas LOUIS

Academic supervisor : Dashnor HOXHA
Industrial supervisor : Jean-Baptiste GODEFROY



Company/institution : Ingénierie Structure

OBJECTIVE/MOTIVATION

One of my main projects was the rehabilitation of the "Galerie de France", a shopping center in the center of Chartres. The aim was to transform this abandoned mall into a bigger and unique shopping area. We had multiple openings to do, including the opening of a bearing wall which took over the load of the entire facade. We also had to create a staircase as well as a freight elevator case. As the soil wasn't good enough, we had to load the existing deep foundations, which means that we had to hang all the load that we brought to existing beams that we had previously reinforced. The last task of the rehabilitation was the verification of fire resistance to respect architect's requests and calculate the quantity of material we had to bring to resist fire.

be reinforced with metal assembling, designed with the same method as seen previously. We calculated that the floors, columns and beam of the structure could remain standing in a fire not exceeding one-and-a-half-hour using data tables in Eurocodes, (Building standards), so we will have to make them withstand for another hour and a half with a covering that could be shotcrete, plaster or another coating that has good fire resistance. The concrete walls of the structure can withstand a three-hour fire as requested by the architect.

KEYWORDS: structural engineering, rehabilitation, Chartres

Façade galerie de france

RESULTS

For the big opening in the bearing wall, the client and the inspection office agreed on the creation of a metallic assembling around the concrete that I designed manually using Excel, and the creation of two new concrete columns designed on GRAITEC software. The staircase and elevator will be held by new concrete beams and the existing one will



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Structural mechanical analysis of the nave of Orléans Cathedral by Method of Fundamental Solution

Civil engineering



R. SOMMIER



A. VANBECELAERE

Rose SOMMIER / Angèle VANBECELAERE

Academic supervisor : Dashnor HOXHA / Laurent JOSSERAND
Industrial supervisor :



Company/institution : LaMé

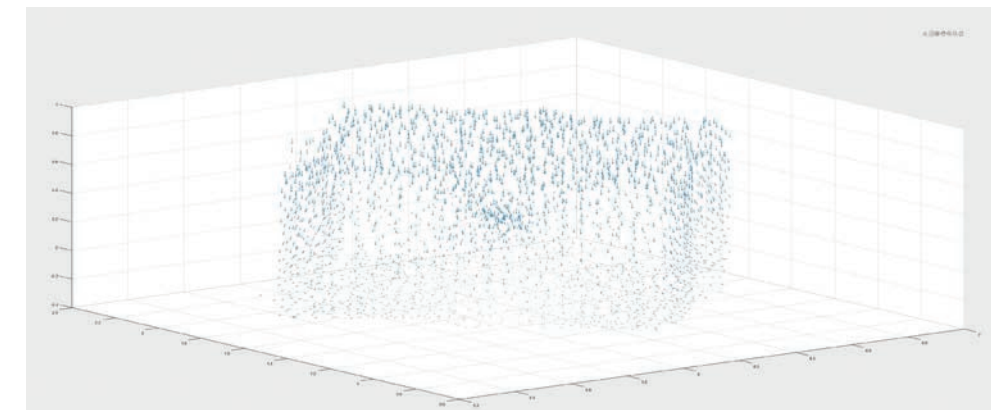
OBJECTIVE/MOTIVATION

Nowadays, 3D modelling is more and more advanced with specialized tools (3D scanner). From this modelling, it is possible to have a graphic result but not only. Indeed, in previous years the projects on the same theme developed a structural mechanical analysis procedure based on finite elements. Considered too time-consuming and voluminous, our objective is to develop a new procedure based on the method of fundamental solutions. This type of procedure is intended to analyse complex structural buildings such as the one on which the project is based, the Sainte-Croix Cathedral in Orléans and more specifically an intermediate 'culée' of the building. In addition, this project is of interest for the preservation of cultural heritage.

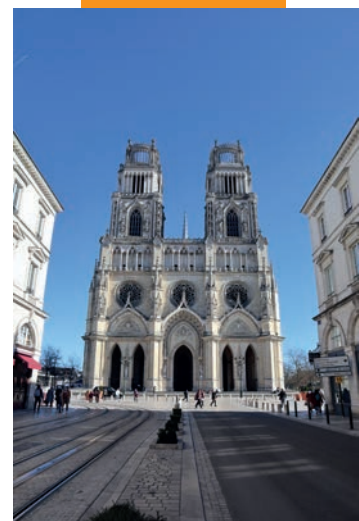


volume of the file. From the selected elements of the building, the layout is made to simplify the study and obtain a more detailed analysis. Those steps are performed with the CloudCompare software. The obtained data is then transferred to calculation software (Matlab) programmed specifically for the project. The results from the program graphically represent the stress, strain, and displacement in the element. In conclusion, this established method is less time-consuming and file size-consuming than the previous method. Therefore, the application of this procedure in companies or institutions is more likely.

KEYWORDS : modelling, 3D scanning, cathedral, structural analysis



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Waterpipes and air-conditioning pipes replacement in the underground of Paris

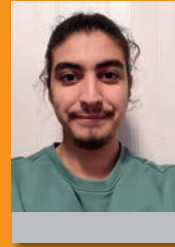
Civil engineering



Company/institution : EIFFAGE Génie Civil - Réseaux

Yaser MOUSTAHSSIN

Academic supervisor : Laurent JOSSELRAND
Industrial supervisor : Christopher LEFEBVRE



OBJECTIVE/MOTIVATION

During this time in the company, I had to start everything from scratch since I was discovering everything. First of all, I met Christopher LEFEBVRE who showed me around and explained to me how things operate. I firstly Started by understanding the pieces and parts used in our worksites since our goal was to change underground pipes around Paris. My job was to supervise and manage these worksites, by organizing a planning that shares the tasks and determine the deadlines. In addition to that I had to contact our suppliers so I could order the parts needed. Once this is done ; it comes the following step where we set up our worksites and send workers in places to do the job, and what's left is supervising and solving any problem that might pop up and disturb our rhythm. On top of that I did anything that is related to price calculation of each worksite with every detail possible while keeping a marge of profit for the company. Then submitting it to the client.

RESULTS

This experience with the company benefited me on different aspects. First things first, I managed to gain a better understanding of the professional world and change my ideas about how big companies function. Second of all, I had the opportunity to put my theory that I've been learning in action. which, I believe it helped me a lot to prosper and grow as a future engineer. Not to forget to mention, that me being a social person abetted me to blend in easily and overcome various obstacles such as stress of meeting new clients or sometimes getting overwhelmed with work. Also, I would like to thank my co-workers that have been very helpful and patient with me. Especially, Christopher LEFEBVRE. Since he was the person that monitored me and



A picture of the pipe freshly changed

taught me lot of things that made me become more efficient and confident about myself.

As a conclusion I'd like to say that I'm very grateful and blessed to have such an opportunity and I can't wait to learn more and expand my knowledge.



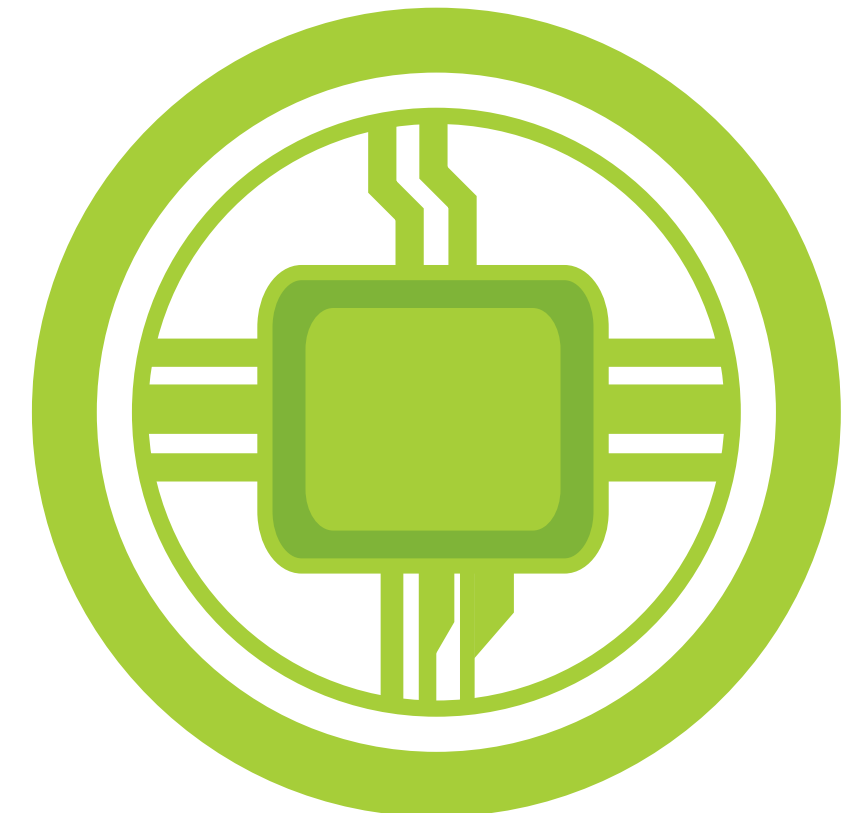
Puit de service



Worksite preparation

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Engineering Physics and Embedded Systems



Automatic Defects Detection on Mechanical Parts using Image Processing

Electrical engineering

Moulaye Driss BEN MESSAOUD / Damien POIX
Academic supervisor : R. JENNANE
Industrial supervisor : P. TAVARES

Company/institution : APERAM

OBJECTIVE/MOTIVATION

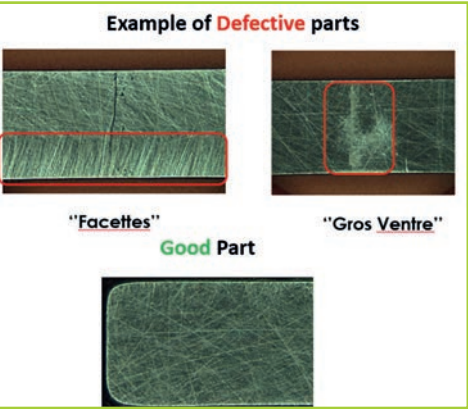
Computer Vision is a subcategory of Artificial Intelligence that enables computers to obtain meaningful information from visual inputs (camera...). It is widely used in the industrial sector. In the manufacturing industry, it can be used for production quality control. APERAM does business in the manufacturing of mechanicals parts such as pallet parts. To validate conformity of the parts, operators check them visually. To simplify the checking, the company decided to go for image processing methods to improve the checking of the pallet parts.

The proposed approach in this project consists of using image processing based methods to distinguish between pieces with and without defects and highlight parts with defects from the bad parts then classify the type of defect on the bad parts.

To allow us to confirm the feasibility of a system capable of finding defects on the pallet parts, a

phone camera, a lighting system, and the python program were used separately. The lighting system is composed of 8 LED strips. Each of these strips can be controlled with voltage to allow the user to set the light's intensity and adjust it to find the best luminosity to detect the defects. The smartphone's camera, consequently, allows us to have more details in the pictures. Two main programs enable counting the number of parts on the images provided by a standard Smartphone, processing and detecting the pieces containing defects. The detection allows us extracting features to distinguish between pieces with and without defects. Extracted features are sent to a classifier (K-NN, SVM), to distinguish between the defective and the non-defective parts.

KEYWORDS : computer vision, defects detection, image processing



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Conception of an artificial microfluidic channel for geological applications

Industrial engineering

Clément TOCABEN
Academic supervisor : Arnaud STOLZ
Industrial supervisor : Flore REMBERT

Selected participant
16th annual final year projects forum

ISTO
Company/institution : ISTO

OBJECTIVE/MOTIVATION

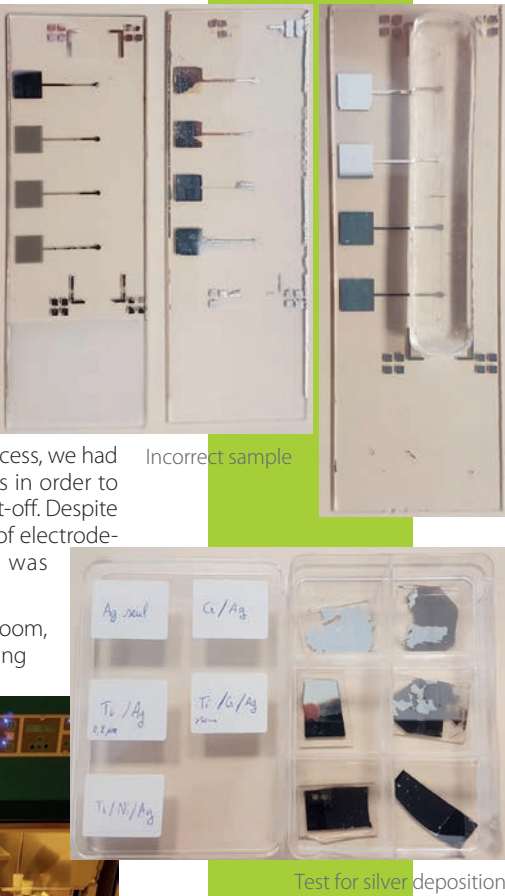
The project aims to manufacture an artificial microfluidic channel. This device should recreate a channel found in the rock matrix of the underground layer of the Earth, where some phenomena such as mineral dissolution or precipitation occur. To monitor these underground processes, geo-electrical prospection is conducted. It consists in generating an electric field in the sub-surface and measuring the resulting voltage, which can be linked to petrophysical properties (e.g., porosity, tortuosity, constrictivity). However, due to interpretation uncertainties at the macroscale, a microscopic approach is proposed to link geo-electrical signals to direct visualization of the geochemical processes of interest thanks to microfluidics experiments. The design of such a microfluidic chip requires fabricating a transparent channel, in which miniaturized unpolarizable silver-based electrodes coated with silver chloride are integrated. Obviously, these electrodes must be isolated from the liquid phase and the

manufacturing process must be environmentally friendly.

RESULTS

After two months of the project, the fabrication was done successfully. Problems have been encountered relating to several aspects of the project, such as the bad adhesion of silver material onto the glass substrate using the sputtering technique. Despite the mandatory use of an intermediary layer between metal and substrate, the best result was to deposit directly silver onto the glass substrate. Moreover, during the lithography process, we had to increase the photoresist thickness in order to improve the fabrication step called lift-off. Despite these problems, a proof-of-concept of electrode-integrated geological microchip was obtained.

KEYWORDS : porous medium, clean room, artificial channel, lithography, sputtering



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Deep Learning & Autism

Electrical engineering

Faez ABDOU

Academic supervisor : Aladine CHETOUANI



Company/institution : Polytech Orléans

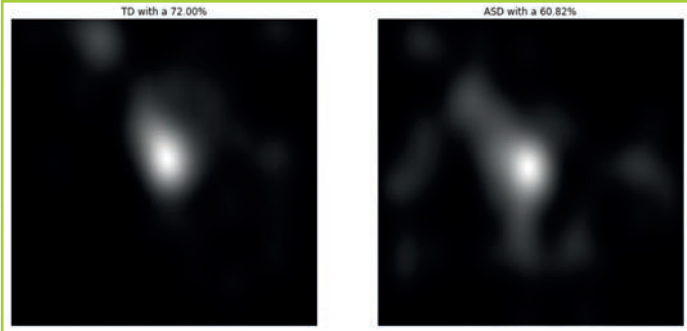
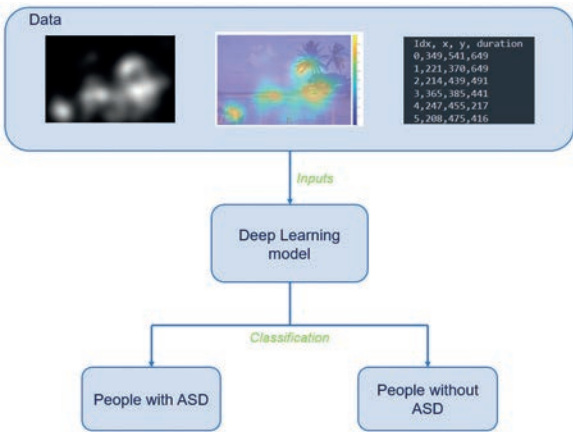
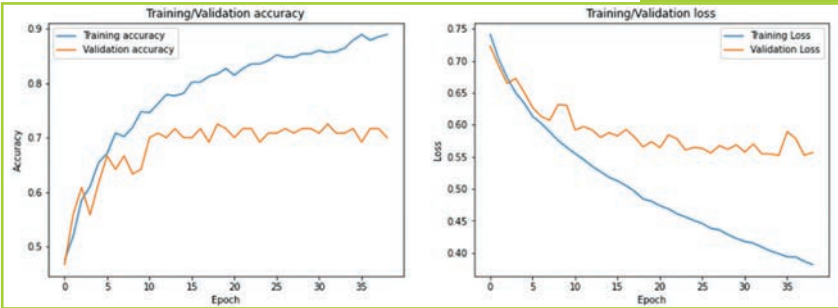
OBJECTIVE/MOTIVATION

Test deep learning model for classifying data from people with and people without Autism Spectrum Disorders (ASD).

RESULTS

After the training of the model using saliency maps, the deep learning model was able to correctly classify 70% of the data with more or less accurate results. But this is not enough since the goal was to have at least 90% accuracy.

KEYWORDS : deep learning, autism spectrum disorders



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Engraving on glass with a femtosecond laser

Industrial engineering

Honoré FORTIN / Bastien EGOT / Mélanie LOHIER

Academic supervisor : Barthélemy ASPE

Industrial supervisor : Alex CAPELLE



Company/institution : GREMI

OBJECTIVE/MOTIVATION

This project, carried out by the GREMI laboratory in collaboration with the engraving company Decor World Service (DWS), aims to use a femtosecond laser to create decorative etching on glass for the luxury industry. Nowadays, CO₂ lasers (with continuous waves or nanosecond pulses) are commonly used for this. However, this type of laser creates a strong thermal effect on the glass during the etching. Using a femtosecond laser would lead to engraving free of thermal effect and therefore to a more precise, thin, and clean drawing. The effect of the femtosecond laser on glass is rarely present in the literature. The project will highlight the engraving possibilities through the study of the influence of the process parameters (the laser power, focalization, covering ratio, the angle of incidence and the laser wavelength) on the glass etchings, characterized in Polytech's cleanroom.

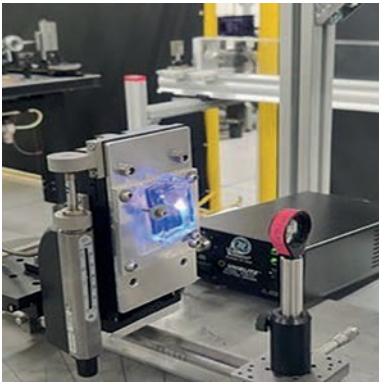
RESULTS

The first tests show some positive results. Indeed, the study of the influence of the laser energy has enabled a clean engraving over one line with clear impact and minimal cracks on the glass. Even though the single line is hardly visible to the bare eye (~10 µm large), it could be used to create a larger pattern with thin details. For now, a major problem lies in the fact that the engraving occurs through the sample, on the backside and not the topside as expected. This might be caused by the low absorbance of glass at the laser wavelength or by a lack of precision in the focalization. Further tests are currently undergoing to optimize the engraving process parameters in order to preserve a clean and precise etching while engraving a more complex pattern.

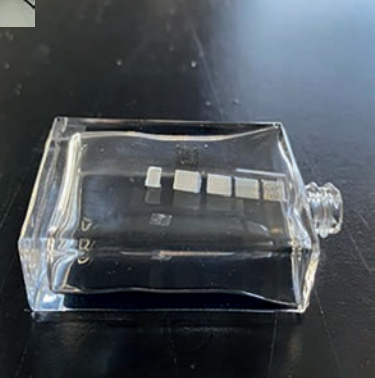
KEYWORDS : laser engraving, laser-glass interaction, femtosecond laser



A sample on the numerical microscope being characterized in the clean room



Glass sample being engraved with a visible laser impact



A sample with engraving on top

H. FORTIN

B. EGOT

M. LOHIER

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Fast imaging with CCD camera

Electrical engineering



Company/institution : POLYTECH and GREMI

Héloïse ABBÉ / Bastien PLANTE / Zakari PAULSEN

Academic supervisor : Sophie RAGER

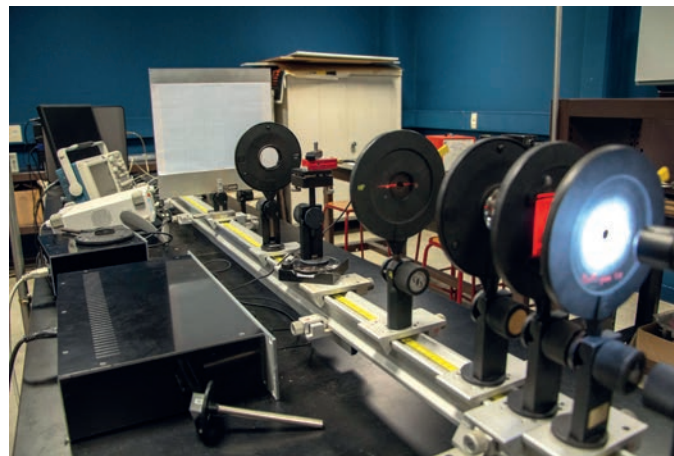
Industrial supervisor : Sylvain ISÉNI

OBJECTIVE/MOTIVATION

The aim of the project is to create a fast-imaging camera system using a CCD camera.

The researcher wants to study a plasma discharge using the CCD camera he already owns. However, the camera has an acquisition time around 10ms while the plasma phenomenon is around 1μs long (1 000 times faster).

Therefore, the objective of the project is to create an optical assembly using an external shutter to reduce the acquisition time of the camera.

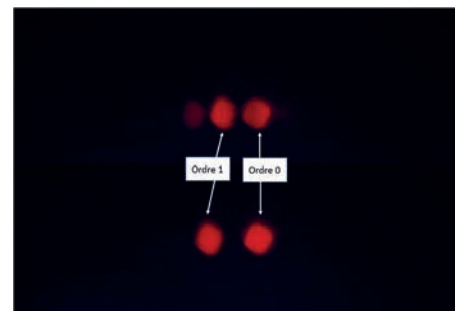


Optical assembly

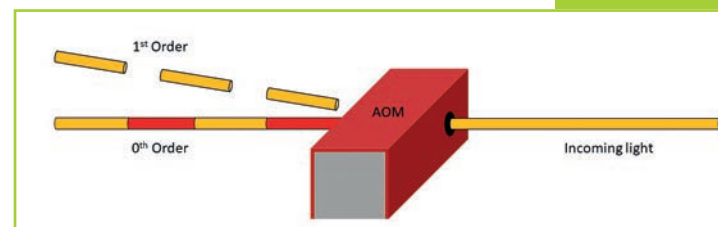
RESULTS

We have decided to choose between the use of an Acousto-Optic Modulator and a Pockels cell to perform the gating operation. We characterized and experimented with both to comprehend what may or may not work. We have been facing some difficulties with the optical system. In fact, the image of the plasma needs to go through the shutter which has an opening height of 2mm. This difficulty, in addition to the constraints of the wavelength bandwidth of the project, have lead us to give up on some of those constraints to make a proof of concept (POC). Once we reached the point where the POC is working, we aim to update and improve our system along the lines of the first unmet constraints.

KEYWORDS : CCD camera, optical shutter, optical engineering, instrumentation



Optical results



H. ABBÉ



B. PLANTE



Z. PAULSEN

Industrial Engineering applied to Cosmetics, Pharmacy and Food Processing



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5S Informatic Project on Teams channel at Novo Nordisk

Industrial engineering

Laura FERNANDES ROMANELLI BERNARDI / Marie-Amélie FONTANET-FELIX
Academic supervisor : Audrey HIVET
Industrial supervisor : Camille VENTROU



Company/institution : Novo Nordisk

LEAN Visual synthesized of 5S Strategies



OBJECTIVE/MOTIVATION

Novo Nordisk is a Danish company responsible for 50% of insulin production with one of its main production site located in Chartres (France). After the Covid-19 pandemic, all the managers (aka. Leaders) started to use TEAMS software to exchange and to share documents faster. However, some files weren't correctly shipshape inside folders, making it difficult to find information and increasing risks of files duplication and use of an old file. Moreover, this implies bad communication between both leaders and employees (as an example, only 50% of people see the weekly documents). The project's objectives are to optimize the storage,

sharing and communication of documents between managers and their teams. To do this, we must implement a 5S method which aims to improve the workspace by eliminating the useless, tidying, cleaning, standardizing, and perpetuating.

RESULTS

As the objectives were to organize the work interface, define an ideal, simple and intuitive structure for storing and naming documents and design tools to help maintain and perpetuate the method, we have created some procedures to formalize all of these strategies and facilitate their understanding by the leaders of Novo Nordisk. We also have created tools to facilitate the use of standards and sustain the deployed method: a file naming generator and a checklist for the monthly control. Finally, we have carried out a visual synthesizing the strategies to remind the defined rules to all users. These different documents will be accessible to all members in one of the main folders of the Leaders Teams channel.

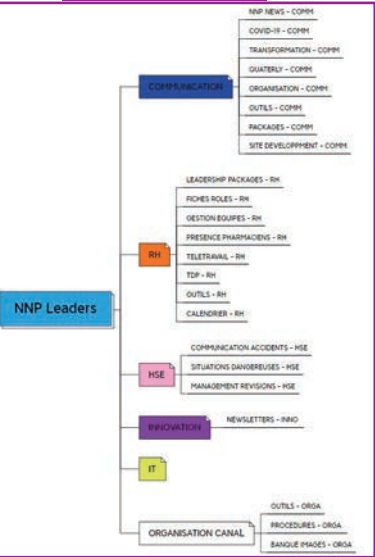
KEYWORDS : 5S, informatic, communication, TEAMS



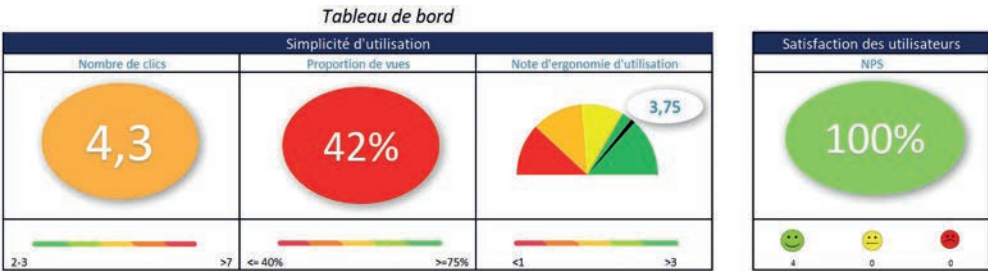
L. BERNARDI



M. FONTANET



Tree structure of Teams channel



Initial (Project) Dashboard

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5S of a non-production area

Production engineering

Elisa CIACCIO

Academic supervisor : J-P. BLONDEAU
Industrial supervisor : A. PATERNE



Company/institution : L'Oréal, Cosmétique Active Production



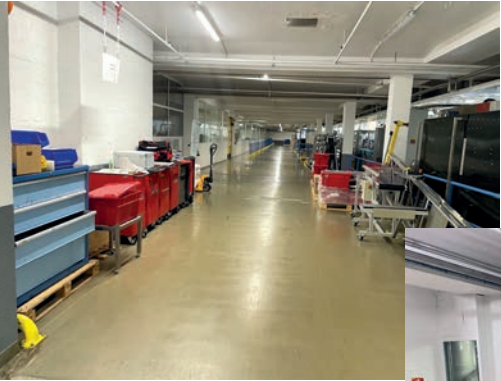
OBJECTIVE/MOTIVATION

Due to the very strong growth of the production site, some non-priority tasks were left pending. The opportunity to have my help made it possible to launch this project. The objective was to sort, de-clutter, tidy and clean a non-production area of the production unit. This area was mostly made up of stagnant technical parts due to numerous machine modifications to accommodate growth. We needed to reclaim these floor spaces to position strategic elements: pallets of consumables, parts for format changes, etc.

no longer in accordance with the company's standards. Finally, we standardized the visual management of the area by inserting new markings and new displays, particularly for consumables. To perpetuate the actions, an audit was created to verify that the area remains in good condition. Now, the area is useful, orderly, and clean.

KEYWORDS : 5S method, sorting, standardization, sustainability

Area before our intervention



Area after our intervention



RESULTS

Today, the area is tidy, and each item present has its clearly defined location. A complete inventory has been made by putting in parallel the place of each object. Then, the area was cleared, each element was put away. Afterwards, the cleaning allowed us to clean the space and to remove the old floor markings that were



Example of product

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Change capsules for capsules without titanium dioxide

Production engineering

Emeline LEFEBVRE
Academic supervisor : Luc DELPLANQUE
Industrial supervisor : Charlotte PERGEAUX



Company/institution : Adare Biome



OBJECTIVE/MOTIVATION

The objective of this project is to find a new supplier who sells capsules without titanium dioxide (TiO2) in early August. This project is due to several changes in regulation about titanium dioxide. This molecule is found in the food product as an additive colorant. It is also used in cosmetic products because TiO2 absorbs UV rays. Today, the European Commission prohibits the use of TiO2 as of August 2022 in food because some research proves that the use of TiO2 is dangerous for human health. Since, Adare Biome has capsules with TiO2, the company needs to find new capsules without TiO2 before August 2022. These capsules must respect some constraints like the size, color, and the supplier must have some certifications. The

several tests with packaging machines to validate their utilization. Today, we can't choose a supplier because the quality and marketing department do not agree about the color of the capsules. Once a decision will be made, we can easily decide on the supplier. If the white color is selected, we will decide on the supplier that offers that color. If clear color is selected, we will choose the other one because the price is lower.

KEYWORDS : titanium dioxide, supply chain, supplier, capsules

RESULTS

We only study suppliers already used by Adare because there is not enough time to certify a new supplier. So, I examined three suppliers. Only two are selected to purchase some orders to receive capsules samples because one is too expensive. The marketing department is evaluating the attractiveness of capsules to the customer. Simultaneously, the quality department makes



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Closure of packaging lines

Industrial engineering

Camille SERRURIER
Academic supervisor : M. POTELLE
Industrial supervisor : B. FOURNIER

Company/institution : Astrea Fontaine, Fontaine-lès-Dijon

OBJECTIVE/MOTIVATION

At Astrea Fontaine, drugs are produced in dry and solid forms. One of my projects in the packaging department is to close the packaging lines. In fact, at the start /beginning and the end of each day, the operators have to blank or fill them with packaging items (cases, leaflets, labels, boxes...) for quality and economic reasons. Indeed, the operators can inadvertently exchange notices or boxes in the stock in the production lines. On the other hand, the blank /the emptying and filling of the production lines has a financial impact estimated at a loss of 60 euros per production day and line. Thus, the objectives of this project are the reduction of wasted time and the risks of non-quality incurred.

RESULTS

First of all, specifications have been done / written. Then, mobile manual forklifts have been purchased to replace the fixed lifting tables currently present in

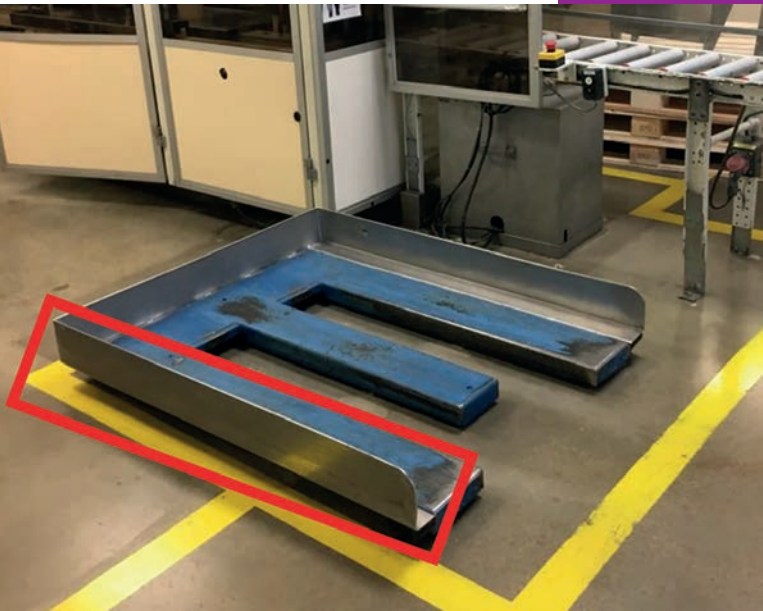
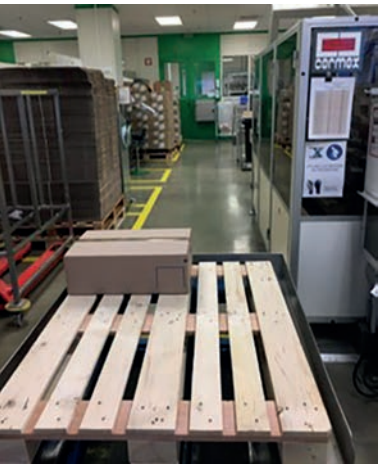


Table fixe



Ligne

order to put doors that will allow the closure of the secondary area of the packaging lines. This mobile manual forklifts can be moved easily and stored in a dedicated area identified for this purpose. This solves the problems of safety and ergonomics of the workstation. After this task completed, door suppliers were contacted in order to obtain quotes. Two quotes were compared. Then, doors for each packing lines were ordered. Afterwards, they were implemented. Finally, new procedures were drafted. This procedures are adapted to the new equipement put in place.

KEYWORDS : packaging, quality, muda, forklift

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Continuous improvement in the filling department

Industrial engineering



Company/institution : PUIG

Safia OUKAL

Academic supervisor : Audrey HIVET
Industrial supervisor : Julien GHIRARDO



Working on the
new practice



OBJECTIVE/MOTIVATION

PUIG is a third-generation family-owned fashion, cosmetics and fragrance business based in Barcelona. Its products are distributed in 150 countries around the world. Since 1976, the group has had a production site in Chartres, where 6 of the top 10 references are produced. Sustainability is a part of the company's way of doing business. Through my internship, I have been entrusted with eliminating loss (or Muda) in any form, whether it is waste in the production process or time without added value (as in the format change). I am working in the filling department where we fill and package every perfume bottle in a very automated way. Using the company resource planning SAP, I was able to gather many data about the production department in the last year that will allow me to analyze and target the critical points.

RESULTS

The analysis process is still in progress. Once all the data are processed, I will be able to target our most problematic component and gather a work group in order to implement an action plan.



PUIG site in Chartres

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Continuous improvement in the FlexTouch maintenance department

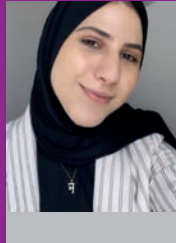
Industrial engineering



Company/institution : Novo Nordisk Production

Fadwa LAHLOU

Academic supervisor : Gilles HIVET
Industrial supervisor : Christophe ROUSSEAU



OBJECTIVE/MOTIVATION

Novo Nordisk is a Danish global healthcare company and leader in diabetes treatments. I had the opportunity to join this company at their site in Chartres in the FlexTouch maintenance department. The FlexTouch was first implemented in the site as a project in 2020. Now, it's among Finished Products. In the context of ramp up, newest technologies and lines, the maintenance department has pointed out the need to have more support to manage the follow-up and traceability of investigations and problem-solving tools such as A3 and Long Stop Board LSB. I'm working also on Failure Investigation Trea FIT and Maintenance Works Description MWD in collaboration with technicians. Furthermore, I'm in charge of planning and following up technician trainings and assuring that technicians are working in compliance. The goal is to reach the objectives of OEE1 by reducing stops and improving the availability and performance of equipment.

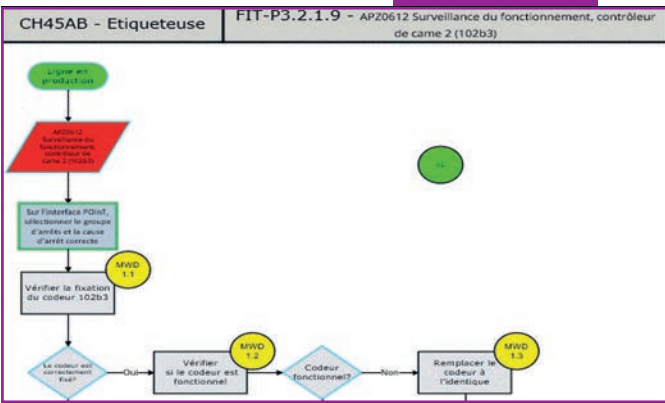
RESULTS

The training part: a major advance is noticed by the implementation of a training board, and a flowchart to pursue the training in a certain logic for both the packaging and the assembly lines and a schedule

on going to plan trainings. This part involves different persons : operators, quality coordinators, engineers, and technicians. Therefore, there is a big work on the coordination and the planning to anticipate trainings and form technicians as soon as possible regarding the stops and the training requirements.

Investigation & FIT : An A3&LSB board was created to follow up definitive actions taken after opening a new Long Stop Board or an A3 on going. In addition, I created some indicators to follow up the tools used in Maintenance department A3&LSB and FIT&MWD.

KEYWORDS : maintenance, FIT, MWD, A3, long stop board



Extrait d'une FIT

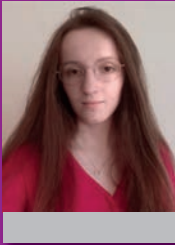


Novo Nordisk site de Chartres

Contact : fadwalahlou1999@gmail.com

Continuous improvement in production

Industrial engineering



Marion LEFEBVRE
Academic supervisor : A. HIVET
Industrial supervisor : G. LE MAÎTRE

OBJECTIVE/MOTIVATION

The company I work for is a French pharmaceutical company that produces and supplies medicine and health products. My work as a production assistant in the filling department of the plant allows me to carry out various performance-oriented assignments. In this position, the tasks are varied. My first assignment is the updating of documentation (e.g., operating modes and procedures). I am also involved in the daily and weekly performance monitoring of the lines. Then, I will be involved in the deployment of new software for monitoring the OEE (Overall Equipment Effectiveness). I will have steering continuous improvement activities. These assignments allow me to interact with a lot of people: the operators present on the production lines, as well as with the maintenance, quality, and project departments, not forgetting the team leaders.



Isolator for the filling of syringes

RESULTS

Updating documentation is a long and consequential task that is part of various objectives and projects on the plant. The updating of documents such as batch records is part of the Data Integrity and GMP Annex 1 compliance objectives. At the end of January 2022, all the procedures and forms that were allocated to me had been updated. The remaining work to be finalized by March 2022 concerns the batch records update. The software following the OEE was launched in January 2022 on the production lines. It allows the performance of the lines to be monitored in real-time, by the production team. The main difficulties in my different assignments are to successfully involve operators in the deployment of the new tools, and the communication between the different departments and the different teams within the same department.

KEYWORDS : continuous improvement, performance, documentation



Semi processed product with caption

Contact : marion.lefebvre@etu.univ-orleans.fr

Continuous improvement in quality laboratory

Industrial engineering



Tessy VOUSTAD
Academic supervisor : Eric COSTANZO
Industrial supervisor : Audrey DERVILLEZ

GUERLAIN

Company/institution : Guerlain (site La Ruche)

OBJECTIVE/MOTIVATION

Part of the LVMH group, the House of Guerlain is a luxury cosmetic brand. The recent site of La Ruche is responsible for the global production of skincare and make-up and is the reference in technology, craftsmanship and high-quality standards. Guerlain aims to provide the best quality to the customer, and that's why the company implemented Lean Management and Continuous Improvement within the factory. The development of the Lean Management at La Ruche came with a digitalization of a performance animation tools, using the software Power BI, to improve the reliability of information and the way to access data. The goal of my project is therefore to create and implement these animation tools in the quality laboratory.

RESULTS

The main performance animation tool in the Quality service that I must digitalize is the SIM

(Short Interval Management). It's a daily meeting with all quality managers (laboratory, packaging...) where information is exchanged, and solutions are found. First, I listed what kind of data were used and discussed. Then, I had to learn how to use Power BI, which is a software program that allows to create virtual Dashboards. To digitalize the Quality SIM using a Dashboard, it's necessary to program reports, which are virtual pages that summarize data contents and data visualization. Indeed, my work consists in creating new reports or/and modifying existing ones. Currently, the Dashboard will be ready to use soon.

KEYWORDS :
improvement, digitalization, programming, cosmetics, Power BI



Site de production La Ruche (Chartres)

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Continuous improvement - Standardization process

Industrial engineering



Adrien BERNE

Academic supervisor : Audrey HIVET
Industrial supervisor : Margot LE BRETON



Company/institution : SOPHARTEX

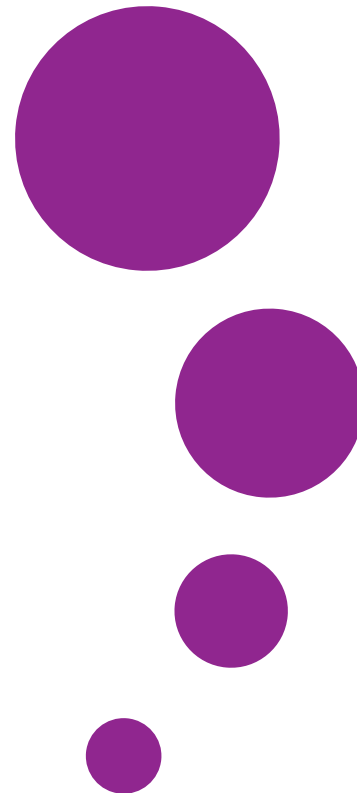
OBJECTIVE/MOTIVATION

SOPHARTEX is a pharmaceutical subcontractor owned by SYNERLAB group. The company's craftsmanship is in the manufacturing and packaging of dry and liquid pharmaceutical dosage forms. Between 2018 and 2019 the company suffered from a significant decrease in its sales revenue caused by many quality deviations and low efficiency. Following a change of management in 2019, the group took the initiative to implement a lean culture in all their production sites. The main challenge of this initiative is to consolidate each company's environment by improving quality, efficiency, and security alongside reducing lead times and costs. To reach those ambitions the company develops a strategic deployment plan. A standardization process, combined with change management, is led throughout each unit production to eliminate causes of variation, time without added value, and waste (MUDA).

RESULTS

5S are spatial organizational projects that highlight inconstancy, security, and quality deviation in a delimited area. Working with the users of each zone permitted redefining and normalizing the use of the space. The result was compliance with quality and security specifications. The standardization process was based on an important observation phase, in which, each step of the process is timed and described. Then, an improvement phase led to identifying the waiting times and the difficulties resulting in the implementation of a standard process. According to the number of batches planned, the standard describes each step of the process with an average time and specifies the type of activities the workers must do during the potential waiting times.

KEYWORDS : pharmaceutical, continuous, improvement, lean, standard



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Continuous performance improvement in production

Industrial engineering



Souhila MAMOUZI

Academic supervisor : Thomas SAYET
Industrial supervisor : Jennifer HO TCHOU LIONG

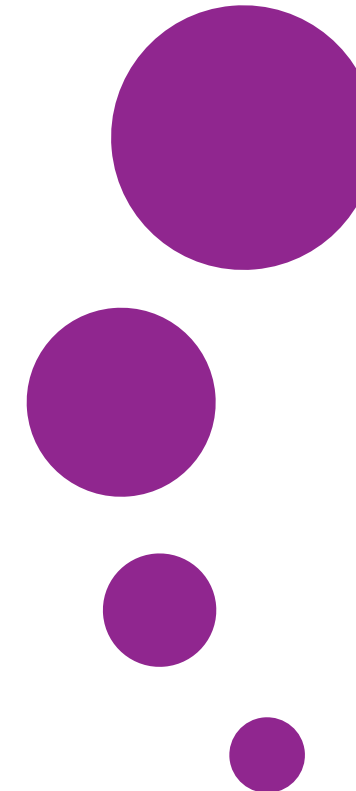
OBJECTIVE/MOTIVATION

Sanofi is a French pharmaceutical company, global leader engaged in research and development, manufacturing of pharmaceutical products. As part of my work placement, my project within the production support team consists of improving the management of Media Fill Tests (MFT), a project which is part of a continuous improvement process. The objective of a MFT is to perform filling with culture medium to simulate as closely as possible the aseptic filling interventions, to validate the process and the operators. Indeed, the scenario are created to perform the MFT with routine interventions and exceptional interventions. As the management is far too complex today, it was decided, as a first step, to reduce the number of exceptional interventions to facilitate the creation of scenarios. The work is carried out on 3 different filling suits.

RESULTS

Currently, the results are very promising, because for each box we can count dozens of exceptional interventions that can be removed.

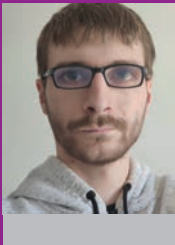
KEYWORDS : production support, continuous performance improvement



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Developing and improving digitalized monitoring solutions

Industrial engineering

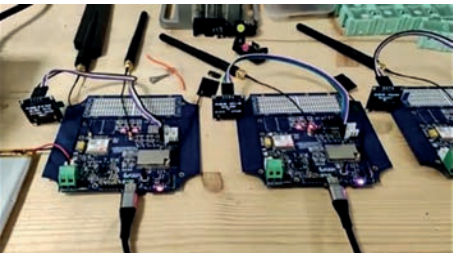


Quentin COURVILLE

Academic supervisor : A. HIVET
Industrial supervisor : D. LEROY



Company/institution : IGGO



different parameters for his sensors and masters, they could also display information on graphs for monitoring, and lastly set and configure triggers based on different value conditions. Currently, a v3.0 is being developed and it contains lots of improvements and visual optimization, but also a master geolocalization feature.

KEYWORDS : programming, improvement, 4.0, monitoring, digital



OBJECTIVE/MOTIVATION

IGGO is a French company specialized in the IoT (Internet of Things) which develops solutions for different fields such as cosmetics, pharmacy, agri-food,... One of these solutions is composed of a system with a temperature and humidity sensor, and other sensors can be added through extensions. All the sensors communicate with a master, then the data is transmitted through an API (application program interface) and finally saved in a remote database. To verify and control all captured data, a monitoring interface had to be created and an Extranet, which offers multiple features, had to be improved, those being my two major tasks.

RESULTS

To begin with, the monitoring interface has been created. It consists of the customer's facility map and every sensor represented by tags, at a place corresponding to its real position. Each tag displays every important data to the, from the sensor designation to all the captured data, and is refreshed every five minutes. Then, the Extranet is still a work in progress, though it has progressed significantly. At the beginning, clients used a v1.0 of the solution, where they could control and set

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Ergonomic optimization of a packaging line

Industrial engineering

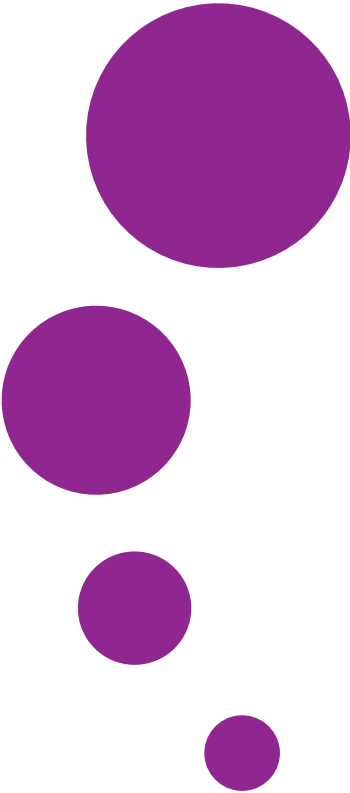


Sophie CHAMPAGNE

Academic supervisor : Benoît LE ROUX
Industrial supervisor : Sébastien BOURNEIL



Company/institution : Fareva Amboise



OBJECTIVE/MOTIVATION

FAREVA is one of the world's leader subcontractors in the sectors of cosmetics, pharmaceutical and cleaning products. The main challenge of this company is to ensure customer orders, in terms of cost, quality and delivery time. FAREVA Amboise site manufactures and packages health products. Recently one of the packaging lines has undergone major changes and therefore, the operators' workspace has been modified, which can be a source of lost time. To resolve this and to ensure that operators have an organized and ergonomic working environment, a continuous improvement project was implemented. This project involves to rearrange the layout of the material and identify the material used on the line in an optimal way, where the operators need it and when they need it.

RESULTS

Exchanging with the operators of the packaging line and observing their way of working have enable to clearly define the necessity and to draw up an action plan of the improvements to be implemented. This action plan includes, for example, the optimization of the management of material flows on the line, the reorganization of the storage of changeover pieces and the optimization of the space dedicated to the batch records writing. This project has improved the working conditions and workspace of the operators and thus avoided some loss of time or human errors. The last step is the longest and most difficult: maintain the different actions implemented over time.

KEYWORDS : continuous improvement, pharmaceutical, ergonomic, workspace

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Flow Optimization and limit collisions between forklifts

Industrial engineering



Company/institution : Novo Nordisk, a Danish multinational pharmaceutical companybetween forklifts

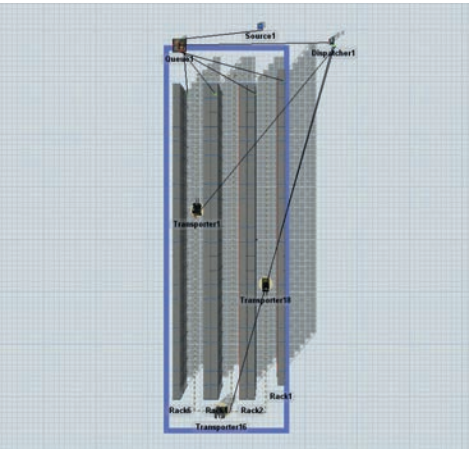
Sakina BATT/ Xuehui RUN / Wenjing XU
Academic supervisor : Audrey HIVET
Industrial supervisor : Camille VENTROU / Christian LUDOVIC

OBJECTIVE/MOTIVATION

During our 5th year at Polytech Orleans, we were asked for participating in a project with Novo Nordisk company. Our project splits into two parts : first, the forklifts in the warehouses occasionally collide with the walls and between each other. It's a major problem because it causes accidents and loss of money because of maintenance operations.

The second part is a project about smoothing of the flows of reception area. Indeed, at the reception area, the flows are irregular, and it causes a heavy workload for employees especially on Fridays. To solve our first issue, we had to make a specification with different solutions to implement in order to limit collisions. The goal here was to analyze the flow and find some scenario to avoid heavy workload. To do this, we decided to create a 3D simulation on FlexSim with what we have to describe an ideal state of the process.

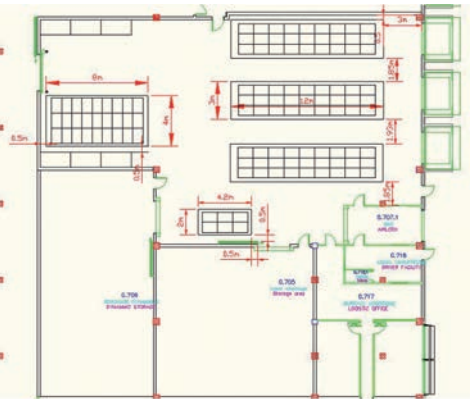
Flow direction to limit collisions modeled on FlexSim



RESULTS

Concerning the problem of collisions with forklifts, we created indicators like the number of deliveries to follow the project and make sure that our ideas are the most appropriate. We decided to add safety mirrors, more signs on the wall and on the ground to limit collisions between forklifts. We also planned to create an area for the pallets to limit collisions between forklifts and the building. We hope that a new team will continue our project. About the flow optimization, we mainly modeled our ideas on FlexSim. Here you have a picture of the digital model. We decided to separate the products in different areas and to create a direction for the traffic flow to avoid accidents. With FlexSim, it's now possible to get data like the distance travelled by the forklifts or the number of pallets in an area, that may help the reception team on its further investigation. For this second part of project, we didn't have time to carry out the solutions, but the specification was approved by Novo Nordisk.

KEYWORDS : forklifts, collisions, flow, workload, reception



Extract of the reorganization done on the company plans

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Harmonization and optimization of batch files

Production engineering

Mélie GRANIER
Academic supervisor : Mélanie POTELLE
Industrial supervisor : Géraldine VIGUIER

OBJECTIVE/MOTIVATION

I'm working in a laboratory producing food supplements in liquid and solid forms (capsule, powders). The purpose is to give the body what it needs for optimal functioning thanks to the ACN (Active Cell Nutrition).

Currently, batch files are not adapted to the needs of the operational staff, but also of the releasing staff. In addition, the direction wishes to follow the requirements of GMPs, that is to say a rigorous and precise traceability of all operations involved in the manufacture of a product. Finally, the point that initiated the request for harmonization and optimization of batch files is the difficulty in making updates. The laboratory produces a very wide range of products (about 50 products). For each of them, there is a specific manufacturing and packaging record which increases the number of batch files to be modified.

RESULTS

The goal of the project is therefore to harmonize and to optimize batch files. The objective is to review them in their entirety (contents, documentation system, process, controls). This requires a study of the needs of operators, but also of releasing staff, an identification of the critical steps of production and a modification of the document management of files.

To do so, batch files will be automated on Excel. For example, for the liquid production area, there will be only one Excel file for the conditioning document that can be applied for each product and format. In the case of an update, it will be necessary to modify 1 document instead of 30. Also, the processes have been standardized (dissolution of raw materials, process types relative to batch size for example).

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Implementation of a computer 5S in the Quality department of a pharmaceutical industry

Industrial engineering

Marie-Charlotte DURAND
Academic supervisor : Cecile CAPDESSUS
Industrial supervisor : Isabelle VORON



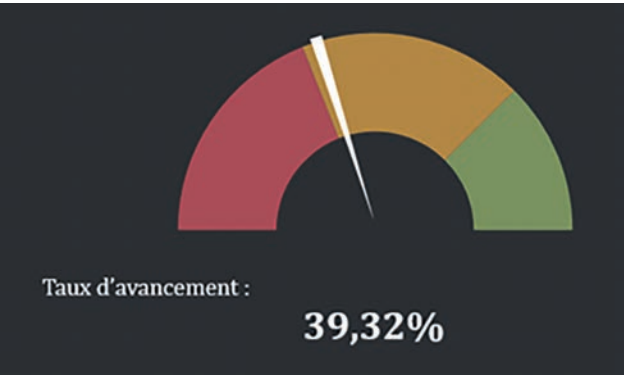
OBJECTIVE/MOTIVATION

My company is a multinational plastic processes company that developed in the United States in the 1940s. Within the pharmaceutical branch, we find my company, composed of two poles, in Granville and in Brecey. In the Granville pole (50), the quality department found itself in need of a computer 5S. Indeed, folders are not arranged by a tree view, there are no clear archives, files are renamed without precise and common nomenclatures, etc. Following this idea of harmonizing communication and facilitating the intuitiveness and autonomy of the computer workspace, I, therefore, suggested to set up a computer 5S. This assignment seemed to be a major asset to discover the service and get familiar with Quality Assurance. Furthermore, it was an opportunity to work with my colleagues, as the 5S is a collaborative approach.

RESULTS

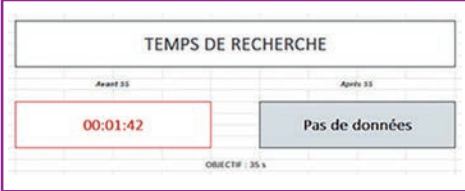
Currently, the computer 5S is still ongoing. I built my 5S approach during the first weeks of October. After proposing an action plan and a retroactive schedule to the colleagues concerned by this project, I held a brainstorming meeting on a key point of the 5S IT : the tree structure. Once it was done, I cleaned the tree structure and deployed the approach to my colleagues. To date, the cleaning phase has begun. Four folders have been created on the workspace : useful, indeterminate, archived, and regular. During the sorting and storage phase, the files used each day were available in the "regular" folder. The other three folders were buffers for the sorting phase before the creation of the tree view in the disk. The end of the 5S is set to mid-April and I set indicators for the project.

KEYWORDS : computer 5S



Indicator of progress

Indicator of research rapidity



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Implementation of a European tool for monitoring finished product inventories

Industrial engineering

Mathilde VIAUD
Academic supervisor : Jean-Baptiste VIDAL
Industrial supervisor : Julien PERGAY



OBJECTIVE/MOTIVATION

The Mars Group is an international family-owned company, with its headquarters and one of its factories based in Saint-Denis-de-l'Hôtel (STD) in France. Mars Petcare manufactures and distributes dry and wet products for dogs and cats while respecting five fundamental principles: quality, responsibility, mutuality, efficiency, and freedom. The challenge of the supply chain at the Saint-Denis-de-l'Hôtel site is to meet the needs of customers within the required timeframe and to ensure the availability of all Petcare products sold on the French market while respecting the stock policies agreed with the different factories. My role as an apprentice stock coordinator is to accelerate the continuous improvement process of the Sales & Operation Planning department through the optimization of processes and the implementation of action plans in order to gain efficiency and reach the set objectives.

are the reliability of the data and the time needed to update the data daily. The use of this new tool is in line with the objectives of the service and has many advantages. Firstly, it is supported and maintained by qualified teams from Mars Europe. In addition, the new tool allows to analyze data with a daily duration lower than one hour. Finally, the reliability of the data will be improved since the new tool will have a tolerance of more or less 5% of errors.

KEYWORDS : supply chain, project management, continuous improvement, optimization, data reliability

RESULTS

The project I am leading consists in implementing the last version of a generic solution developed by the IT services of Mars Petcare Europe. It allows the visualization of the inventory situation of the Petcare activity sector for the French market. It was decided to implement this new tool because currently an excel solution specifically developed locally is used. The unsatisfactory points of this tool



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Implementation of barcode readers

Industrial engineering



Sandra NGUYEN

Academic supervisor : Ziad DAHER
Industrial supervisor : Alexandre TINGRY



Company/institution : PASCUAL Cosmétiques

OBJECTIVE/MOTIVATION

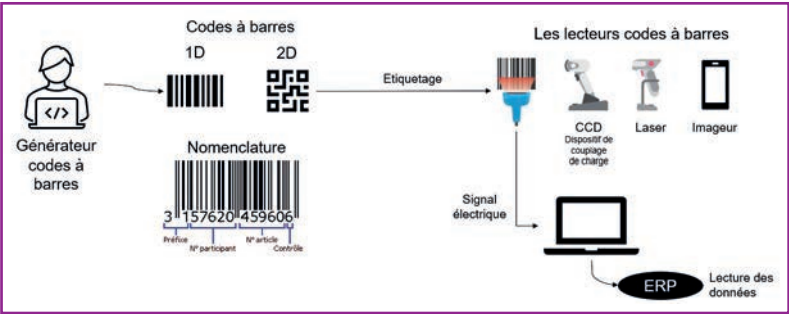
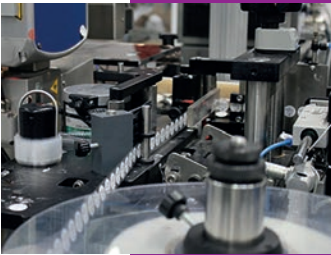
Pascual Cosmetics is a cosmetic subcontractor since 2010, that produces cosmetic products such as lipsticks, nail polish, foundation for luxury brands. Pascual Cosmetics is part of the Anjac Group. It is located in Ferrière-en-brie, in Seine et Marne. The company support cosmetics brands during all the process of creation and production of their products. Pascual is constantly evolving and is in the process of re-establishing the factory since joining Anjac. Working as an apprentice in continuous improvement in production department, my main project concerns the implementation of barcodes readers on the whole production flow. The project started in December. The aims are to enable data reliability, product traceability and production monitoring in real time.

RESULTS

The strategy consists in studying all the process in order to define the way to collect data information quickly and link information in the same software. There has been a first step of collecting information from the flow, defining limits of installation and defining production needs. I also work with the

supplier of our ERP system to define the scanning steps, the possibilities in terms of equipment and installation. There are currently problems with the compatibility of the company's different software. This is a problem that needs to be solved in order to move forward. Afterwards, we will have an equipment installation phase and a test phase. We expect to finalize the installation in June in order to start the test phase. The aim is to be operational in September 2022.

KEYWORDS : continuous improvement, barcode readers, traceability, quality, information



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Implementation of indicators in the manufacturing department

Production engineering



Anaïs JOLIBERT

Academic supervisor : Ziad DAHER
Industrial supervisor : Anil MUTLUAY



Company/institution : SOPROREAL

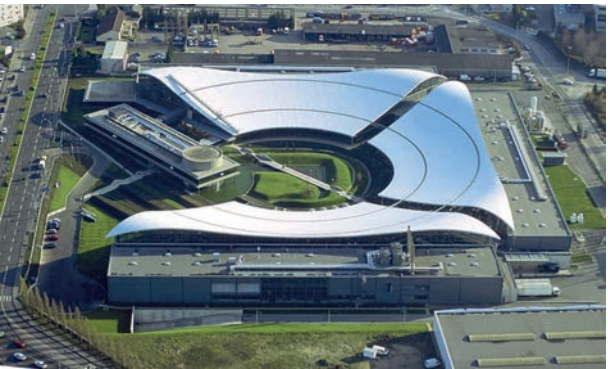
OBJECTIVE/MOTIVATION

The SOPROREAL plant is one of the four factories of L'Oréal's Luxury Product Division since January 1st, 2021, following a transformation project : the "Equilibre" project. It has indeed moved from the production of creams to the production of perfumes. The manufacturing department at SOPROREAL is responsible for producing the various juices that will then be packaged in perfume bottles. The main challenges of the manufacturing department are to produce "Good at the first try" juices, which means compliant juices, respecting quality and hygiene rules. Besides, other issues of the manufacturing department are to respect production plans and to be flexible. That's why it is important to implement indicators within the manufacturing department, to allow us to assess the performance in order to size a budget but also to manage people, since they allow us to see if we need staff.

RESULTS

We have chosen to develop performance indicators measuring the efficiency of SKIDS (production module) and weighting indicators, as the manufacturing department is also in charge of the centralized weighing of the plant. The equations and parameters of each of these indicators has been determined. Then, I worked on how we were going to collect these parameters. I have created an excel file containing all the parameters to be recorded in order to calculate the performance indicators. I sent this file to the SKIDS provider, so that they could create a program to collect these different parameters. The quote for this has been established and the program will be provided in March. Regarding the weighing indicators, the IT department is working on computer queries to extract the weighing times. They should be ready for February. The next steps can then be taken.

KEYWORDS : cosmetic industry, luxury field, indicators, performance



SOPROREAL

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Implementing of monitoring indicators on a production transfer production

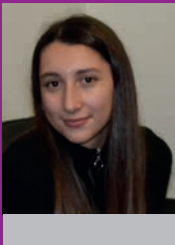
Industrial engineering



Company/institution : Delpharm

Claire ALBRIEUX

Academic supervisor : Régine WEBER
Industrial supervisor : Sonia TOUKAM



OBJECTIVE/MOTIVATION

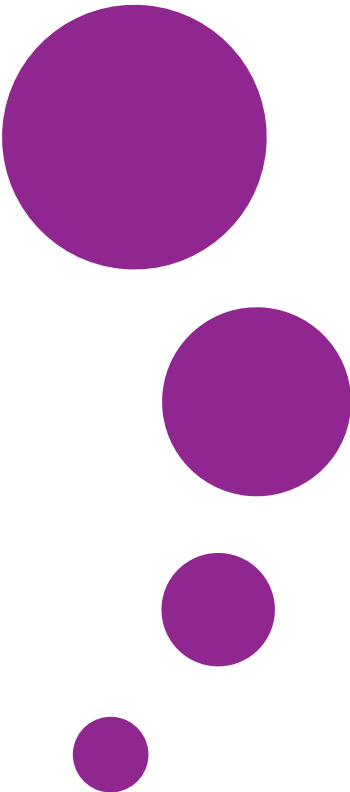
Delpharm is a French CDMO (Contract Development and Manufacturing Organization), it's a multi-expert which produces medicine. Delpharm Dijon is specialized in the manufacture and packaging of dry and injectable forms. The industrialization department contributes strongly to the development of the company because its objective is to complete successfully projects for the production. These projects are opportunities to get new customers and markets for the company. They are the future of the company, that's why they must be followed carefully. Among the various ongoing projects, one is to implement a new production process. This means setting up a new area for the production considering the different constraints (qualification of equipment, raw materials used or training of operators...). To have an effective project management, the objective is to create and set up monitoring indicators for this project.

RESULTS

Delpharm is a French CDMO (Contract Development and Manufacturing Organization), it's a multi-expert which produces medicine. Delpharm Dijon is specialized in the manufacture and packaging of dry and injectable forms. The industrialization department contributes strongly to the development of the company because its objective is to complete successfully projects for the production. These projects are opportunities to get new customers and markets for the company. They are the future of the company, that's why they must be followed carefully. Among the various ongoing projects, one is to implement a new production process. This means setting up a new area for the production considering the different constraints (qualification of equipment, raw materials used or

training of operators...). To have an effective project management, the objective is to create and set up monitoring indicators for this project.

KEYWORDS : pharmaceutical, project management, monitoring indicators



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Increase of the production capacity and valuation of production wastes

Industrial engineering



Company/institution : Adare Biome

Bruno CAVACO PEDRAS

Academic supervisor : L. DELPLANQUE
Industrial supervisor : Y. SAIBI



AdareBiome plant

OBJECTIVE/MOTIVATION

Adare Biome is a pharmaceutical and food industry of the group Adare Pharma Solutions in Houdan (78) that manufactures a drug called Lactéol, active ingredients for food supplements for humans, pet food, veterinary products, and aquaculture. To satisfy the demand of the clients but also to develop their food products and their presence in the food sector, Adare Biome decided to increase the production capacity. This global project is divided on three projects and I'm working on all projects with the Production Manager, the Qualification Manager, and the Maintenance Manager. Two of them consists of the acquisition of new devices to increase the production capacity. The last one consists of the treatment and valuation of the increase of production wastes to respect the environmental standards.

RESULTS

These projects are still in progress. together, they will ensure an increase of the production capacity. To achieve this increase, it is

necessary to not only buy new devices but also manage the impact on the environment. I did many tasks for these projects but the most important one was to familiarise myself with the devices and the preparation step of the projects. In fact, this step consists in identifying the needs of the company, calling for tenders and analysing the offers to choose the best one.

KEYWORDS : pharmaceutical and food industry, projects, increase, valuation of wastes, production capacity



Image of lactéol

Installation and qualification of equipment for a new production clean room in the pharmaceutical industry

Industrial engineering

Emilie JUIN

Academic supervisor : Cecile CAPDESSUS
Industrial supervisor : Emmanuel COUENNE

Company/institution : Aptar Pharma

OBJECTIVE/MOTIVATION

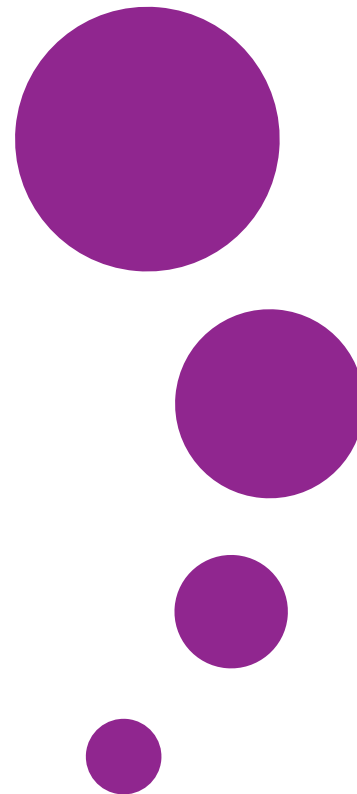
The company is specialized in manufacturing of elastomeric compounds for pharmaceutical industry such as caps, pistons and needle-shield. In recent years, the company has noted a sharp increase in customer demand. To meet this demand, the company has decided to implement a strategy to increase production capacity. One of the main projects is the creation of an extension of the plant including four production clean rooms. Finally, the latest project is the construction of the first production clean room in a other site in the US. My main assignment during the short company period is to implement activities related to the installation and qualification of the equipment of one of the clean rooms. In order to meet the deadlines, it is necessary to coordinate the different actors. During the longer period, I will carry out the same mission on the project in the United States.

RESULTS

We encountered a delay in the delivery of one of the equipment. Due to this delay, we had to shift the delivery of all the other equipment and coordinate the different external companies and internal actors in order to match their availabilities with the delivery of the equipment. I was able to carry out various missions within the Engineering department. Indeed, I was able to coordinate the delivery and installation of the equipment and carry out qualification stages as "Site Acceptance Test", "Installation Qualification" and "Operational Qualification". The performance qualification still needs to be completed when the clean room and all equipment will be qualified. During this period, I was able to be autonomous in my work and learn to adapt to unexpected situations such

as equipment delays. Finally, from mid-March I will do again the whole project but in the United States.

KEYWORDS : injectable, pharmaceutical, engineering, project, qualification



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Logistics quality Support

Industrial engineering

Sabrina AREVALO

Academic supervisor : Mélanie POTELLE
Industrial supervisor : Stéphanie BLATGER



Company/institution : BOEHRINGER INGELHEIM

OBJECTIVE/MOTIVATION

BoehringerIngelheimToulouseis a production site for veterinary pharmaceutical and biological products where 431 collaborators work. 4 categories of galenic forms are produced : topical solutions, pill, injectable and biological drugs. My main objective with this apprenticeship is to make the connection between logistics and quality assurance. The pharmaceutical industry requires compliance with regulatory requirements to ensure the quality and safety of the products manufactured and this requires compliance with GMP (Good Manufacturing Practices). My aim is to make sure that the documentation is constantly updated, so the documentation should be clear, with explicit content and exact correspondence with reality.

RESULTS

The strategy consists in analyzing all logistics deviations. If to close this deviation, it is necessary to make corrective and preventive actions with documentary update, I change the quality document to incorporate the new actions, while always ensuring that the GMPs are respected. During inspections and audits, quality documents are checked to verify that they are in compliance with pharmaceutical regulations. We have quality plans which mention all the documents that need to be reviewed in the year (obsolete documents, documents that require changes because there is a deviation...). In 2021, 95% of the documents planned were revised.

KEYWORDS : quality, logistics, documentation, pharmaceutical industry

Warehouse



Rack Warehouse



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My project based on 5S methodology

Industrial engineering



Camille ORTENZI
Academic supervisor : M. HIVET
Industrial supervisor : M^{me} MUCHA

Company/institution : Pierre Fabre

OBJECTIVE/MOTIVATION

For my last year at Polytech Orléans in industrial engineering, I am doing my apprenticeship at Pierre Fabre, a dermo-cosmetic factory located in Castres.

I am working as an assistant engineer in production. My main assignment in the continuous improvement department is to contribute to the improvement of ergonomics, safety and performance of the packaging lines. For this purpose, my objective is to implement, train and maintain the 5S methodology in the production unit where I am assigned. The deployment of the 5S methodology will allow the operators to work in a clean, tidy and secure environment.

In the 5S methodology, there are 3 main steps : the first one is the preparation stage, the second one is the execution of the first three S's (Sort, Tidy, Clean). The last one is the implementation of the 4th and 5th S.

RESULTS

The preparation phase consists in going out into the field, talking to the operators to become familiar with the operators' needs. I did satisfaction surveys to get a numerical indicator of the current feeling of the operators and the possible things to improve on their line during the 5S.

I prepared the team composed of several operators, a technician and myself and the material needed for 5S. This preparation consists in anticipating the needs for consumables to ensure their presence at the time of the 5S project and for its maintenance.

Finally, the last steps are :

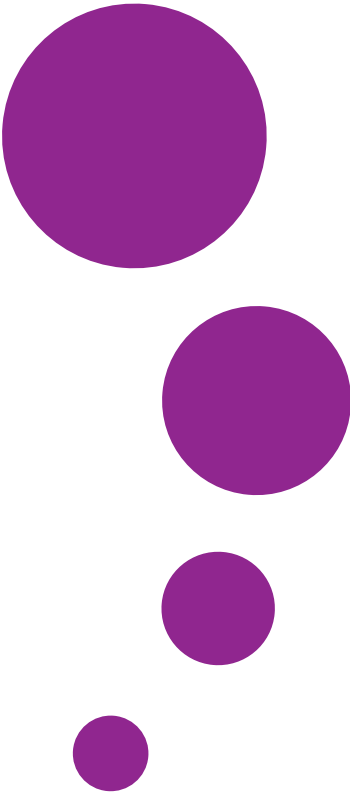
- ▶ Carrying out the 5S projects over 3 days. My role

is to accompany and manage the teams but also to coordinate the project.

- ▶ Accompanying the people in the management of the change.

Currently, one 5S out of 5 has been achieved.

KEYWORDS : 5S, production lines



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Optimization of the best-before date file

Industrial engineering



Laurane AUBONNET
Academic supervisor : Thomas SAYET
Industrial supervisor : Camille CHASSIGNOL



Company/institution : Révillon Chocolatier

OBJECTIVE/MOTIVATION

Révillon Chocolatier is an agri-food industry which is well-known for production of chocolate candies "papillotes". When packing products, the operators append a best-before date on it. This date means the duration during which the product keeps all its organoleptic qualities. It is calculated from a rule, set by the quality department, which can be different according to the product. The current tool used to calculate the best-before date is an Excel file which is composed of thirty tabs. The file is considerable and contains some obsolete item numbers or products. Moreover, there is no standardization between these tabs, and some rules can be hard to understand. The operators waste a lot of time to find the right rule by going through all the tabs. The main aims of this project are to reduce the changeover time and the non-conformity.

RESULTS

A new Excel file has been created to reduce the changeover time. The file must be simple to use

for the operators and the quality department. The operators look for a rule, whereas the quality department enters new products and updates the rules. The new file is composed of two tabs: one search engine for the operators and one database for the quality department. The database enables the quality department to add new products with the item number, the name, the family, and the rule. The search engine enables operators to enter the item number in a cell and to directly obtain the rule. Since mid-February, this new tool has begun to be used in routine. Some tasks are presently in progress to automate the calculation of the best-before date depending on the type of the rule, and to simplify the rules.

KEYWORDS : continuous improvement, optimization, agri-food industry



Révillon chocolatier Roanne site



Example papillote

Renseigner uniquement le code PF

| Code PF | Libellé PF | Règle DLUO CCF | Commentaire |
|-------------------------------|----------------------------------|-------------------------------------|--|
| 980190 | EC REV ETUI FRITURE LAIT 190G | Fin juillet année N | |
| Familie REVILLON Pâques | | Code BBN (si monoproduit) + libellé | Informations complémentaires Code Weiss Code Valrhona |



Best-before date example

Schematic new tool search engine

Contact : laurane.aubonnet@etu.univ-orleans.fr

Preventing risks and well-being at work

Industrial engineering



Walid MOUSTAGHFIR
Academic supervisor : Gilles HIVET
Industrial supervisor : Wejda VERNIER



Company/institution : Stallergenes Greer

OBJECTIVE/MOTIVATION

Stallergenes Greer is an international biopharmaceutical company specialised in the treatment of respiratory diseases by allergen immunotherapy. I had the opportunity to join this company and I am part of the HSE (Health, Safety and Environment) department.

My work experience project is to improve the safety system in new projects within the company. I carry out field safety audits to ensure the safety of the sites. I validate the prevention measures put in place before each intervention, I make a risk analysis and safety sheets for new equipment. I also develop a methodology for analysing accidents using a root cause approach, after which I implement an action plan to eliminate the source of the risks.

I am also involved in improving the safety culture and well-being at work of the employees by carrying out actions in the 2022 prevention program and by improving the single document for assessing professional risks.

In the near future, I intend to improve the analysis of accidentology and to ensure the proper transmission of safety information within the various departments.

KEYWORDS : HSE, Risk, DUERP, project, safety sheet

Example of stallergenes product



RESULTS

Currently, I have defined the appropriate personal protective equipment to be used for the new operations, I have carried out a risk analysis on a new production and packaging line in order to correct the non conformities. I carried out a study of gestures and postures which enabled me to choose the appropriate handling equipment.

I created a document and an indicator for field visits, to encourage people to go out into the field and to keep a record of the places visited within the company, which will enable us to monitor what is happening in the field.

Site stallergenes, Antony



Contact : walidmoustaghfir160@gmail.com

Production improvement project through a software deployment

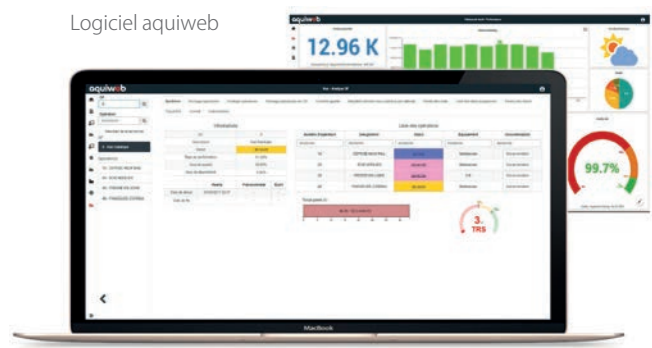
Industrial engineering



Safa DLIAA
Academic supervisor : Edgard SEKKO
Industrial supervisor : Sandrine MALLET



Company/institution : Delpharm



OBJECTIVE/MOTIVATION

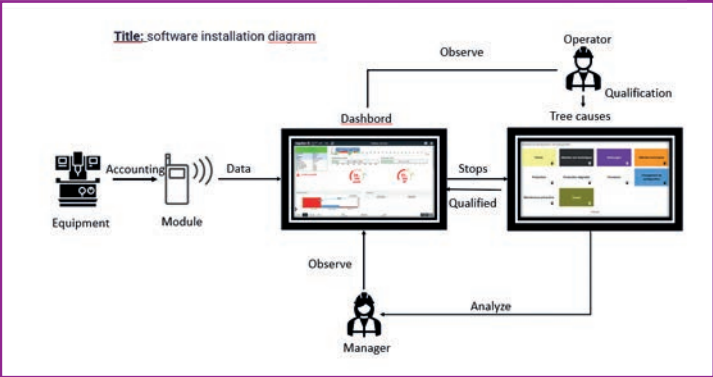
For my apprenticeship, I am working at Delpharm Saint Remy as a production engineer and my main goal is to improve the production department KPI, especially the OEE. To achieve my assignment, my role is to manage this project. To produce a new product, the production department needs to increase the performance of the production lines. Previously, the performance was measured through a manually filled sheet of paper on the shopfloor. It caused a lack of information and an unreliability of the duration of stoppage on the lines. We needed a new way to measure with precision the performance. To respond to these needs, Delpharm choose to deploy a software program, which measures the OEE and justifies the stops. The operator will justify the stoppages with a tablet on each equipment. We created a stop cause tree, thanks to another site of Delpharm group, to help the operator to justify the stoppages.

the software program. However, we need some IT securities on the tablets. To resolve this issue, we need to work with the IT department. Moreover, I have to improve the tree of stop causes to correspond more to our equipment. Indeed, the name of the stoppage needs to be adapted to the vocabulary of the production and the maintenance service. I am working on a model with the maintenance service, so the stops causes will also help the maintenance to manage the line. The mid-term purpose is to deploy the software on another line and to improve the actual line of production with an addition of tablets on other equipment. In the long term, the goal will be to deploy the software on all the production lines.

KEYWORDS : pharmaceutical industry, specialization : injectable production

RESULTS

We deployed the software on one line of production. Currently, I am training operators to use



Contact : safa.dliaa@etu.univ-orleans.fr

Production support assistant

Industrial engineering



Melek KARAL

Academic supervisor : J.P. BLONDEAU
Industrial supervisor : S. MZE SOILIHI / A. PILLOT



OBJECTIVE/MOTIVATION

Sanofi is a French pharmaceutical company. My main assignment is to treat quality deviations. By definition, any deviation from a specification, good manufacturing practices, documentation or any defect that may affect the finished product or the quality process must be the subject of a quality deviation. When a deviation is detected, it is necessary to conduct an investigation in order to identify the cause(s) and to implement the suitable corrective and/or preventive actions so that it does not happen again. A deviation can be identified at any time during the drug production process; for my part, I deal with deviations occurring in the filling department with the role of an investigator on the floor. My role as a deviation investigator is to :

- ▶ Define the scope of the deviation,
- ▶ Search for root causes and select the most likely to occur,
- ▶ Suggest corrective or preventive actions,
- ▶ Analyse the impact on the product,
- ▶ Provide documentation to prove the elements reported in the investigation.

RESULTS

Deviations are tracked by indicators that are updated daily. The goal of an investigation phase is very important because it will permit to identify the causes and to take the necessary measures to guarantee the quality of the batch in order to preserve the health of the patients. When a deviation occurs, the first step is to evaluate the impact of the severity according to two parameters :

- ▶ the impact on the product (contamination, batch rejection...)
- ▶ the impact on Good Manufacturing Practices (GMP), which corresponds to regulatory compliance.

For the analysis of a deviation, different Lean tools such as the QQQCP or the 5M are used, which will permit us to structure the arguments and identify the problem.

KEYWORDS : quality, performance, production, aseptic environment

Contact : melekkaral@etu.univ-orleans.fr

Qualification of equipment and validation of cleaning and sanitation processes

Industrial engineering



Maud GOUMIN

Academic supervisor : M. HIVET
Industrial supervisor : M^{me} TALABARDON

OBJECTIVE/MOTIVATION

Reckitt is a global company specialized in production and sale of cosmetic, hygiene and health product. In order to demonstrate the efficiency and the performance of the cleaning and sanitation processes and equipment, it is requested from the group to perform validation. For example, performing validation permits to ensure that a sanitation process is efficient to have a clean product in terms of microbiology. This can avoid consumer claims about the cleanliness of the products. With a constant replacement of products and new lines onsite, my task is to ensure all these validations are performed. Moreover, the quality team and I must find a strategy to achieve these validations efficiently to reach the key performance indicator to the objective given by the group.



RESULTS

Since the beginning of September, key performance indicators about the percentage of validations (for equipment, cleaning and sanitation processes) are getting higher. The percentage of validation of equipment is above the objective given by the group whereas the indicator for the cleaning and sanitation process validation is still under the objective. Several root causes have been identified and the strategy in place is starting to improve the indicator, but this type of validation is quite time-consuming. In the following months, we are expecting to achieve the objective given by the group and continue to work on the new validations that are coming.



KEYWORDS : qualification, validation, equipment, cleaning, process

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Qualification of a freeze-dryer and an isolator on an aseptic production line

Industrial engineering



Ines RAHAL
Academic supervisor : S. BEN ARAB CHAKER
Industrial supervisor : A. MATHIEU

sanofi
Company/institution : Sanofi

OBJECTIVE/MOTIVATION

I am currently achieving my apprenticeship in Sanofi, in the Site Quality Operations Department, in the Research and Development platform of Vitry-sur-Seine, near Paris. This platform produces injectable drug products in vials that are intended to be administrated to patients during clinical studies.

The project I am working on takes place in a GMP pilot area, where vials are aseptically filled, stoppered and crimped. The project consists in adding a freeze-dryer to this filling line to produce freeze-dried products in vials, to improve the stability of the clinical drug products. An isolator under grade A, that guarantees the aseptic conditions of the operations, and a conveyor with automatic loading and unloading of the vials in the freeze dryer will also be added to the filling line.

RESULTS

During the project, I will carry out the qualification of the new equipment with the suppliers. The qualifications aim to ensure that the equipment permits to produce injectable drug products that fulfill the GMP requirements. I will follow up the

tests done, check that they comply with the GMP, help to resolve the potential deviations and support the redaction of the reports for each step of qualifications. For the moment, I worked on the update of the risk analysis performed on the current production line to include the conveyor components. The objective is to predict the preventive maintenance and interventions that will be necessary to avoid any impact on the production or on the sterility. I also followed up the qualifications made on the building and the utilities and reviewed the protocols of the qualification's tests for the equipment.

KEYWORDS : pharmaceutical industry, quality assurance, qualification, GMP



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Qualification of manual mirage tables for injectable service

Industrial engineering



Mathilde BERNARD
Academic supervisor : Jean-Marc AUFRÈRE
Industrial supervisor : Dominique VIGNAU

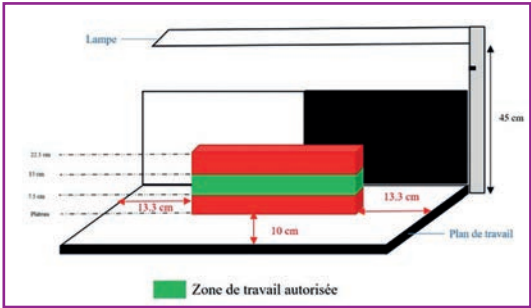
sanofi
Company/institution : Sanofi

OBJECTIVE/MOTIVATION

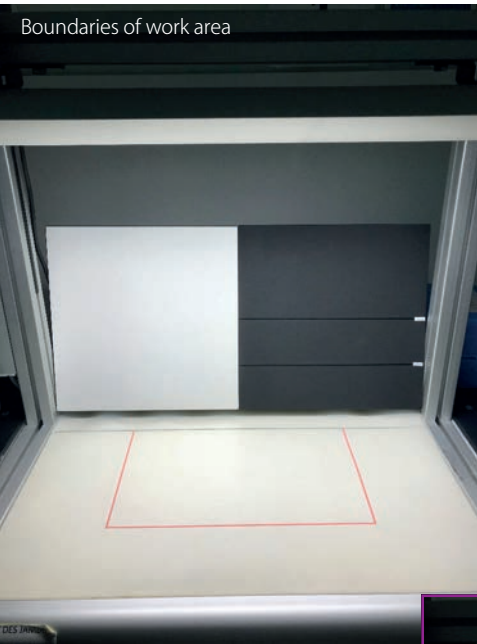
The objective of this assignment is to qualify the five tables as a manual mirage of the site for workstation ergonomics. This qualification is needed because of changes in table lamps. Formerly the lamps were fluorescent tubes, however this is an obsolete technology which is no longer manufactured. They are therefore replaced by LED lamps that are accepted by the group. The lamps have been changed for visual comfort because it is too powerful, they tire the eyes of the operators. It was also reported that the lamps were not stable, and that the light flickered. Changing of these lamps leads to a qualification with a lux meter to check if the conditions of mirage are respected: work between 2 000 to 3 750 lux. In addition, it is necessary to define an authorized mirage zone, the area where operators can inspect the vials.

RESULTS

The five lamps have been changed, the authorized mirage area is common to the five tables and the mirage conditions are respected. The zone is defined using red scotch to define the boundaries of the work area and black to define the mirage height. The feeling of the operators is as follows :



Autorized mirage zone



Mirage plan table

more homogeneous light, more pleasant light for the eyes, less reflection. However, an operator feels visual discomfort, so additional protection has been added so that she can work in good conditions.

KEYWORDS : qualification, manual mirage, injectable, vial



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Quality Key Performance Indicators monitoring

Production engineering



Safa OISMAYO

Academic supervisor : Safa BEN ARAB CHAKER
Industrial supervisor : Kristel DROLLÉE



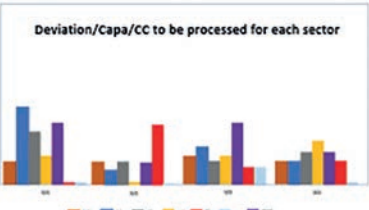
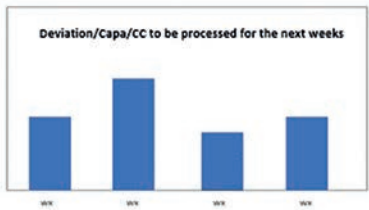
Company/institution : Sanofi

OBJECTIVE/MOTIVATION

In quality, the notions of “Deviations”, “Capas” or “Change Controls” are omnipresent and must be followed carefully.

A deviation is defined as an unforeseen gap observable throughout production or control operations, in the drafting of a procedure or document, or in the application of the latter in accordance with quality standards. A Corrective Action Preventive Action (CAPA) is the action implemented after investigations to correct the deviation and prevent the latter from being observable again. And finally, a Change Control is the formal system by which qualified representatives review proposed changes that may alter the validation status of equipment, processes, methods...

The latter are followed up through the monitoring of the Key Performance Indicators (KPIs) in a daily and weekly basis in preparation of quality



Sanofi Centre de Production de Vitry

meetings. The KPIs are management tools that inform a company about its performance (production, management...). They are useful and essential insofar as they allow companies to highlight the performance of their activities and so to improve the latter in several ways. The Quality System Department is mainly responsible for delivering those regarding Deviations, CAPAs, Change Controls met and handed over each day in each department such as Supply Chain or Technic Resources for example.

RESULTS

These representations below are a perfect example of some indicators presented in the company quality meetings. They allow to highlight which department is out trend and so need to be reactive in order to respect the quality company objectives.

KEYWORDS : quality, performance, deviations, CAPA, change control

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Recovery of biomass lost in production

Production engineering



Baptiste ROUSSELLE

Academic supervisor : M. BLONDEAU
Industrial supervisor : M. DEKEISTEIR



Company/institution : Flandres Oignons

OBJECTIVE/MOTIVATION

We need to create a new product for a better diversification of the production. We want for this new product a raw source coming from the production waste. This raw source is obtained thanks to the main activity of the company which is onion peeling. The raw source is the skin of onion peeling as well as the head and the tails of onions. Thanks to that, we can recycle the waste in income with a new type of product. Currently the part of waste is huge

RESULTS

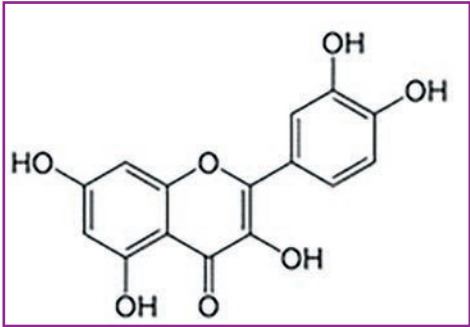
For the project we need to define what type of product we want. There are four possibilities: oil, a concentrate, a dye, a drugs molecule. Each product has its particularity with advantages and drawbacks. The company wants to stay to Agri food sectors that's why the selected product was the concentrate and the dye. The dye is currently the best solution because it is a new market with very few competitors and a company like ours can be a leader in this new market, we need to extract a molecule called quercetin which is inside the skin of the onion. To create an extraction protocol



Production Waste

working at industrial level we have contacted some labs to make tests and, to find money to create this line, we are looking for subsidy in different levels like “Le plan de relance”.

KEYWORDS : onion peeling, extraction, polyphenol, new line



Quercetin Molecule



Onion Oil

Contact : baptiste.rouselle@univ-orleans.fr

Reducing total micro-stops duration on packaging production lines

Production engineering

Louis BROSTEAUX
Academic supervisor : Stéphane LEROUX
Industrial supervisor : Paul Perdereau

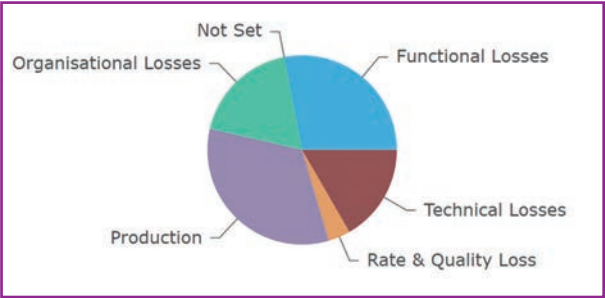
Company/institution : Merck Semoy

OBJECTIVE/MOTIVATION

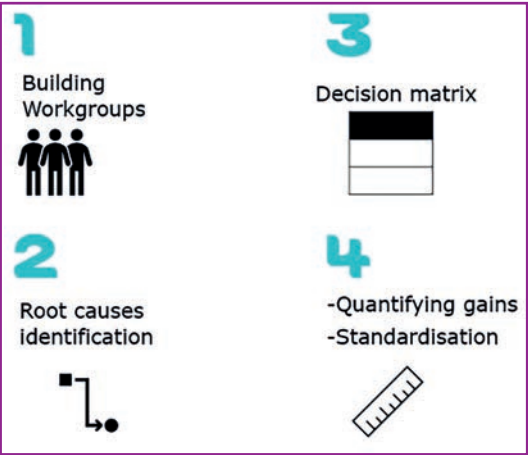
Merck Semoy is a subsidiary of Merck KgaA specialized in antidiabetics, I am working in the packaging service with the goal of improving the production lines efficiency, the first project will be aimed at micro-stops. Micro-stops are the 4th most OEE impactful stop category. The goal of the project is to improve OEE (Overall equipment efficiency), OEE is an indicator that reflects the effectiveness of an equipment. The point of improving OEE can be to make sure that we are able to do the planned production, more specifically on lines with a heavy load, that will be the case on the Uhlmann line that will take care of the production for our new contract of at least 10Mio boxes per year. Improving OEE can also help improve the efficiency of the service, for example the goal on the MK33 line is to produce the same number of boxes but faster and with fewer teams. We want to reduce by 20% the total micro-stops time.

RESULTS

The measuring process will provide data looking most likely like a Pareto diagram, from there we'll be building workgroups to work on the 20% of causes

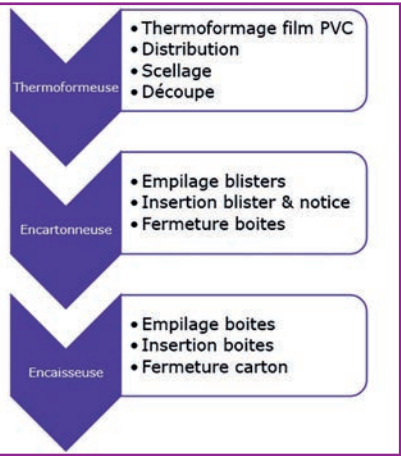


Time losses



causing 80% of stops and try to reduce or remove these stops.

KEYWORDS : production, micro-stops, packaging



Next Steps

Fonctionnement ligne V2

Contact : Louis.brosteaux@gmail.com

School Factory

Industrial engineering

Pooja BISSESSUR / Jiajia SONG / Ruxin ZHENG / Xinyue REN
Academic supervisor : Cécile CAPDESSUS / Audrey HIVET / Gilles HIVET

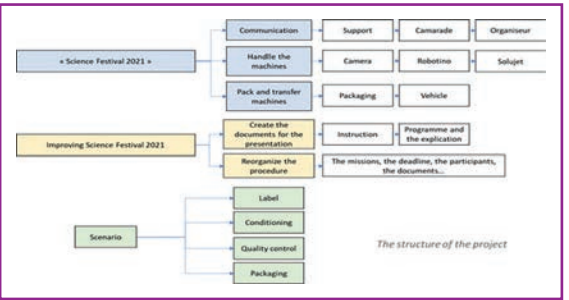


Company/institution : Polytech Orléans

OBJECTIVE/MOTIVATION

Participate in the Science Festival on behalf of the college, show the school factory as well as Industry 4.0 to the public.

Create a scenario that can be showcased at events such as the Tech Festival and School Open Days. Draw up a plan for the students and staff in the follow-up activities, and provide feasible solutions or solutions to the existing problems in the school factory. In order to have a planned, clear and organized the school factory's activity in the future.



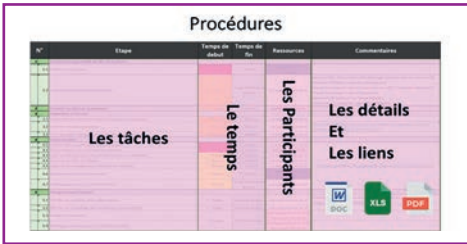
The structure of project

RESULTS

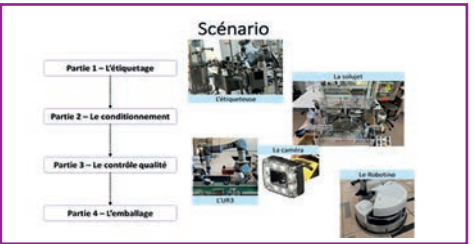
We successfully organized the school factory to participate in the 2021 Science Festival. After analyzing the advantages and disadvantages of the activity, a plan for Polytech GI to attend the science festival was established. In this plan we have Created a history of the production line for school factory to attend science festival. To analyze the feasibility of the history, we have tested the operating condition of the machine of school's factory. To bring the school factory closer to the

concept of Industry 4.0, we have given suggestions, including the introduction of AI, Collaborative robotics.. We have also provided a plan to organize the school to participate in the science festival, including the time, task name, responsible person.

KEYWORDS : project management, industrial scenario, collaborative robotics



The plan



The history of production line

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Set up a Machine Opening Time (M.O.T.) for the preparation workshops

Industrial engineering



Company/institution : Bonduelle International Traitor

Shauna BEAUBRUN
Academic supervisor : Thomas SAYET
Industrial supervisor : Claire RAIMBEAUX



Bonduelle usine

OBJECTIVE/MOTIVATION

The Bonduelle factory located in Saint-Benoist-sur-Vanne is specialized in the conception, manufacture, and marketing of catering products for mass distribution and out of home catering. They produce mainly grated carrots, tabbouleh, pasta and rice salad and coleslaw. The factory is divided into several areas including one called preparation workshops. This area is composed of 6 workshops in which semi-finished products such as seeds for tabbouleh or even the cut of fresh vegetable

production in order to organize the management of the preparation workshops.

RESULTS

The support file (Excel) of the T.O.M. was supposed to be finished by the end of the year 2021 with the aim of being able to use it at the beginning of 2022. Currently, the project is in its final phase. The Excel file has been finished, now it's in his test phase. We set up an indicator in order to evaluate the efficiency of our tool. We consider the tool as effective if the rate is over 85%. For now, in the last 3 weeks we have efficiencies over 85%. As the results were good, we decided to apply it on a real scale. We will follow the evolution over the next few weeks before considering it as truly functional and start to really use it in the company.



localisation Saint-Benoist



Produits Bonduelle

Contact : beaubrunshauna65@gmail.com

Team leader training and new process flows mapping

Industrial engineering



Company/institution : Danone France fresh dairy products

Alice FILLEY
Academic supervisor : Gilles HIVET
Industrial supervisor : Hugo JORT



OBJECTIVE/MOTIVATION

It is a real opportunity to do my apprenticeship with the Danone group as one of the world's agro-food leaders.

The site is located in Villecomtal-Sur-Arros and it is specialized in fresh dairy products such as stirred fruit yogurts. At the beginning of 2023, the site will evolve, and plant-based product will be produced.

During 2022, it is important to continuous the dairy productivity, and a team leader training will make it possible to be more flexible in managerial organizations.

The plant-based site has yet to be built, so it is necessary to redefine everything. I'm going to work on flow mapping (upstream, internal and downstream) the new plant-based production with work on all human and physical flow. This is an issue that has an impact on the overall organization of the factory and its future productivity.

RESULTS

On the dairy side, dealing with my team leader role, I have to:

- ▶ Manage a production team according to the SQCDMN indicators (Safety, Quality, Cost, Deadlines, Motivation, Nature).
- ▶ Manage short-term hazards and malfunctions.
- ▶ Ensure permanent liaison with cell managers and support services (Maintenance, Quality, Safety).

On the plant-based side, the project has started recently. I attended a three-days event value stream mapping during which we have clarified all the steps of the new process, sized the storages according of the future recipes. Thereafter we have

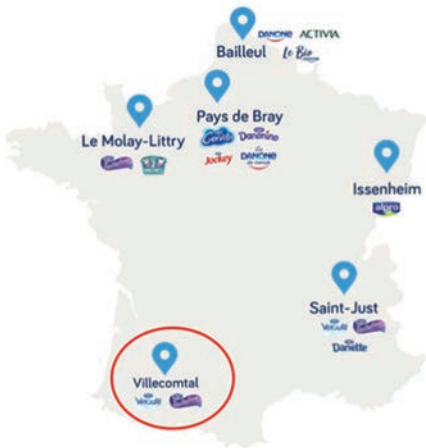
been able to define the intermediate step from the existing process to the new process.

The next step will be focused on detailing the new process step such as : stock sizing, human flows, in shop floor and implementation of the machines.

KEYWORDS : production department, mindset Danone, continuous improvement, agro-food industry, supply chain, team leader management



Factory



Plant-based product

Contact : alice.filley@etu.univ-orleans.fr

The reduction of the deviation processing time in the packaging department

Production engineering

Zineb AL HASSOUNI

Academic supervisor : Jean-Philippe BLONDEAU
Industrial supervisor : Maathouk BOUAMARA



Company/institution : Sanofi

OBJECTIVE/MOTIVATION

Today, the deviation management process in the packaging department takes more than 20 days in average. In reality when a deviation occurs, the batch in question is put on hold while the deviation is being processed and the investigation is undergoing, in order to make sure that the risk is under control. This delays the process of the batch release thus the access to the drug for the patient. In fact, there is no standard investigation sheet, which generates a lot of back and forth between the packaging department that investigates to gather all the information regarding the deviation and the quality department that treats the deviation and closes it. The quality department often requests for additional information as the sheets don't contain all the necessary information

to process the deviation. This project aims to reduce the processing time from 20 to 10 days or less to facilitate the task for the investigators.

RESULTS

The goal is to create deviation opening frames and investigation frames by type of deviation in which all the necessary elements are defined. This would help the investigator put together all the information and avoid any request for additional information. Moreover, it would ensure the batch release on time so that the patient gets access to the drug as soon as possible.

KEYWORDS : deviation, quality, standard, processing time



Contact : zinebalhassouni@gmail.com

The validation of new equipments

Industrial engineering

Hiba EL YACHKOURI

Academic supervisor : Benoit LE ROUX
Industrial supervisor : Marie DE L'ESPINAY



OBJECTIVE/MOTIVATION

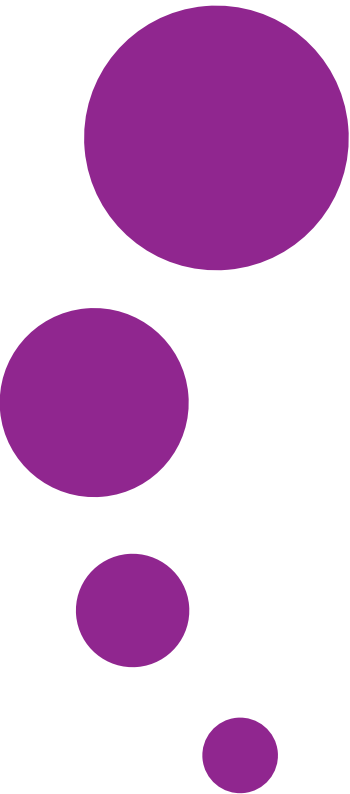
Shiseido group is a Japanese cosmetics and luxury goods company, founded in 1872. It's the most ancient cosmetic company in the world. I'm currently an apprentice in Shiseido unit located in Ormes near Orléans where perfumes and skin care products are produced for Europe, Middle-East countries and Africa. The company's primary challenge is to develop its market in order to remain competitive with other cosmetic brands. To do so, Shiseido aims to keep diversifying by offering new quality and innovative products. The implementation of a new product requires the purchase of a more efficient and more capable machine. In order to satisfy the customer and avoid complaints, each machine must undergo a validation process in order to guarantee products compliance to customers. This step is an obligation according to the Good Manufacturing Practices.

between 28 mL and 32 mL. When the validation process is in accordance and only if it is, the new equipment can be used in a production order.

KEYWORDS : validation process, new equipment, GMP, cosmetics, conformities

RESULTS

So, at the beginning of my block release training, the company received a new filling machine for one of its 12 production lines. Before using it for a fabrication order, it must undergo a validation process to demonstrate, with supporting documents, that our new equipment, leads to the expected results. To do so, we had to test the filling of this new filler on a sample of 30 products either by taking the most cosmetic produced on line or the worse case which is the most critical finished product. Once the 30 products are filled, they are then weighed to validate the equipment. To consider the new equipment in compliance with its specifications and with predetermined quality characteristics, the 30 weighing must be in the filling standard of the product. For example, for a 30 mL cosmetic product, the filling norm are



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Training and onboarding continuous improvement project

Industrial engineering



Maëva BEAULIEU
Academic supervisor : Ziad DAHER
Industrial supervisor : Matthieu VENARD



Company/institution : Lactalis Nestlé Ultra Frais

OBJECTIVE/MOTIVATION

During my professional training contract within Lactalis, I had the opportunity to oversee the project to improve onboarding and training within the process department of the Lactalis Nestlé Ultra Fresh plant in Vallet. The Vallet plant specializes in dairy desserts such as “viennois”, “céréales”, “craquants”... It is important to know that 75% of the process employees have been present for more than 10 years. The assignment was thus set up to compensate for future retirements in the years to come. This project allows me to exchange daily with the operators to have knowledge of the field and the problems as well as with the team leaders to meet their expectations.

RESULTS

In order to have an elaborate approach, I treat this project by respecting 4 steps : the analysis of

the initial situation, the determination of the problems and the objective targeted thanks to a phase of observation and exchange with the operators, the improvements and action plans and a result and interpretation phase. The purpose of the implementation of this new approach is to provide operators with the technical skills in line with the different positions, a team spirit and a good working atmosphere as well as regular monitoring of the heads of team in order to monitor an increase in skills for employees.

KEYWORDS: process, improvement, project, onboarding, training

Example of improving the training process (skills checklist)

[illegible]

Packaging picture in Vallet factory



Usine Lactalis
Nestlé Frais site,
Vallet, Nantes

Innovations in Design and Materials



Airless Tire

Mechanical engineering



Sinclair ANDREU / Maxime BIAVA
Academic supervisor : R. HAMBLI



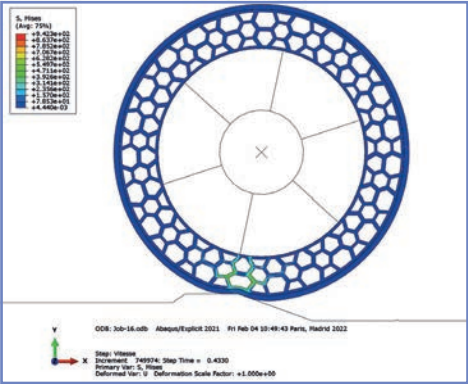
Company/institution : LAMÉ laboratory

OBJECTIVE/MOTIVATION

The objectives of this topic are to reduce tire waste and avoid flat tire due to punctures and pressure problems. Indeed, an airless tire makes tire problems easier for people because with it we avoid some problems we can have with conventional tires (pressure, punctures...). In addition, an airless tire can be printed in 3D and also connected, you can find out when it needs to be changed or if there is a problem with the tire. Moreover, the goal for us is to succeed to design different types of airless tires on Abaqus software. Obviously, the purpose is to compare an airless tire and a conventional tire, to see the benefit of it. Finally, we will choose the best design for an airless tire, the one which can at least provide the same lifespan than a conventional tire.

RESULTS

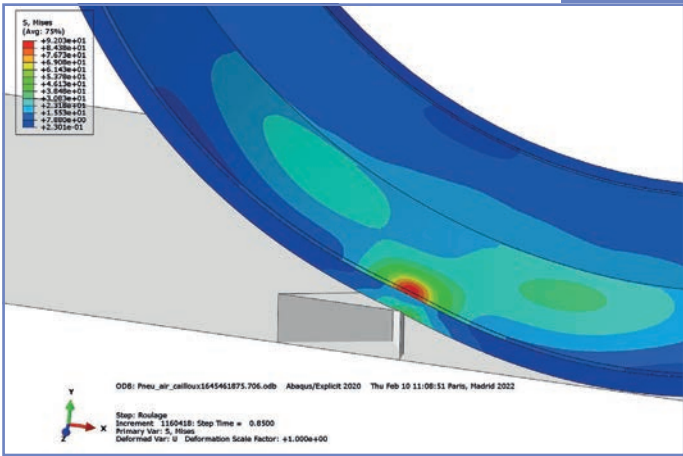
We achieved to run 2D and 3D models on Abaqus with an hyperelastic behavior. Moreover, we designed 3 different models: honeycomb structure, triangle model and one inspired by the Uptis tire designed by Michelin. After comparison,



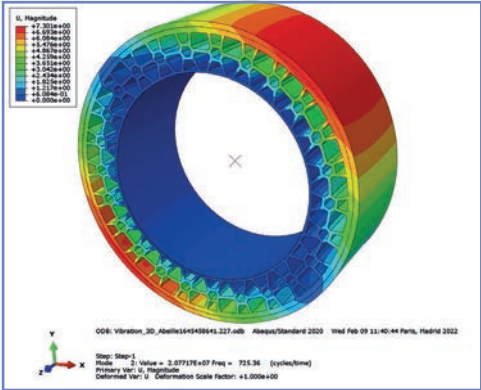
2D airless tire deformation with a honeycomb structure

the biggest problem for the airless tire seems to be the lifespan of the product. We need to figure out how to increase it by adapting the materials or the design. It's difficult to find some information about the materials because it's also a project for tire companies, which means there are a lot of patents. Indeed, to find some properties about materials, some tests need to be done with the materials themselves. This type of experimentation cannot be done at Polytech, then we have found approximations for the properties, which can degrade our results. Finally, it is assumed that the airless tire will save the weight of 200 hundred Eiffel Towers, which is 2 million tons of rubber.

KEYWORDS : materials, tire, airless, honeycomb structure, innovation



Deformation of a conventional tire in contact with a tire



Vibratory study of an airless tire with a honeycomb structure

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Automation of transfer operation of parts

Production engineering



Romain TIBERGHIE / Vincent TURIN
Academic supervisor : Estelle COURTIAL
Industrial supervisor : Ghislain SAUJOT



Company/institution : Aperam Alloys Amilly

OBJECTIVE/MOTIVATION

Aperam Alloys Amilly is a company which focuses on the production of stainless steel, alloys, electrical steel and carbon steel. For one of their clients, Aperam produces magnetics parts with a specific shape. After production, these parts are washed and moved into storage cases.

The purpose of our project is to automate the transfer operation of magnetic parts into storage cases. With this project, Aperam will automate a non-value added operation and free up machine operators who can put their skills to another task in the company. Aperam will also reduce arduousness and musculoskeletal disorders due to the repetitiveness of the task, improving the quality of life at work.

RESULTS

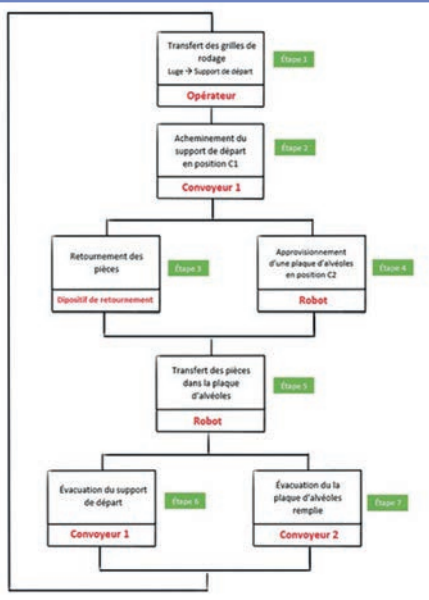
The function of transferring the parts into storage cases is broken down into three sub-functions: moving the parts from the washing stands to storage cases, organising the parts for storage cases (10 rows of 10 parts) and turning the parts over. Parts must not be scratched, bent, or soiled during transfer.

We have been developing various solutions to automate the transfer of these parts, then Aperam chose one of these solutions. Finally, for the chosen solution the step

of turning parts is accomplished with a plate which grips parts and turns them over. The organization and the transfer of the parts are carried out simultaneously, these operations are executed by a robot which picks and places them into storage cases.

KEYWORDS : automation, robot, continuous improvement

Robot 6 axes
Doosan M1013
(source leobotic)



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Design in virtual reality and augmented reality

Industrial engineering

Alexandre GAVELLE / Loïc BRAMAT
Academic supervisor : Jean GILLIBERT

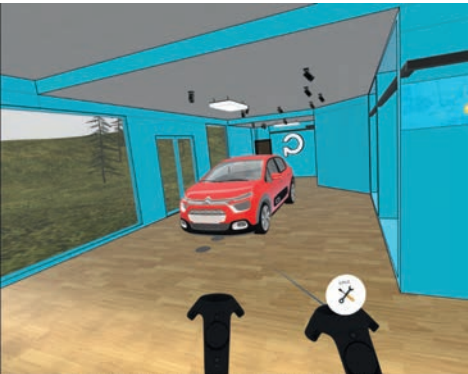


Company/institution : Polytech Orléans

Selected participant
16th annual final year projects forum

OBJECTIVE/MOTIVATION

When technicians have to learn how to interact with machinery and all kinds of tools, they sometimes have to put their work on hold in order to get accustomed to working with certain tools. With the help of virtual reality and augmented reality, it should be possible to teach people how to use equipment without them having to leave their workplace. The user efficiently and autonomously



learns in a virtually generated situation. This brand-new item helps the user to gain self-determination according to studies. It is also particularly useful in case of teaching dangerous jobs. Indeed, virtual reality allows workers to train with their tools with no bad consequences. Augmented reality, despite its cost is even more comfortable since you can see your familiar environment but with holograms. Thanks to this, you can have instructions or information given in real time while you interact with a tool.

RESULTS

A playful way of mounting a power steering on a C3 has been created on 3D experience using the HTC Vive. Thanks to this piece of software, a worker who needs to know how to assemble a power steering can do that using a headset on a computer. There are several screens around the 3D environment to explain how to assemble the power steering step by step. In order to test software capabilities, we also created a pool ball, which perfectly displays collisions and mechanical connections between pieces. Even though, most collisions are disabled in our power steering mounting experience, a professional license of 3D experience would let us have all the collisions we need. Augmented reality is possible using the Microsoft Hololens, and we could display a car in our field of view. It is an impressive sight, even if it remained in the state of displaying items.

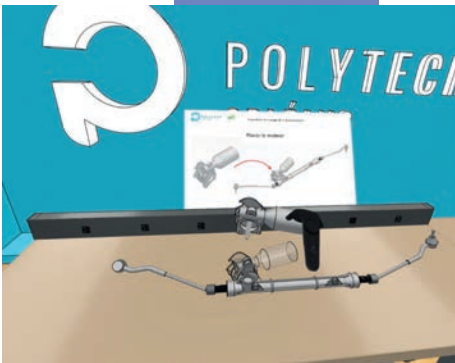
KEYWORDS : design, innovation, virtual, immersion, headset



A. GAVELLE



L. BRAMAT



Design of a cryogenic liquid hydrogen tank

Industrial engineering

Marion FOULADOUX / Thomas CHUPIN
Academic supervisor : Alain GASSER
Industrial supervisor : Eric TORRES



Company/institution : Design Tech Centre

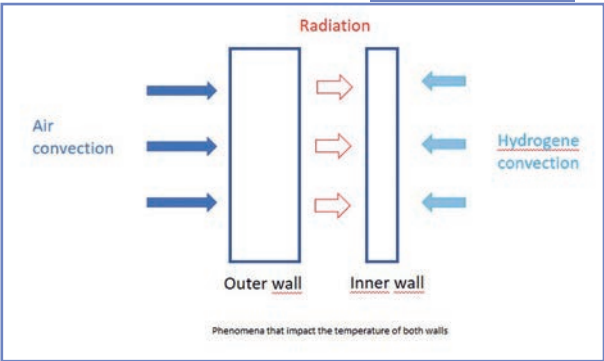
OBJECTIVE/MOTIVATION

The project consists in designing and manufacturing a cryogenic liquid hydrogen tank. This tank will be mainly used in aeronautics. The objective of this tank is to keep the hydrogen in liquid form, at -252°C. To do this, it is composed of an inner wall and an outer wall made of specific material to considerably reduce the weight. The two walls are separated by a primary vacuum whose role is to thermally isolate the tank. The primary vacuum corresponds to very low pressures which are close to the vacuum in space. The air is pulled out as far as possible between the two walls. Moreover, the heat exchange with the environment is studied to understand how the liquid gasifies naturally during the flight.

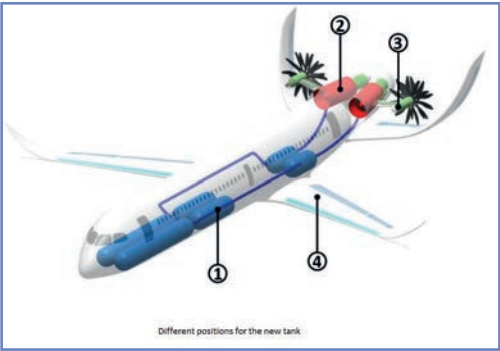
RESULTS

The project is divided into two parts. The first part is to study the different technologies to create the desired primary vacuum and the second part consists in thermally modeling the tank to determine the thicknesses of the two walls and the space between them. During the study of the creation of the primary vacuum, we noted that the vacuum was solely created by pumping. We evaluated the operation of different types of pumps usable to obtain the desired pressure, and all the components required for installation and performances. During the thermal modelling, the primary vacuum was initially modeled, then we added the different thermal constraints on a 2D wall. We designed the model in 3D to observe the thermal evolution of the tank walls. Finally, we simulated the temperature evolution of the tank during a flight.

KEYWORDS : cryogenic tank, aeronautics, defense, terrestrial mobility



Phenomena that impact the temperature of both walls



Different positions for the new tank



M. FOULADOUX



T. CHUPIN

The future of the aviation liquid hydrogen

Different positions for the new tank

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Contact : marion.fouladoux@etu.univ-orleans.fr / thomas.chupin@etu.univ-orleans.fr

Design of a frame for a military drone

Mechanical engineering



Company/institution : Orléans – Bricy Air Base

Coralie BOURGEON / Edouard LALLEMENT
Academic supervisor : Jean GILLIBERT
Industrial supervisor : Julien BOCQUET

Selected participant
16th annual final year projects forum



C. BOURGEON



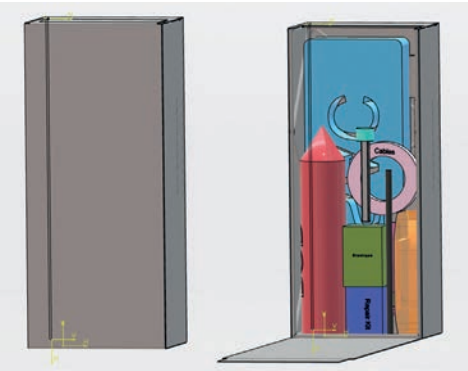
E. LALLEMENT



Military Drone

OBJECTIVE/MOTIVATION

The aim of this project is to design a frame for a military drone and its additional components. Today, the current frame of the drone's manufacturer is made up of multiple bags, which requires a vehicle to carry it. The main goal is to create a single frame, which allows us to carry all the components. The frame needs to be resistant to any harsh conditions



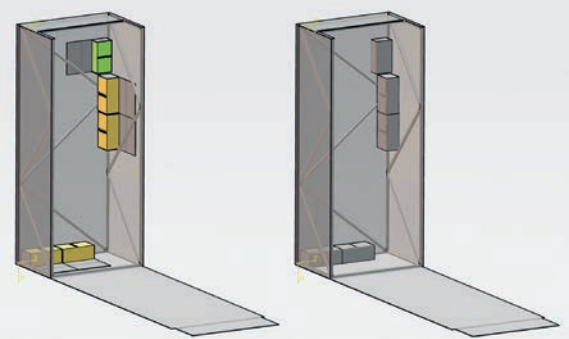
Frame closed and opened

due to temperature, altitude, humidity... Our concept is developed on 3D Experience via a CATIA extension. On the one hand, it is important to do the weight and balance on the frame to maximize the centering and the comfort of the soldier transporting the frame and on the other hand it is important to optimize the opening of the bag, which is an important aspect of the project in order to facilitate the access to the components.

RESULTS

The study of our project allowed us to design the military container on 3D software according to the specifications. It consists of an aluminum frame with additional foam to protect the equipment from shocks. This frame is covered in a fabric used by the army to make their backpacks. The sizing of this set was made according to the different parts of the drone to be transported, so as it is also adapted to the carrying rack. 3D experience enabled us to create this container as well as the different pockets for additional components such as batteries, the receiver and the hammer. We were able to create the opening of the container and optimize the positioning of the different objects in order to have an optimal use for the user.

KEYWORDS : design, military, CAD, drone



Frame with pockets opened and closed



Metallic structure for the frame

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Development of a Jominy end-quench test device

Materials



Company/institution : Polytech Orléans

Serigne DIOP / Louna MOREL / Paul ROBERT
Academic supervisor : Emmanuel DE BILBAO

OBJECTIVE/MOTIVATION

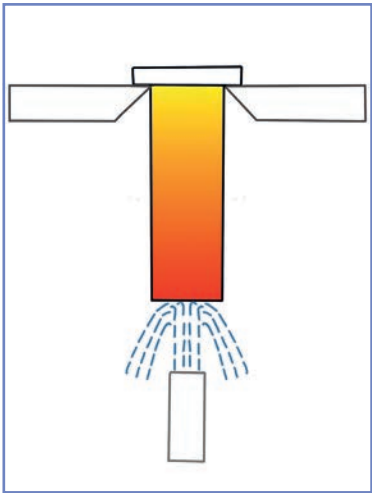
Practical works focused on real life applications are important for students, it is an opportunity for them to practice and develop their knowledge about the characterization of materials. The hardenability of steel is its ability to harden after being quenched, it can be evaluated with the Jominy end-quench test. The Jominy test consists in heating a round steel bar and then cooling it by a water jet on one end. The hardness is measured along the bar, the more the measure point gets away from the quenched end, the lower the hardenability. This final year project aims to develop a Jominy end-quench test device for ICM-students. The developed bench must fit practical work room, the equipment in the room and the training condition requirements. Due to the small space available in the room, the customer wants a moveable device that can be stored under a table.

RESULTS

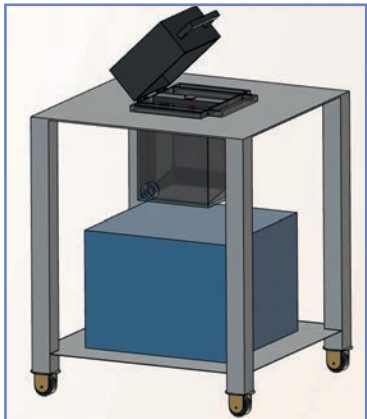
To make the best product that meets the client needs, a functional analysis of the device has been made to find out what its specifications are. This step was used to get every requirement of the customer and convert it into specifications. In addition, some calculations and tests about water temperature and rate flow were made to size the equipment needed for the Jominy test. Following this, we used the specifications of the bench, our calculated and experimental results, the analysis of what already exists, and the comments made by the customer to find which solutions were the best for the device.

Regarding this, two solutions were chosen, then designed because of their adaptability to the context: one using the water of a small plastic tank and the other one fixed on the top of a large steel tank available in the practical room.

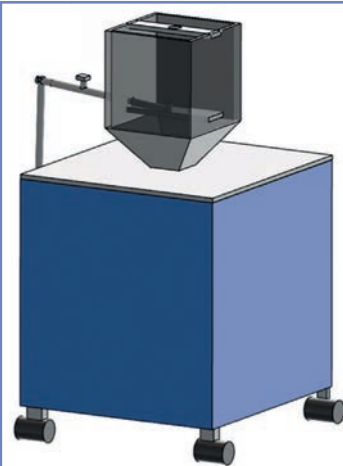
KEYWORDS : steel, quench, jominy test, product development



Sketch of a Jominy test



Design of plastic water tank solution



Design of steel tank solution

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S. DIOP



L. MOREL



P. ROBERT

Elaboration and characterisation of sodium borosilicate glasses

Glasses

Margot GICQUEL / Emmanuel LE BEC / Marine MOUSTROUS
Academic supervisor : Mohammed MALKI

Selected participant
16th annual final year projects forum

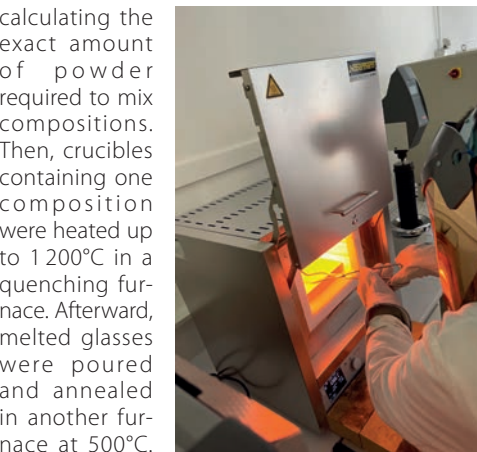
OBJECTIVE/MOTIVATION

The objective of this project is the study of the ionic conductivity and of the density of a sodium borosilicate glasses. This kind of glass is used for the vitrification of nuclear waste. During this project we had the opportunity to elaborate and characterise a series of sodium borosilicate glass by using a quenching furnace. This project deals with a concrete and current problem which is the treatment of nuclear waste to protect from radioactive radiations. The subject was very enriching because many scientific aspects were covered. The first part was theoretical and included bibliography and the set-up of an Excel sheet to calculate the molar composition. The second part was experimental and was split in two : the elaboration of the glass and the measurement and analysis part.

RESULTS



The main goal of this project is to provide a better understanding of the characteristics of sodium borosilicate glass. Two types of results are expected in this project : production and characterisation results. Regarding the achievement, an “Excel sheet” was developed



calculating the exact amount of powder required to mix compositions. Then, crucibles containing one composition were heated up to 1 200°C in a quenching furnace. Afterward, melted glasses were poured and annealed in another furnace at 500°C. As for characterisation results. For the 6 types of glass of interest, conductivity was analysed by impedance spectroscopy methods and compared. Density was also measured by the Archimedes’ principle. Thus, we obtained reliable results to find the perfect match.

KEYWORDS : sodium borosilicate glasses, ionic conductivity, density, vitrification, quenching furnace



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Experimental and numerical MOOC about the refractory masonry wall

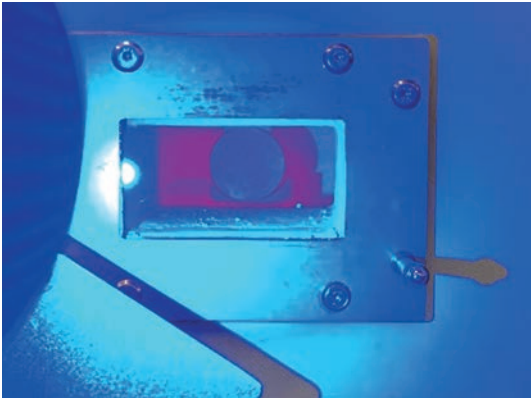
Mechanical engineering

Ylan MODESTO / Yoann HERRERO
Academic supervisor : Thomas SAYET



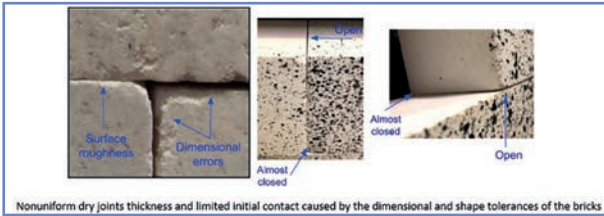
Company/institution : Mechanical laboratory Gabriel LAMÉ

Silicium carbide sample in a furnace



OBJECTIVE/MOTIVATION

This project aim at proposing short videos for students at the end of their engineering cycle and research workers which tackle the fundamentals related to the experimentation and numerical simulation of thermomechanical problems. Thus, the experimental part of the project is based on the characterization of the material used in the steel ladle and the analysis of its behavior through a Brazilian test, made at room and high temperature. The other part, the numerical one, is mainly based on theoretical studies such as how different models



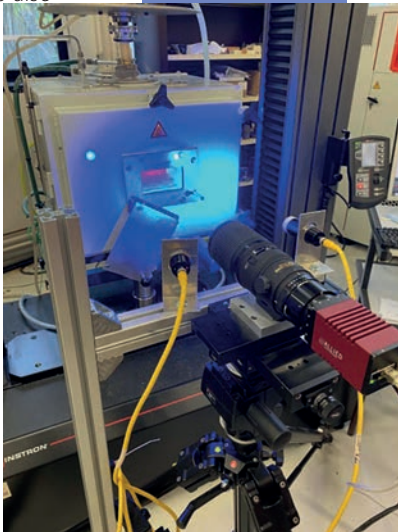
Nonuniform dry joints thickness

were created depending on what kind and how different loads were applied on them. It is also interesting to see how influential some physical parameters such as creep are and what outcomes can be expected in the end.

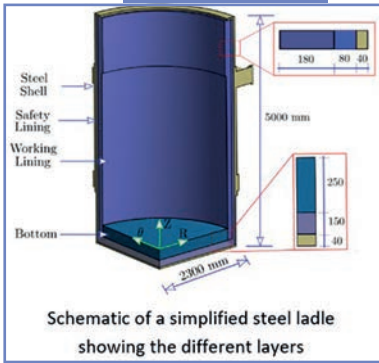
RESULTS

This project was really rewarding with the experimentation thanks to which we had the opportunity to use some uncommon equipments (CCD camera, custom made furnace (water cooled), blue light source etc.) for the Brazilian test at high temperature. Indeed, we were able to see the breach of the material studied which was nearly instantaneous with the load applied. For the numerical part, we’ve seen that the steel ladle was quite complex and many phenomena had to be considered to build the best model such as creep. Moreover, we focused on the existing closing/reopening joint patterns which lead to different behavior of the structure and the importance of choosing the right size for the Representative Volume Element without which we can’t get accurate results for the global behavior of the structure.

KEYWORDS : numerical, experimental, videos, thermomechanical, tests, material, steel ladle, mechanical, engineering



Experimental setup



Simplified steel ladle

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Measurement of residual stresses in a metal strip after straightening process

Mechanical engineering



Company/institution : Aperam

Sofia HENAO DELGADO / Chloé SARRAZIN
Academic supervisor : Thomas SAYET
Industrial supervisor : Ghislain SAUJOT

Selected participant
16th annual final year projects forum



S. HENAO



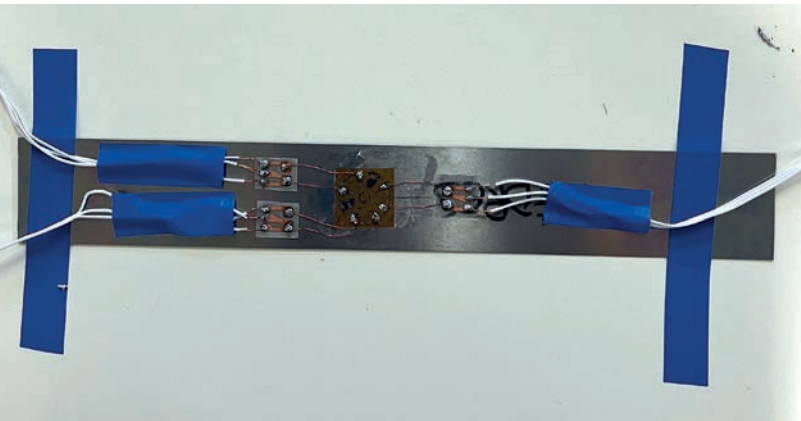
C. SARRAZIN

OBJECTIVE/MOTIVATION

In the present study, the objective is to determine a measurement method for residual stresses in a strip made of nickel alloy, after straightening. Nowadays, the steelmaking industry uses processes such as straightening to meet the growing need for thinner and stronger metal strips. Indeed, straightening process aims to reduce the internal stresses resulting from the metal strip being stored as a coil. However, after straightening, the strip may still have residual stresses that create defects unable to meet flatness requirements. These residual stresses are compensated in the process by the gravity, and the flatness defects remain hidden to the naked eyed. Therefore, the determination of residual stresses after straightening plays an essential role in the mechanical and magnetic properties of a structure, as well as its performance under fatigue conditions. Several numerical and experimental models have been carried out to propose the most suitable method.

RESULTS

In the work done, we conducted a study of the strip microstructure before and after straightening. The results remained inconclusive due to no apparent differences in the two samples. This dismissed all the solutions involving X-rays methods. We also performed a hole-drilling strain-gage test to quantify the residual stresses of two samples of the strip. We retrieved the relieved strain caused by a drill hole and calculate the resulting stresses in accordance with the thickness of the sample. In addition, we completed a numerical simulation of the strip behavior in the presence of residual stresses. With all the above results, we modelled a system of a rigid matrix with pressure sensors fixed on the surface. In contact with the strip, we were able to generate a pressure profile associated to the residual stresses. With these pressure values, the company will be able to know whether adjust the straightening parameters.



KEYWORDS :
pressure,
strain,
simulations,
flatness,
defect

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Participation in the FANUC Olympics, design of a robotic cell

Industrial engineering



Company/institution : FANUC

Quentin ABILY / Aurélien DARIDAN
Academic supervisor : Aicha FONTE



Q. ABILY

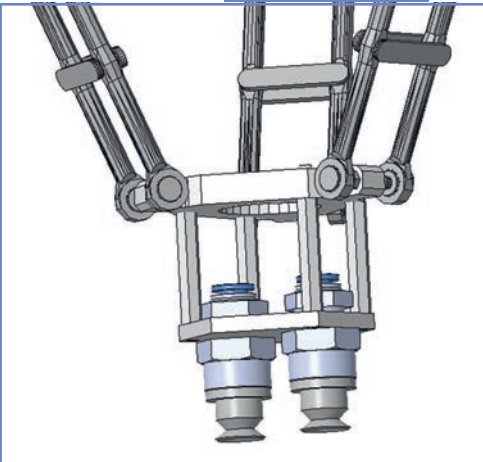


A. DARIDAN

OBJECTIVE/MOTIVATION

The purpose of our project is to compete at the "Olympiades FANUC". Each year a different subject is given by the company. The objective is to create a robotic cell that better meets the specifications given by a subject. This year, we had to automate the assembling process of an electric battery into a blister, a "pick-and-place" workstation. This project started mid-November, during the period which lasts from this date to 20 January 2022, we, led by Ms. FONTE, designed our robotic cell with software such as "CATIA" and "ROBOGUIDE". In order to do this, we had to analyze the given subject and extract the relevant information from the latter, such as the production rate, the opening time of the factory, the interior layout of the conveyors that bring the piles and the blisters inside the working area.

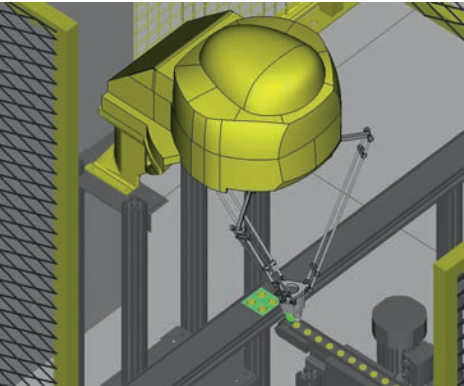
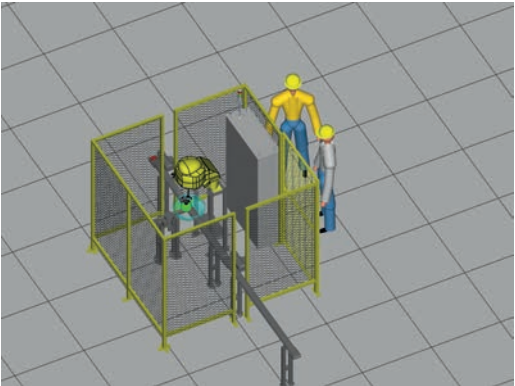
In parallel, thanks to research and documentation made and had, we selected the robot. The one that suited our application best was a "DELTA M-1i A/1HL". DELTA robots are used to complete fast "pick-and-place" tasks with low payload such as batteries whose weight is three grams. Next to this, we simulated the station in the software "ROBOGUIDE", adjusted the trajectories and speed, placed the protections to respect the standards with fences and sensors. Thanks to the simulation, we did a video of the operation as part of our rendering for the competition. However, despite studying our file, we were not selected to participate in the final tests.



RESULTS

Next to this analysis, we designed the workstation. Firstly, we determined which trajectory was the most appropriate to fill one blister every 2.11 seconds, the rate needed to respect the latter.

KEYWORDS : automation,
robotic, industrial, FANUC, workstation



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Sample transfer robot project

Mechanical engineering



Company/institution : IRSN

Yohann RUDEMARE / Ahmad Rasydan BIN ROSLY
Academic supervisor : Jean-Marc AUFRERE
Industrial supervisor : Jeanne MALET



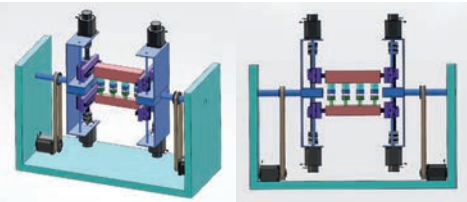
OBJECTIVE/MOTIVATION

The objective of this project is to deliver a technical solution, allowing our client to install a system to automate the movement of an operator. This project is called the Sample Transfer Robot Project. It aims to automate the operation of transferring ammonia water from a 180ml-jar to a small 10ml-tank (so-called fluorometer vessel). The ammonia water contains the uranine aerosol which is collected by an operator from a surface and which is also called "the sample". The ammonia water is injected with a commercial titrator into the 180ml-jar. After waiting one hour to assure complete dissolution of the uranine by the ammonia water, the solution can be injected into the fluorometer vessel by the operator. The aim is therefore to robotize the movement of an operator who transfers the ammonia water, following this surface sampling.



RESULTS

We had several solutions that we proposed in order to achieve the objective of this project. We decided



Robot Verseur

on a particular solution thanks to a requirements matrix that we created based on our clients' needs. This matrix was of course weighed according to the importance of the different criteria of the project. The chosen solution is a robot that spills the liquid in the pots into the tanks. We worked on the 3D Experience software to make a 3D design of this solution. The pots are equipped with special designed caps in order to avoid spills or leaks. Then we simulated the robot to better visualize how it works. Thanks to this, we were able to create a prototype of this solution by 3D printing. Once this was done, we looked for different suppliers and potential companies.

KEYWORDS : robotic, computer assisted design, mechanical concept, automation, operator



Lingette

Rack

Scalmalloy instabilities characterization

Mechanical engineering



Company/institution : Cetim Centre-Val de Loire

Imrane SIMJEE / Gabriel LE CLÉACH
Academic supervisor : Jean GILIBERT
Industrial supervisor : Arnold MAUDUIT



OBJECTIVE/MOTIVATION

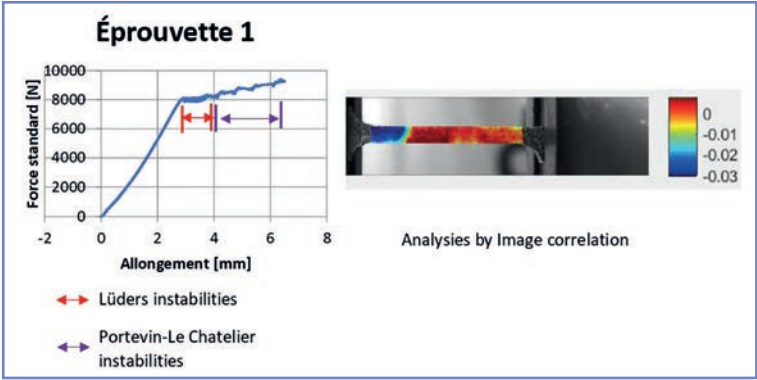
The objective of this project is to determine the behaviour law of scalmalloy during a traction test, this aims to characterize the instabilities that appear in the part. Indeed, researchers want to determine how best to avoid them. Because these instabilities could be harmful during the use of the part when it undergoes efforts, this can lead to sudden ruptures of the part while we are still far from its rupture zone. The other goal is to determine if the method used to create this part is impacting the mechanical capabilities of the part, because there are different types of specimens. Some have been made by laser fusion horizontally, while others have been made vertically, since laser fusion is done layer by layer, one has more layers than the other, but these layers have a smaller area.

RESULTS

We carried out traction tests and at the same time we took photos of our test part when it was

subjected to the forces of the machine. Then, we got pictures of the whole deformation of the part. With the results obtained thanks to the traction machine, we obtained the stress/deformation curves. On these curves we could visualize the instabilities of Lüders and Portevin-Le Chatelier that we wish to study. Then the camera that filmed the tests allowed us to have photos of the deformation of the part by the image correlation method. With these two result files we could compare the points of the curves with the corresponding photos to be able to visually determine what was happening in the part. Then with all these values, we have been able to extract the behavior law of the part.

KEYWORDS : traction, Lüders instabilities, Portevin-Le Chatelier instabilities, laser power bed fusion, behaviour law



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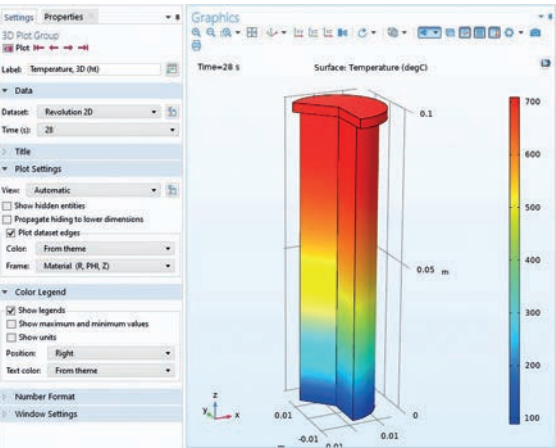
Simulation of the Jominy end-quench test with Comsol Multiphysics

Mechanical engineering, materials

Elise COLIN / Erwan GUILLOTTE / Nicolas MERCIER
Academic supervisor : Emmanuel DE BILBAO
Industrial supervisor :



Company/institution : COMSOL



Simulation thermique de notre échantillon sur COMSOL

OBJECTIVE/MOTIVATION

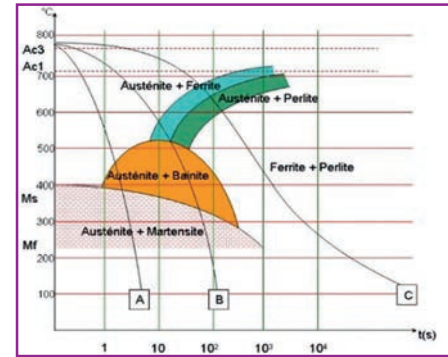
The main objective of the project was to simulate a Jominy end-quench using the COMSOL software and to develop a graphical user interface based on the simulation. The Jominy test consists in quenching with a water jet the lower surface of a cylindric sample, previously heated at the austenized temperature, then hardness measurement are made along the sample and the Jominy curve is obtained with those results allowing to determine the trempability of the steel. This application is intended to be used during the 3rd or 4th year practical work at Polytech Orleans to help students to understand what is happening throughout the Jominy test. The finite element analysis focus on the heat transfer in the sample and it was envisaged to simulate the non-equilibrium transformations of the material from the CCT diagram.

RESULTS

We have succeeded in creating a COMSOL model which runs well. With this model, one can visualize the temperature evolution throughout the sample according to the boundary conditions. We used the hypotheses of Sorin and Homberg to build our model as closely as possible to reality. In addition, the cooling curves of the model were obtained and the hardness curve was deduced as a function of the distance of the different points on the sample. We tested different steels and obtained different hardness curves. We managed to put all this information into an easy-to-use application for students. We also set up a series of user-modifiable inputs to display the results on the same interface. Finally, a sensitivity study of the model was carried

out to show which parameters have an impact on the results of the model and to be able to measure this impact.

KEYWORDS : simulation, jominy test, COMSOL, continuous cooling transformation, hardenability



CCT Diagram



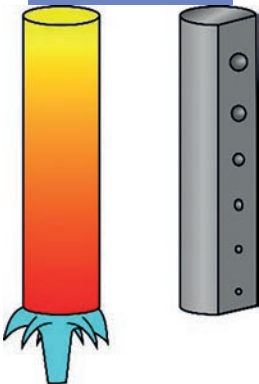
E. COLIN



E. GUILLOTTE



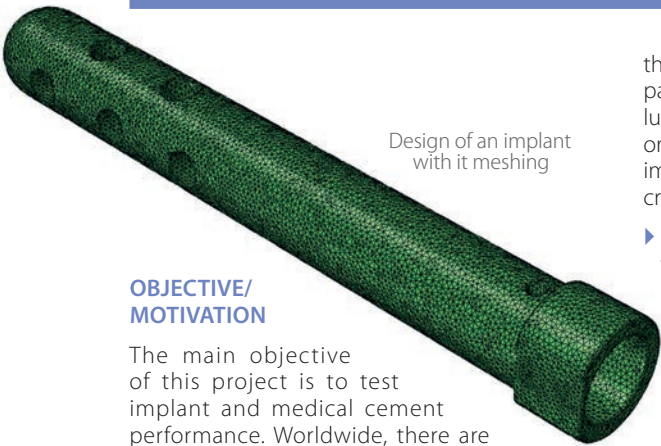
N. MERCIER



Essai Jominy



Company/institution : Laboratoire LAME



Design of an implant with it meshing

OBJECTIVE/MOTIVATION

The main objective of this project is to test implant and medical cement performance. Worldwide, there are approximately 1,4 million new vertebral compression fractures (VCFs) reported each year. It is estimated that only one third of vertebral fractures result in medical attention. That's why "Hyprevention" developed the "V-STRUT" system to help those people to get a better life. In order to reach this goal, we will have to understand the technology of "Hyprevention" industry, master a new software "ScanIP" that will help us recreate the 3D model of the lumbar spine and finally study different simulations. We will have to design virtual vertebra from computed tomographic scans and add an implant inside the vertebra. Then, we will create another simulation with a vertebra filled with cement. Finally, we will compare different designs to check the efficiency of the implant and cement.

RESULTS

The main results that we will analyze is the maximum Von Mises stress and the location of this maximum in the third lumbar (L3). All the results that we got from the different simulations are compared to theoretical and experimental results

Solidification of a vertebra thanks to an implant and medical cement

Industrial engineering

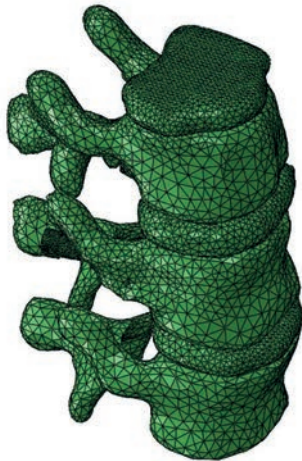
Charles KUBLER / Pierre-Louis NARDOUX
Academic supervisor : Ridha HAMBALI



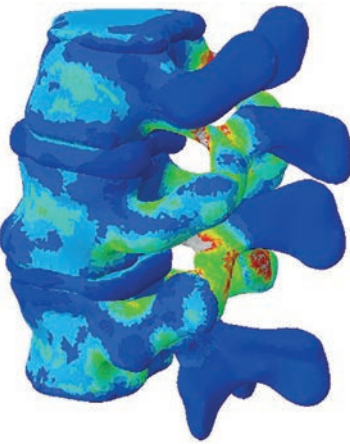
C. KUBLER



P.-L. NARDOUX



Vertebra L2, L3, L4 and 3 intervertebral discs



Spine with 1000N load on the top

that we have, thanks from external thesis. In a first part, we have recreated and simulated a healthy lumbar spine (L2 to L4 with inter-vertebral disc) in order to compare it with the other simulations with implants and bones cement. In a second part, we created 2 different models:

► Healthy lumbar spine with implant in order to observe if only the implant can make an improvement.

► Broken lumbar recreated with a scanner of spine with the cement and implants

We are expecting to have a better mechanical response to an average load for models with "V-STRUT" implants.

KEYWORDS : implant, prothesis, vertebra

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Contact : Charles.Kubler@etu.univ-orleans.fr / Pierre- Louis.Nardoux@etu.univ-orleans.fr

Study of the duplex steels microstructure

Materials



Joseph-Antoine HAMEL
Academic supervisor : Marie-Laure BOUCHETOU

Company/institution : Polytech Orléans

Duplex steels samples after sampling and coating



OBJECTIVE/ MOTIVATION

Heat treatments generally have an influence on the microstructure of duplex steels. During these treatments, precipitates or intermetallic secondary phases can be generated, then lead to mechanical properties or corrosion resistance degradation. This project was carried out in order to establish an operating protocol for observing the microstructure of several duplex steel tubes before and after heat treatment. Thus, it will be possible to see the heat treatment influence on the intermetallic σ -phase formation. First, a 5-steps protocol (sampling, coating, grinding, polishing, electrolytic attack) was achieved to observe non-heat-treated samples with an optical microscope. However, I have been confronted to the difficulty to keep the sample polished surface as horizontal as possible under the

microscope objective, so as to get a sharper image of the micrographs. Thus, a manual press model had been developed in order to solve this problem.

RESULTS

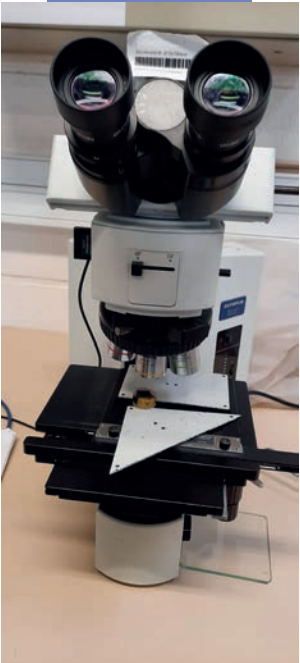
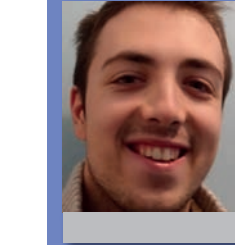
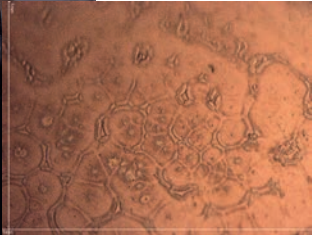
Thanks to this 5-steps protocol, I have managed to observe the grain boundaries on my samples under the microscope, including by using my manual press model, and thus identify the different phases that appeared after electrolytic attack. In order to get them, I first performed an electrolytic attack on my samples in 40% caustic soda, with a 2V voltage, for five minutes. I then cleaned my samples for three minutes in an ultrasonic tank. Next, I made a second electrolytic attack for five minutes, but this time with a 4V voltage. Once this step achieved, I followed up with another three minutes of cleaning in the ultrasonic tank, before observing the precise contour of grain boundaries under the microscope. I repeated this procedure on other samples so as to make a comparison between the microstructure of heat-treated and non-heat-treated samples.

KEYWORDS : duplex steels, microstructure, microscope, protocol



Material used during the electrolytic attack

Microstructure after electrolytic attack



Microscope used for observations



Microscope press

Contact : j-a.h@orange.fr

Study of the vibrations of a refrigeration line in the power supply of aircraft

Mechanical engineering



Company/institution : Guinault

Air conditioning machine



OBJECTIVE/MOTIVATION

Development of a calculation procedure leading to the validation of the mechanical resistance of a copper pipe during its design for future Guinault machines and current products. The study will initially focus on existing lines by comparing the experimental measurements obtained with an accelerometer and the theoretical studies that will be carried out using a numerical simulation software capable of retranscribing the vibration modes after that the line will be optimized in order to improve its mechanical behavior over

time. The project allows to use all the knowledge learned during the course of Innovation in Design and Materials, and like for a thesis, it is complete and complex. The project does not offer a clear solution from the beginning and pushes the student to explore all the research axes seen during his training.

RESULTS

The simulation of the refrigeration line on the software required to find an equivalence between a complex corrugated shape and a homogeneous shape considering all the orthotropic characteristics of the part work on homogenization makes it possible to transcribe these properties by using a representative elementary volume, much simpler to simulate. Numerous theses have been documented in order to find a solution to this problem and many avenues have been approached including that of modeling the corrugated shape by an equivalent homogeneous shape with equivalent material properties, but this study could not be applied to our case. A simplification of the model was also carried out in order to reduce the computation time and the numerous meshing problems. In addition, some work on treatment of the experimental data was necessary in order to compare them with the natural frequencies obtained thanks to the simulation software.

KEYWORDS : modeling, numerical simulation, vibrations, optimization



Ground power unit in operation

Contact : william.baert@etu.univ-orleans.fr / remi.garcia@etu.univ-orleans.fr



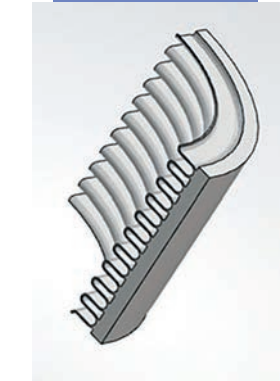
W. BAERT



R.GARCIA



Vibration measurements on a refrigeration line



Representative elementary volume of a corrugated hose

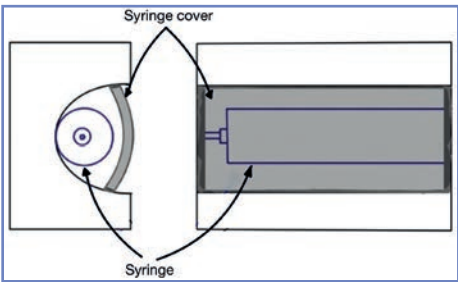
Syringe opacification system for medical purposes

Industrial engineering



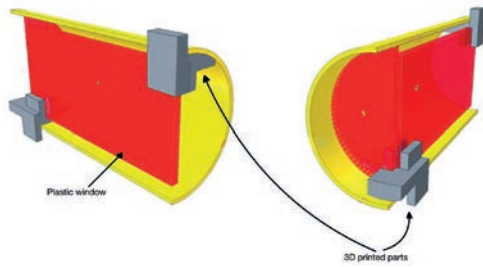
Jenna MARTINEZ / Nadine NDINKABANDI / Dylan SIBILLEAU
Academic supervisor : Jean Marc AUFRERE
Industrial supervisor : Roselyne BRAT

Company/institution : Orléans Hospital



OBJECTIVE/MOTIVATION

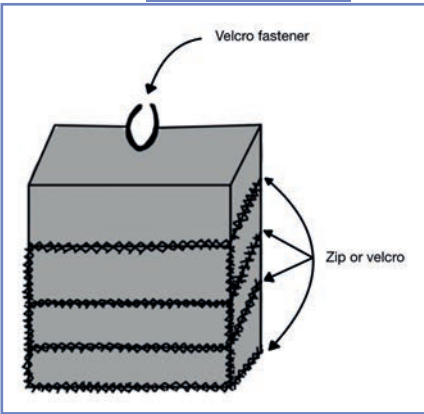
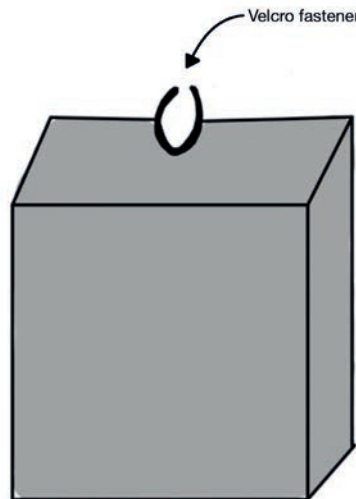
The Orléans hospital needs a system that opacifies syringes placed in syringe pumps because light alters the properties of the product they contain. They have different sizes of syringe and two different models of syringe pumps so our system has to fit them all. It should be noted that the syringe pumps are stacked one on top of the other along a column provided for this purpose. The column contains 3 to 5 syringe pumps. The solution must be easy to use so that anyone can set it up and remove it. It should not hinder the caregiver in using the syringe pump and most importantly: the system should be transparent enough to check the flow of the product and see if there are no air bubbles in it that could cause serious complications for the patient.



RESULTS

We have found 5 solutions. The first is a light-absorbing film that covers the entire column and large enough to cover 5 syringe pumps. The film is attached to the column with a Velcro fastener. The second is a "zip film" that can be adapted to 3, 4 or 5 syringe pumps. Each part of the zip film is detachable. The third solution is a rounded cover system that slides into the hollow space of the syringe pump that holds the syringe. The fourth solution is to place hooks above the syringe pump column and to lower and lift the film following the same principle as a ring binder. The last solution is 3D printed parts that take the shape of the round part that holds the syringe. These two parts will have one groove to hold a plastic window able block the light rays.

KEYWORDS : film, flirty, transparent, interchangeable, reusable



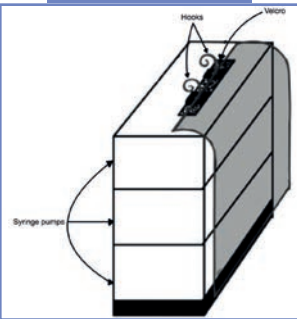
J. MARTINEZ



N. NDINKABANDI



D. SIBILLEAU



The Automatic Counting and Putting in Containers of U-Shields parts

Industrial engineering



Company/institution : APERAM Alloys

Florian PAUL / Muhammad Afham ROSLAN
Academic supervisor : Estelle COURTIAL
Industrial supervisor : Ghislain SAUJOT

OBJECTIVE/MOTIVATION

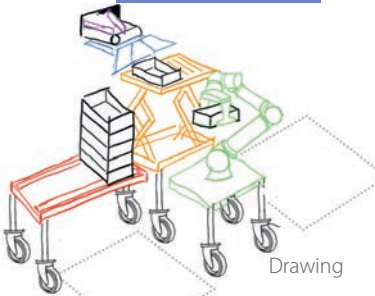
In the 21st century, new technologies have emerged, and this huge effect represents rather well the 4th Industrial Revolution with its automation and robotics developed for some applications. To put our own touch to this revolution, we are working in collaboration with APERAM which specializes in developing magnetic U-Shields parts for automotive industry applications. We need to develop a new system able to collect the parts in a degreasing container then it should be able to move both containers to a storage area until an operator takes them and sends them to the degreasing machine. In the end, this project should help the company to save money and to assign another task to the operator. Indeed, the operator needs to be present frequently to perform exhausting and non-value-added tasks.

RESULTS

First, we developed several solutions by doing some research on existing systems used on production lines nowadays. Then, the existing technologies were adapted to the requirement specifications and to the sequence of actions taken by the operator to collect and stock the filled container. After we had chosen a solution, we carried out a feasibility study on it, which included a lift, a conveyor, a mechanical switch, a cobot, a robotic gripper, and the system integration. The

switch works by distributing the U-Shields parts into two containers that are on standby at the collection area. The cobot manages the transfer of the empty containers onto the conveyor which will bring them onto the lift. The lift rises automatically when the top container has been filled and taken by the cobot. Besides this feasibility study, we also listed the price of each element to stick to the budget.

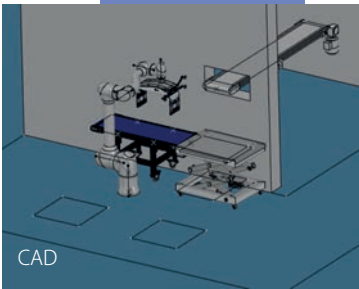
KEYWORDS : automation, productivity, improvement, manufacturing, feasibility study



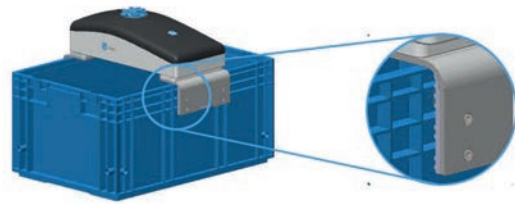
Drawing



Doosan



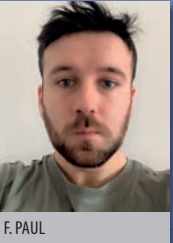
CAD



Gripper



Zone



F. PAUL



M. ROSLAN

Contact : jenna.martinez@etu.univ-orleans.fr / nadine.ndinkabandi@etu.univ-orleans.fr / dylan.sibilleau@etu.univ-orleans.fr

Contact : florian.paul@etu.univ-orleans.fr / muhammad-afham.roslan@etu.univ-orleans.fr

Updating of practical work in Characterization of Materials used by 4th year students in Innovation in Design and Materials

Materials



Mahlo DELATTRE / Omar TIAMIOU / Bertrand VANDENEECKHOUTTE
Academic supervisor : Mohamad Fathi GHANAMEH

Company/institution : Polytech Orléans

OBJECTIVE/MOTIVATION

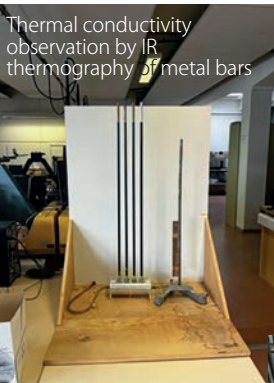
Our project was supported by a mechanics teacher M^r Ghanameh, in the mechanics laboratory and it lasted a bit more than two months. It consisted in updating the Practical Worksheets intended for the 4th-year students, so that they follow the same layout, and contain more precisions on the reminders of course and the manipulations. We also needed to create a practical for the detection of defects in metallic welded pieces, using an ultrasonic testing. This time we did the experimentations understand the problems that students can meet, and the aim was to create a subject support that would allow them to be as autonomous as possible in their carrying out. Another objective was to master technical skills linked to the characterisation of materials by going further from the practical class that we followed in the 4th year.

RESULTS

We updated and created a total of 9 practical-work subjects. To control the quality of re-editing, each member let the others, who are not familiar with

the subject, test the new practical worksheets to have their opinion and comments. Thanks to their remarks, we were able to adjust the final details on the new subjects. We were not able to cover all the topics because we chose to focus on quality rather than quantity. Indeed, the aim is for the new editions to be valid in the long term and not to be updated every year. We believe that this work now allows students to carry out these practical works more easily and overcome the difficulties we encountered last year. This pedagogical approach has given us technical skills. We have been able to strengthen our writing skills, our ability to synthesize important information, and to have a critical eye on the work of others.

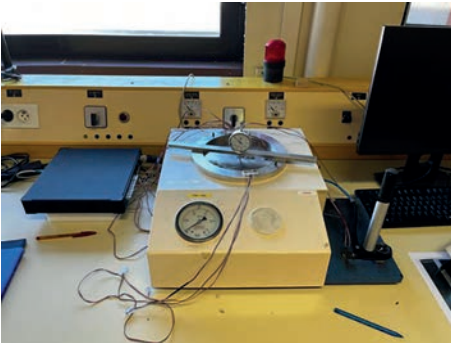
KEYWORDS : practical work, non-destructive tests, characterisation, materials, updating



Thermal conductivity observation by IR thermography of metal bars



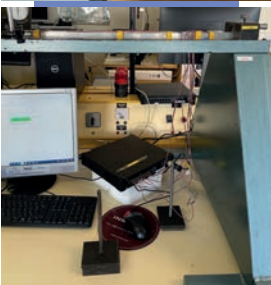
Traction machine of the practical image correlation



Bending test of an embedded plate.



ultrasound testing of defect



bending test of a steel beam



traction test of different materials



O. TIAMIOU



B. VANDENEECKHOUTTE

Internet of Things

IoT

internet of things

Contact : mahlo.delattre@etu.univ-orleans.fr / omar.tiamiou@etu.univ-orleans.fr / bertrand.vandeneckhoutte@etu.univ-orleans.fr

ATOS it challenge - Sargassum Detector

Environment engineering

Gauthier FÉREC / Clément ORTIZ
Academic supervisor : Rodolphe WEBER
Industrial supervisor : Philippe REYNIER

Company/institution : ATOS

First place
of the worldwide ATOS IT Challenge



OBJECTIVE/MOTIVATION

The ATOS IT CHALLENGE is an international contest organized by Atos company. The 2022 theme is Space and the challenge is to use data acquired from space to develop a new and innovative application.

Sargassum is a brown algae, that lives on the ocean's surface and floats in large masses. The size of these floating islands is generally several km long and hundreds of meters wide. Since 2011, there have been several sargassum invasions in the Antilles islands. These algae are perilous for the tourism industry, toxic for humans and there is a huge impact on coastal biodiversity and also significant cost for collection operations.

The first part of the project is to detect floating islands of Sargassum algae in the Caribbean and to predict their trajectory. Then, it is to design an application to connect users, associations, partners and local authorities to fight against these algae

RESULTS

Each day, Caribbean images are downloaded with the ESA Copernicus API. Then, sargassum are detected with a trained convolutional neural network.

When sargassum are detected, detections data are stored in a NoSQL database (Google firebase).

Next, these data are retrieved by the application and displayed on a map.

With the application, associations will be able to see where and when invasions take place. With this information, an association are able to create an event. Users are notified. Users helping associations are rewarded via a points system. Each user has a QR code containing its information. When his QR code is scanned, the database is updated.

The more events users participates in, the more badges they unlock and the more rewards they get. Our application runs on Android 28 and is coded in Kotlin

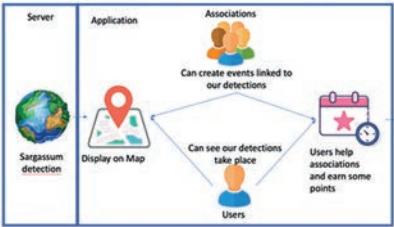
KEYWORDS : application, deep learning, CNN, image processing, sargassum



Vegetation detection



Infrarouge detection



Application diagramm



Project diagramm

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Connected tear gas canister

Electrical engineering

Quentin MAIRE / Clément PLASSE
Academic supervisor : Aladine CHETOUANI
Industrial supervisor : Samir DJENDOUBI



Company/institution : IoTBox

Third place
16th annual final year projects forum



OBJECTIVE/MOTIVATION

This project aims to connect a defence spray used by the police or by civilians. To improve this, a camera and a microphone must be added, which will make it able to film and record the scene when the defensive spray is used. However, to store the video and sound, we need to adapt the storage capacity of the electronic card. The sound will be transmitted to a telephone and the video will be stored on an SD card to facilitate its transfer to a computer. The aim is to prove or not prove the use of self-defence in a trial. One of the main challenges of the project is to respect a very low price limit. The other challenge is to have a camera of good enough quality to recognise the person on the video.

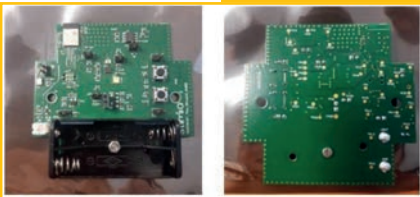
RESULTS

The results obtained during this project prove the feasibility of the project for a total cost of less than \$30. We found a camera with a resolution of around 500 KPixel and a 3V power supply which allows us to recognize an individual but also allows us to connect the camera to the electronic board.

In addition, we opted for an SD card to simplify the transmission and storage of the video. Finally, we decided to transmit the recorded sound to the phone via Bluetooth.

In order to have a powerful defence spray, we replaced the microcontroller with another one, adapted to video processing. So, all the functionalities are present and all the technologies used have a cost lower than \$30. This project is therefore feasible.

KEYWORDS : defense, camera, storage, bluetooth



Electronic board



Application description



Description defence spray

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Design of a standalone sensor architecture

Electrical engineering



Company/institution : NodOn

Bastien LEFEIVRE/ Nicolas SELLE/ Julien DUPUIS
Academic supervisor : Raphaël CANALS
Industrial supervisor : Alexis POLEGATO

High schooler's choice
16th annual final year projects forum

OBJECTIVE/MOTIVATION

The project consists in designing three types of sensors : a thermometer, a thermometer/ hygrometer and a door opening sensor. To stand out from the competition, the sensors will include several features : the sensors will be connected to a Gateway (home automation box) using the Zigbee protocol in order to retrieve, operate and display the measurements; the sensors will include a solution making them energy-autonomous (Energy Harvesting) to make the use of a battery optional ; the design will make the sensors discreet and aesthetically pleasing and will allow a simple and fast assembly.

The sensors are intended for individuals and professionals wishing to monitor their living/ working environment while avoiding maintenance constraints. The objective of the project is therefore to choose the components adapted to the



Sensors From NodOn

specifications, select an Energy Harvesting technology, and optimize the system to reduce its energy consumption to a minimum.

RESULTS

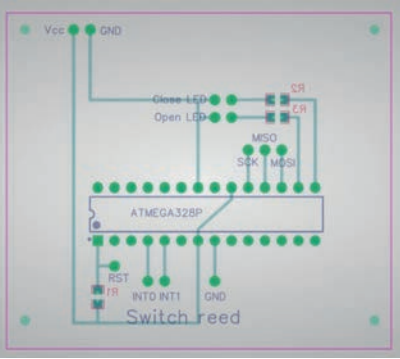
The solution chosen to make the energy system autonomous is solar energy. Light is a source of energy present in most cases of sensor usage. A solar panel allows the recovery and conversion of this energy into electricity. A button cell battery can be inserted

into the product, to allow its use in dark places. However, its use remains optional. An electronic system allows to store the electrical energy in a battery, then to adapt the current and voltage recovered to the system.

To minimize the energy consumed by the system, it will be asleep most of the time. The processor will be awake when taking measurements and sending data.

Moreover, an Excel table was created to calculate the energy consumption of the system and define the best configuration of the system.

KEYWORDS : autonomous, energy harvesting, zigbee, sensor



Electronic Board

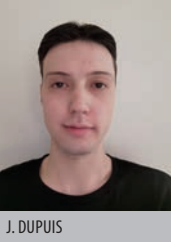
Contact : ns.wanadoo@gmail.com / bastien.lefeivre@gmail.com / julien.dupuis@gmail.com



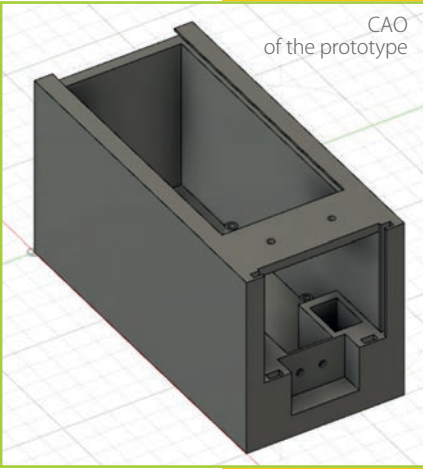
B. LEFEIVRE



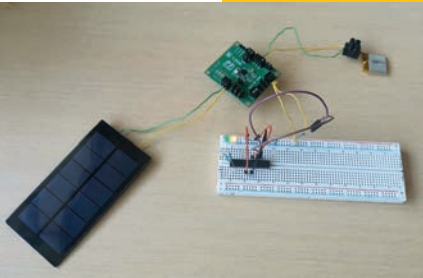
N. SELLE



J. DUPUIS



CAO of the prototype



Prototype

Feasibility study for adding “real time” audio transfer via Bluetooth

Electrical engineering



Company/institution : IOTBOX

Alexandre POULIQUEN / Jérémy GAMEZ
Academic supervisor : Guy LAMARQUE
Industrial supervisor : Samir Djendoubi

OBJECTIVE/MOTIVATION

In the past 10 years, the aggression rate has been increasing, however, the products for self-defense have not evolved. Moreover, in more than 80% of the cases when someone uses a self-defense spray, they will lose the case if the aggressor files a complaint, as there is no proof of self-defense. A first prototype of a connected tear gas canister with new functionalities such as a bright LED and a buzzer to frighten the aggressor without physically hurting them has already been made. A microphone was also put in the first prototype, but the recording could only be used as evidence. The goal of this project is therefore to carry out a feasibility study on audio transmission to the user's phone via Bluetooth. The recording would then be stored on the phone and could be sent to pre-selected contacts to keep them informed of the situation in real time.

RESULTS

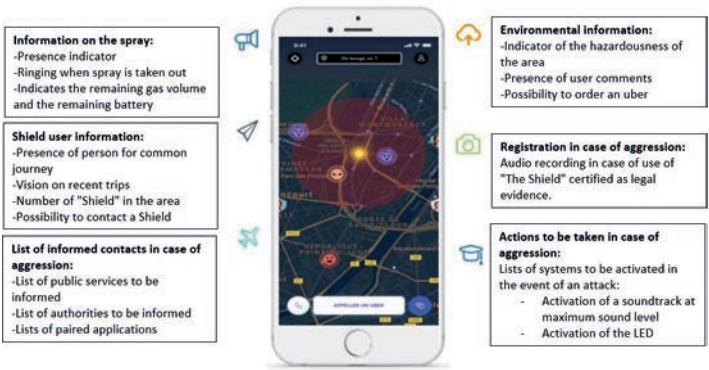
The addition of the Bluetooth audio stream function will be possible on the prototype with

the current materials. The power supply of all the components will be insured with the two lithium stacks when the spray will be fully used. Concerning the memory capacity, a small compromise had to be made, but the current memory will insure the wanted function. The audio stream audio over Bluetooth will be possible. A few solutions have been determined. The audio data can be sent directly in raw format, directly from the microphone output or we can send the audio data and send the audio with specific audio profile provided by the Bluetooth 5.0. The two audio profiles are the ones for sending music to a speaker, or the ones to make calls with a headset. So, the final task is to make the decision concerning the best way to stream audio data over Bluetooth.

KEYWORDS : bluetooth transmission, self-defense, embedded system



Connected tear gas sprayer box prototype



Application features

Contact : alexandre.pouliquen@etu.univ-orleans.fr / jeremy.gamez@etu.univ-orleans.fr



A. POULIQUEN



J. GAMEZ

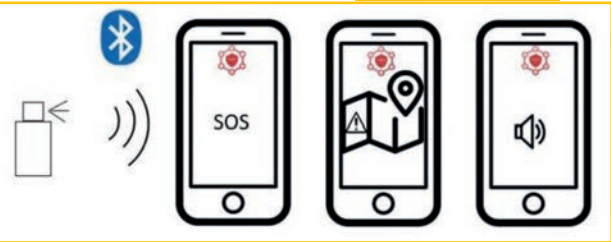


Diagram of emergency mode operation

Icompost : managing a database of compost sites using a web site

Electrical engineering

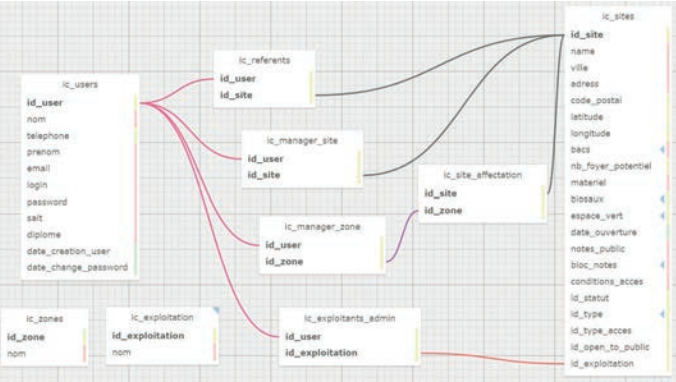
Olivia NOËL / Célia CHOQUART
Academic supervisor : Rodolphe WEBER
Industrial supervisor : Veronique GOREL



Company/institution : O'Compost

Selected participant
16th annual final year projects forum

Modele base de données



have been removed, some tables have been changed to fit the needs and the access level system has been modified to be site depend. Then, after comparing several approaches, a new code architecture has been chosen and applied. Bases on Flask Blueprint functionalities, the code can be divided into small and stable parts. A first set of

OBJECTIVE/MOTIVATION

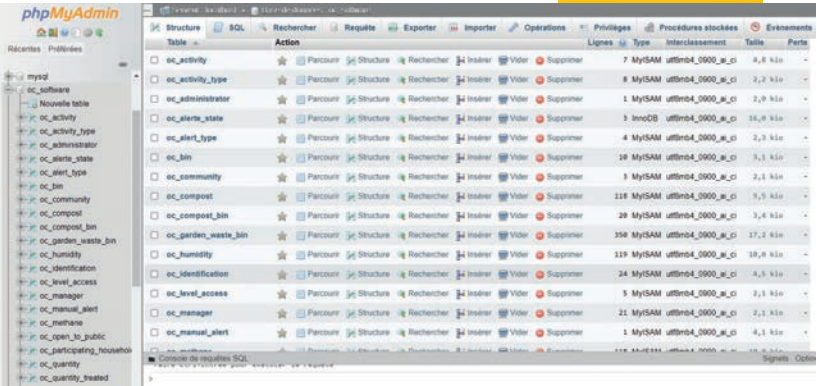
Icompost is a web site managing a database of all the compost sites in Orleans. The Orleans Metropole and the Cycloposteur association (the client) interact with this website to follow the daily work on the compost sites. The beta version of this web site has been set up last year by two Polytech students, Bedu Laura and Huré Corentin. It was functional, communicating with the database using SQL code and showing information about a compost site depending on the user's access level ; the higher the rank, the more information the user can see. Now, this web site needs improvement. First, the model of the database has to be redefined because the needs have changed. Besides, the code structure is not enough flexible to allow any further evolution. Our job is to completely rethink the code architecture to simplify and secure the future upgrades.

web pages will be developed and tested on a OVH server.

KEYWORDS :
database, MySQL, Web application

RESULTS

Sofar, the database has been restructured according to the client specifications. All the unused tables



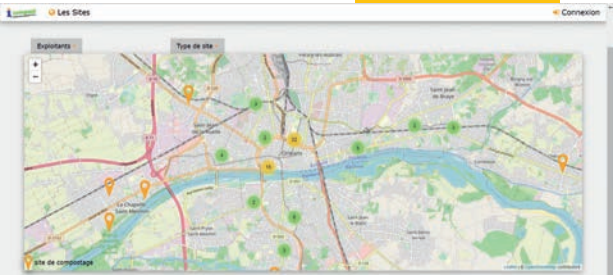
Phpmyadmin

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Production management



Presentation site web



Continuous improvement in a production unit

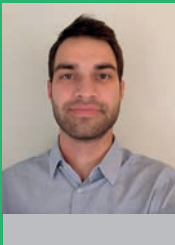
Production engineering

Hélori CHABRUN

Academic supervisor : Gilles HIVET
Industrial supervisor : Olivier BRETEAU



Company/institution : Gestamp



OBJECTIVE/MOTIVATION

You will find in this report the way I have participated in continuous improvement of GESTAMP Sermaises' assembly sector.

I chose to do this apprenticeship in the automotive sector. The market is very competitive and demanding. High production throughput in addition to rude requirements makes very advanced working methods essential, Companies must be dynamics and particularly innovative. Whether it is strategy level, tactical level, and operative level. This is what I was looking for.

Dynamic, technologies, process and management convince me to deal with the automotive sector. The high competitiveness makes the automotive industry continuously evolve and improve. Then we must adapt with the different methods and the new demands. A large range of skills is required, and you must have a global vision but also know with precision the functioning of each of the company's bodies.



Example 5S

RESULTS

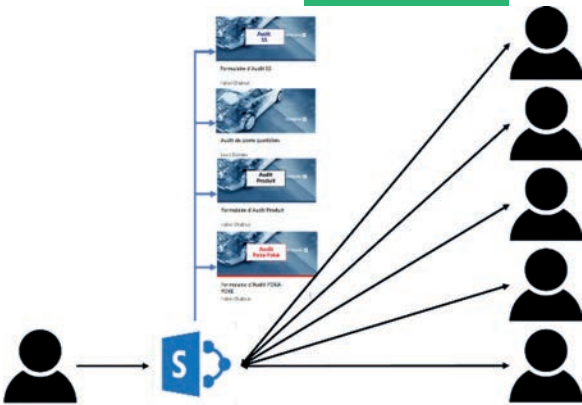
GESTAMP Sermaises' site welcome me in order to participate in the reduction and prevention of alerts and incidents to increase customers' satisfaction. I therefor deal with 3 main subjects this year: Preventive Maintenance Level 1, 5S, and audit.

The 5S does not exist through the documentation. I deployed 5S worksite on the pasts. The standard still needs to be finalised on others posts, applied, and perpetuated.

Preventive Maintenance Level 1 actions, where already being carry out without being formalised. I therefor defined the actions, wrote the documentation, and deploy on certain posts. The indicator of the productivity uses has been improved with the quality average of the products as the claim rate has decreased.

The audit part deals with the sustainability of actions deployed. Especially with the 5S part which is not installed. Then I set up an audit grill and develop a new way to archive the results informatically.

KEYWORDS : automotive, continuous improvement, quality, indicators, management



Organization of the dematerialization of audits

Contact : helori.chabrun@etu.univ-orléans.fr

Digitalisation of self-checking records

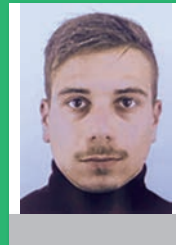
Industrial engineering

Flavio RASTEIRO

Academic supervisor : Benoît ROUSSEAU
Industrial supervisor : Georges RODRIGUES



Company/institution : Dubuis



OBJECTIVE/MOTIVATION

Dubuis has a long-term objective to reduce its environmental impact. Thanks to the project I carried out during my fourth year in Polytech I can slightly contribute to this reduction. The purpose of my project was to digitise the self-checking records of the workshop. Traditionally, CNC operators filled out these records by hand on paper. In addition, many of these records were incomplete when they reached the quality department, firstly because a lot of information could have been filled in beforehand but also because the operators forgot. We used to waste a lot of time checking, scanning and archiving these records. We also wasted some when we had to make up for the operator's omissions. The purposes of my project were simply to eliminate paper records in the workshop and ensure that,

once they arrive at the quality department, the records were always 100% complete.

RESULTS

I set up a project team with the heads of different departments. We first defined everything we could about these records before they arrived in the workshop. By defining this, operators will be able to concentrate on their real added value: filling in the ratings. As we wanted to digitise the self-checking records and make them available to each station, we modelled them in Excel. Thanks to my knowledge of the field and by listening to the operators, I was able to define the best possible form for these surveys. For example, by adding colours, information that was not there before, etc. We were able to do the first tests before my university period. This was the first objective because, during this period, the methods office could start to digitise a maximum of references. The objective of the methods office is to digitise 200 references before 2022.



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Digitalization and traceability in the production plant THALES in La Ferté-St-Aubin

Production engineering

François-Xavier TOULOUSE
Academic supervisor : Benoit LE-ROUX
Industrial supervisor : M. MOREAU

THALES

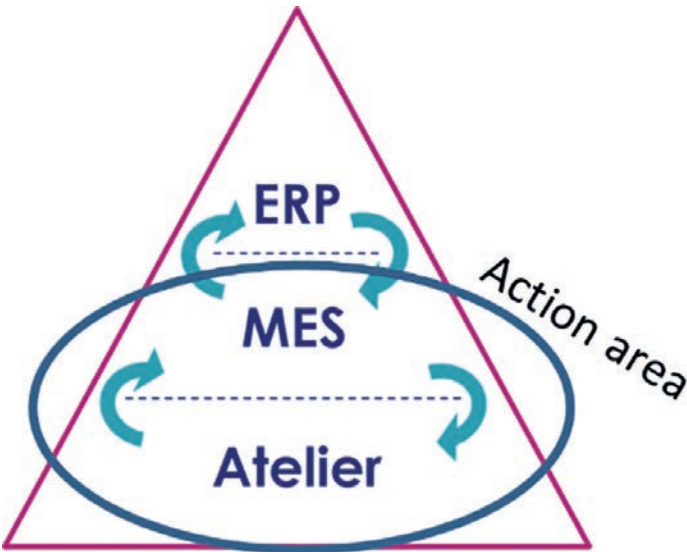
Company/institution : THALES

OBJECTIVE/ MOTIVATION

Today, the traceability of our production lines is made with paper. With this solution, we could lose some data on the production and its very difficult to find which components are used in our product. The goal of this project is to find a solution to feedback the product line data in software. Indeed, with a software program and connected equipment (tools, machine, etc.) we can have more information and we are able to make more analyses on the production line. The objectives of this project are to improve the quality of production, the traceability of components, the quality control and make a control report more easily for customers. The production site is a pyrotechnical site so we must find a solution which respects the hygiene safety environment (HSE) rules. Moreover, this one should connect to our machine program and ERP software.

RESULTS

To carry out this project, we made a benchmarking in other THALES plants to find a group solution. In fact, we had to find a corporate solution to facilitate and reduce the cost of setting the software. In addition, it will allow us to facilitate the



maintainability of the software. We have chosen the group solution using an MES on our production line. The MES software feedback all the information in the production line to make a strong traceability. The other sites having other specializations, we had to adapt this MES to our needs and constraints. In the first place, we have developed this solution in one production line which doesn't have a lot of restrictions. Indeed, this production line is in an inert area, is the smallest production line. This production requires extensive documentation to be deliver to the customer.

KEYWORDS : industry 4.0, project management, traceability, defense, development

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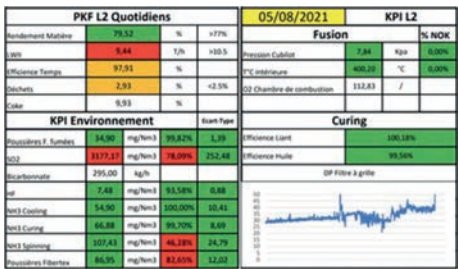
Digitization to support the management of a production activity

Production engineering

Arnaud DEVERS
Academic supervisor : Christophe DUROS
Industrial supervisor : Emmanuel BAUD

ROCKWOOL

Company/institution : ROCKWOOL



Picture of report

OBJECTIVE/MOTIVATION

My 5th year project objectives were to help the production in the line management and in the vision of the indicators on the manufacturing process of rock wool on two production lines. Process technicians oversaw monitoring the indicators on monitoring software with feedback on all the sensors of the factory (more than 200 sensors installed on a production line). This supervision allowed the process technicians to assist and give instructions to the production. The main objective was then to standardize the analysis of the indicators automatically and to edit a report every day to supervise and assist the production

in the decision making. All the hierarchy can have access to these reports and, thus, this approach is based on a continuous improvement approach since we will be able to know the evolution of the indicators and the drifts during production.

RESULTS

The entire production and management team follow these reports to implement an investment strategy. The team managers use these reports to guide their teams so that they do not repeat the errors reported the day before. The management team can easily know the state of the production as the days go by. A drift is noticed more easily than by the technicians' analysis. Moreover, the process technicians are now freed from this task and can concentrate on other aspects of the process. In addition, the indicators increase day by day. An environmental aspect was added later, allowing us to follow the respect of the standards to keep our certifications. The project is a step towards the factory of the future and makes it possible to launch the digitalization of the rock wool manufacturing process to extend it to the group level.

KEYWORDS : digitization, supervision, factory 4.0, standardizing, knowledge



Before the project



After the project

Contact : arnauddevers@gmail.com

Industrialisation of the 155 mm Smoke shell

Production engineering



Guillaume GATEAU
Academic supervisor : Pascal VRIGNAT
Industrial supervisor : Jean-Pierre MAZERON



Company/institution : NEXTER

OBJECTIVE/MOTIVATION

As part of a sustainable and profitable growth process, the management of NEXTER Munitions has decided to develop a new product, the 155 mm Smoke Shell. This projectile is fired from an Artillery Equipped Truck (CAESAR). This product is developed to support military forces operating on the ground. Indeed, the main function of this support shell is to mask the visibility of a defined area.

The development and production of war material must be approved by the Direction Générale des Armées. Here, the DGA represents our customer. In this context, NEXTER must provide a milestone progress report on the technical and industrial development of its products and meet customer requirements.

This year's objective is to ensure the launch of an industrial pre-series, to put in place the necessary proofs to pass the last development milestone and to have the industrial development validated by the customer.

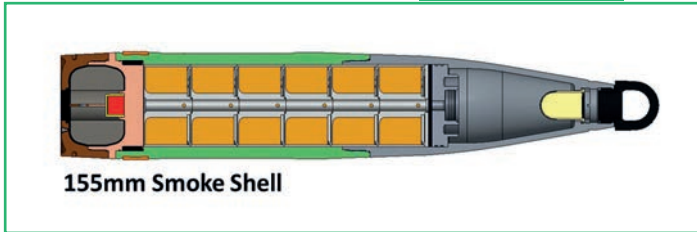
RESULTS

The industrialisation of this new product was carried out in phase with the design office. The first phases were the constitution of the industrial bill of material and the Make-or-Buy strategy of the different components of the ammunition. Next, we received quotations from our suppliers (according to our call for bids) allowing us to carry out our external qualifications. At the same time, we set up manufacturing and control processes. These documents permit our production units to carry out and qualify the operations required to manufacture the new artillery shell.

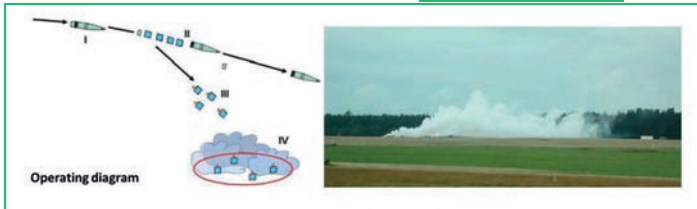
By carrying out and validating the various tasks required to produce this ammunition, we can attest to the robustness and safety of the manufacturing processes used for this new product.

Finally, the pre-production batch is presented to our customer in order to validate the planned series production.

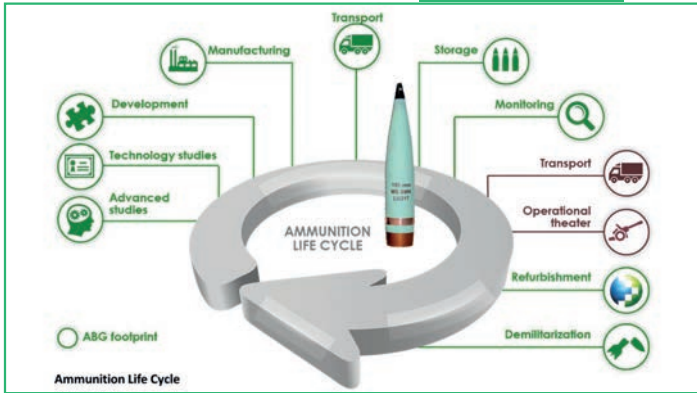
KEYWORDS : industrialisation, defense, production, artillery ammunition, product development



Product



Operating



Life cycle

Contact : gateauguillaume@yahoo.fr

Integration of autonomous and poolable handling aid equipment such as collaborative robots

Production engineering



William DESBRUNS
Academic supervisor : Philippe GRILLOT
Industrial supervisor : Fabrice BRETTE



Company/institution : MSL CIRCUITS

OBJECTIVE/MOTIVATION

The objective of this project is to set up autonomous solutions of the collaborative robot type. These cobots will be flexible and can therefore be used on any station according to needs. MSL CIRCUITS has joined the consortium of electronics manufacturers TECHGEN2, led by the techno campus We Network, in order to be accompanied in this process. As I have been designated to do this, I must, together with my tutor, implement this technology which will make it possible to reconcile productivity and employee well-being. Not having a robotics department with skills in cobotics, the company turned to an integrator. The latter will carry out the necessary studies and the installation of the cobot within MSL CIRCUITS. Today, this project represents

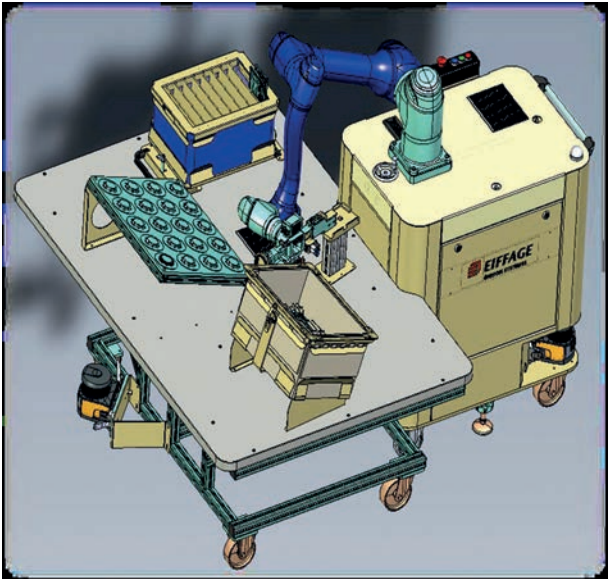
an opportunity for MSL CIRCUITS to enter Industry 4.0 while reducing musculoskeletal disorders which generate significant costs for the company.

RESULTS

Two in the three use cases, grouped in the logistics area, are currently being implemented. The third, in the production lines, is currently on hold due to costly workstation modifications. The desire to seek a return on investment was a difficult thing to achieve here. This is due to the high investment cost compared to the budget initially planned with the consortium. Nevertheless, the strategy was revised to focus on the risk of musculoskeletal disorders, which have a direct impact on the well-being of employees and the company as a whole.

Despite the delay due to the health crisis and development concerns, the development of the cobotised cell is progressing and should be installed at the end of my apprenticeship period. A receipt for the equipment can be envisaged during this year following the latest developments.

KEYWORDS : musculoskeletal disorders, robotics, project management



Robot

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Launching of a new project "Lucid BasePlate"

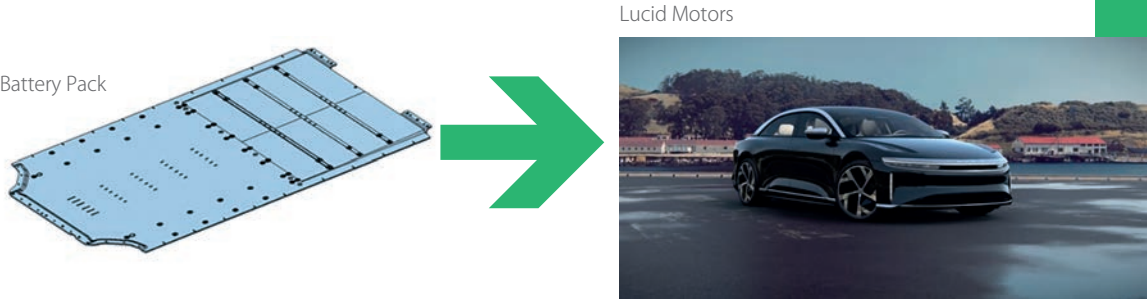
Production engineering



Guillaume RICHARD
Academic supervisor : Aïcha FONTE
Industrial supervisor : Jean-Luc PLOT



Company/institution : Faurecia Automotive Composites



OBJECTIVE/MOTIVATION

My 5th year project is the launching of a new project called "Lucid Base Plate" for the new car manufacturer Lucid Motors localized in the USA. This new project is the production of parts from the Battery Pack of the new constructor Lucid localized in USA. My goal was to follow the objectives sold by the Method Service with the arrival of new technical equipment. The new manufacturing process used for this project is called Liquid Compression Molding: the resin is applied to the top of the fabric, either outside or inside the open tool cavity, the press then closes, and resin is pressed into the laminate air inside the mold. This new manufacturing process was unknown for us, so it was a big challenge. I had some goals like: SCRAPS, TRP (Production Ratio Productivity), Cycle Time mini and Pareto diagram.

RESULTS

During this trial period, we also received new technological tools such as a gripper, new cutting

tables and a rotation tool for the part. We had an average of 52.5% scrap and after the introduction of Dinitrol, we decreased to an average of 32% scrap. Our cycle time decreased by 50.3% thanks to the integration of a new operator, new technological tools and the reorganization of operations. So, during this launching, our PPH indicator (Parts/ Person/Hour) increased by 33%. The integration of a new manufacturing process is a real challenge for any company. Even though we are making progress in understanding the product and the manufacturing processes, some phenomena remain to be discovered and new means have yet to be installed. There is still a lot of work to do, our scrap rate is still too high, as is our MOD workforce.

KEYWORDS : launching, liquid compression molding, battery pack, composite, lucid motors

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Parcel flow management

Production engineering



Camille MENTEAUX
Academic supervisor : Jean-Baptiste VIDAL
Industrial supervisor : Romain BRISSET



Company/institution : Platform Colissimo of Mer

OBJECTIVE/MOTIVATION

Currently, the supply rate for incoming line packages is not constant. This results in power cuts at the injection stations. This problem is due to an increase in volumes handled by the Mer site. The increase in volumes implies an increase in production targets in the years to come. For the first step of this project was to start by observing the supply flow around the perimeter of the arrival platform to determine the causes of supply failures. Then, for the second goal, the objective was to put in place improvement solutions to improve the flow of traffic.

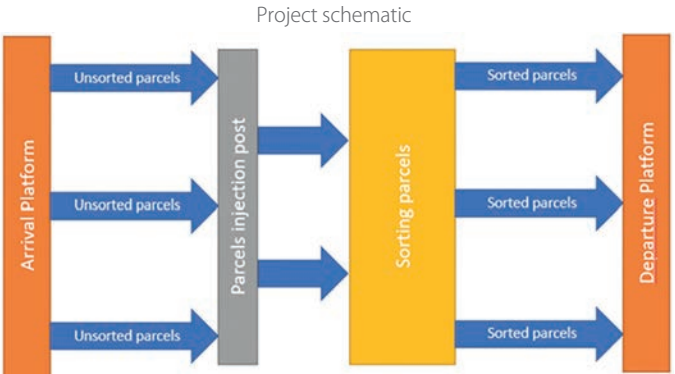
To eliminate the supply disruptions of parcels, it was necessary to put in place:

- ▶ one or more indicators that would allow monitoring
- ▶ actions aimed at reducing ruptures
- ▶ direct management action and practices, make a success of the approach

RESULTS

To carry out this project, it was necessary to follow a structured approach to project management. The various tasks that I was able to see through with this project are first the observation of the production flow, to determine and analyze the causes of the power failures then the implementation of technical solutions, if necessary, to eliminate the power outages. In addition, it was necessary to train the agents to use the solutions put in place and to create procedures. Finally, technical solutions to eliminate supply interruptions were put in place with the aim of allowing a constant and controlled injection rate. In the first time I did this study on the arrival platform flow. Now it necessary to analyze and improve the flow of the sorting machine and the departure platform flow with the same method.

KEYWORDS : logistic, flow, management, continual improvement



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Reduction of the rate of abnormal baking due to the baking oven

Production engineering



Abir BEN SALAH

Academic supervisor : Christophe DUROS
Industrial supervisor : Thomas FEBVRE



Company/institution : Pneu Laurent (Michelin)

OBJECTIVE/MOTIVATION

In 2021, the quality department was challenged by the company to reduce the rate of our Quality Indicator of Material Losses. Several working groups were then set up, depending on the quality criteria that have the highest impacts on our Quality Indicator of Material Losses rate. It is in this context that I was assigned the management of one of these groups, composed of people from the quality department and the maintenance department, in order to work on the 4th quality criterion impacting our Quality Indicator of Material Losses rate "Abnormal baking due to the baking oven". The aim of this project is to provide the necessary solutions to reduce the rate of abnormal cooking due to the cooking presses and thus participate in the reduction of the rate of our Quality Indicators of Material Loss.

RESULTS

The application of Lean tools in this project led to the identification of various ways of improvement to be implemented. The efforts made by the working group set up were able to lead to short term but also long-term solutions. Once implemented,

these solutions will achieve the objective set at the outset, with a reduction in our abnormal cooking rate of approximately 22.5%.

This first professional experience in leading a work group contributed to my personal development, as well as to my professional skills.

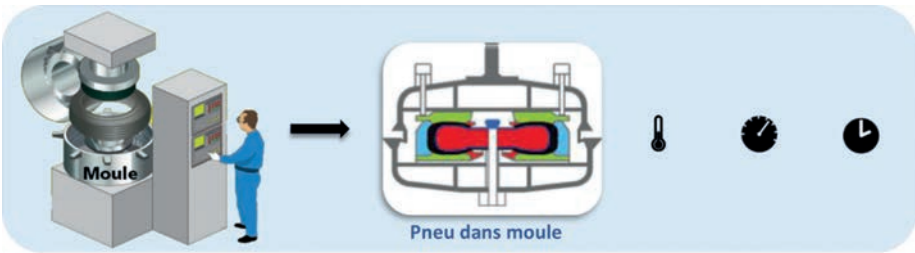
Indeed, I learned a lot about the management of a field problem using the Lean tools seen at Polytech Orléans, but also about the collaboration between colleagues during the various meetings that I was able to lead. Preparing and leading meetings has been a very formative discovery for me this year.

KEYWORDS : DMAIC, quality, indicators, lean, management



cooking oven

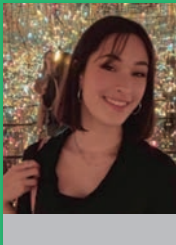
Method of a tire baking in a cooking oven



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Reorganization of the Alstef Group airport building

Production engineering



Maryem HOUTTEMANE

Academic supervisor : Emmanuel BEURUAY
Industrial supervisor : Frédéric VERNA



Company/institution : ALSTEF GROUP

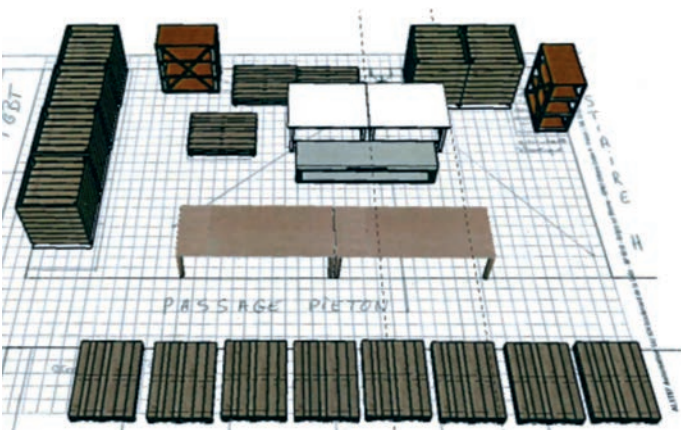
OBJECTIVE/MOTIVATION

The goal of this project is to reorganize the airport assembly building (where we assembly conveyors), to improve flows, to gain space and convenience for technicians by reducing movements and avoiding musculoskeletal disorders.

To identify the majority of the problems and to understand as well as possible the organization of the building and the conveyor assemblies and the pre-assembly of parts, a working group made up of various skills was created. This committee was composed of people from the production department and with a good knowledge of airport pre-assembly and assembly. The aim of this meeting was to take stock of the situation in the airport building in a context of rapidly expanding activity and team renewal in order to determine together the areas of improvement on which to focus.

RESULTS

The future assembly area will allow us to have a defined and ventilated space: 1 space for assembly, 1 space for stock and 1 space for warehouse preparation. Moreover, this area would be a suitable space for our production rate which is on average 4 conveyors per day. This new implementation and changes will eliminate unnecessary time loss, fatigue and optimize productivity at different levels of the company (assemblers, assembly coordinator). The most important gain targeted, evaluated at 17.5%, is a gain of 21 minutes for the assembly of a conveyor. The optimization of the assembly and pre-assembly areas reduces the number of technician movements in the assembly areas and traffic lanes and allows a saving of approximately 4 hours per week, i.e. 2 conveyors.



Choice of the solution

The development of this implementation will allow us to use this time to increase the production rate and reduce the risk of injuries.

KEYWORDS : airport building, conveyors, alstef, reorganization, airport

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Standardization of the validation of operators' skills

Production engineering



Company/institution : MSL CIRCUITS

Yoann DEPOND

Academic supervisor : Philippe GRILLOT
Industrial supervisor : Laurent BERGOT



line managers and standardising the processes associated with the production lines. To develop the skills of the line operators, we use validation grids associated with each of the production lines in our sector. These validation grids, as well as their standardisation, allow us to develop the skills and versatility of the line operators but also to enhance their daily work within the company and to make it more attractive. My work was organised in an autonomous way, with the freedom to use all the tools in my possession to understand the different production lines.

RESULTS

This project was quantified based on various criteria. In particular, the number of tasks carried out as planned, the time saved in validating line drivers and the percentage of people validated following the implementation of this project according to the different objectives of each entity. The automation of our validation tool has allowed us to save a certain amount of time, about twenty minutes for a validation. Moreover, this automation, by reducing the possible choices left to the user and the firewalls included in the programming, eliminates sources of error. The time saved will allow managers to devote themselves to other activities. To quantify the impact that the deployment of this new validation process has had, a table summarised the percentage of validation in each entity before and after the deployment with the objectives of each. This learning process was a challenge for me in terms of communication and organisation in the relationship between the different actors who were part of this project.

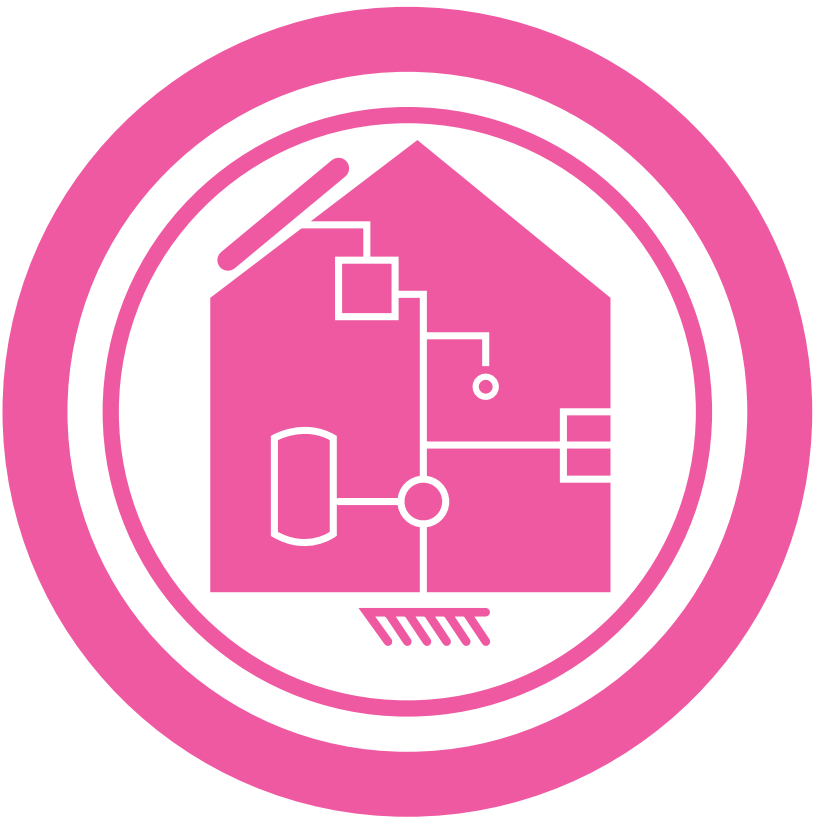
KEYWORDS : production, quality, skills development, communication, electronic manufacturing

OBJECTIVE/MOTIVATION

I am doing a work placement at MSL Circuits in the Loiret region. This company is one of the leaders in the manufacture of electronic boards for the automotive sector. I was assigned to the "Finishing" department, which is an integral part of production. I oversaw redefining the validation grids for

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Smart building



A new electrical cabinet and automatic system for an hospital

Electrical engineering

Jason HARRIS

Academic supervisor : Raphaël CANALS
Industrial supervisor : Eric LE FAUCHEUR



Company/institution : HERVE-THERMIQUE

OBJECTIVE/MOTIVATION

The objective of this project was to change the electrical cabinet and the various sensors in the ventilation part of the offices of a hospital building.

The goal of this project was to refurbish the regulation system to ensure system stability on the one hand and on the other hand to save energy thanks to a PLC and internal programming.

Firstly, I had to do the different quotes. Secondly, I had to carry out the electrical study of the project. In the end, I was responsible for the administration and management part during the execution and reception phase of the project.

So I had the opportunity to work with calculation and design software such as AutoCAD See electrical, Caneco.

RESULTS

Thanks to this project, I was able to gain autonomy in everything that is management, market research,

electrical study, suppliers and customer contact.

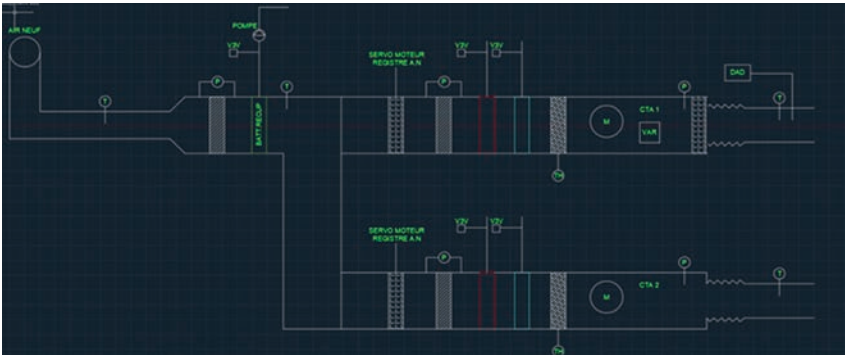
We had two objectives for this project which were achieved :

- ▶ To make profit thanks to a gain on the workforce.
- ▶ Gain the client's trust to obtain new businesses

Indeed, thanks to the good success of this project, we were able to establish a relationship of trust with the client. As a result, we will subsequently have to be consulted again for future work.

Last and not least, the result was to prove that Herve Thermique company does not only thermal but also electrical installations. This project therefore also serves as an advertising showcase and thus demonstrates a certain know-how.

KEYWORDS : electrical engineering, smart building, energy savings, automatism, market research



Contact : jason.harris1305@gmail.com

Assistant business manager in tertiary electrical installations

electrical engineering

Rémi DUPOY

Academic supervisor : S. RAGER
Industrial supervisor : O. RABOT



Company/institution : Eiffage Energie Systèmes



OBJECTIVE/MOTIVATION

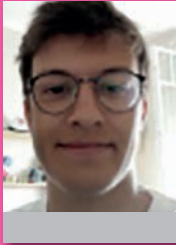
During my Smart Building studies, I had to carry out electrical studies and manage construction sites in the tertiary sector. The branch is specialized in thermal, electricity and HVAC. Specialized in the field of electricity, I followed the construction of two residences in La Rochelle for a total of 133 residential dwellings. I also manage electricians for the construction of a high school with 1 500 students. From the power supply to the buildings to the sockets in classrooms, I was required to monitor and manage studies, purchases and on-site meetings.

RESULTS

Construction of the dwellings went well, residents were able to move in two months after the scheduled date due to covid 19. The follow-up that I carried out made it possible to reduce certain costs, in particular on the equipment planned at the origin of the site and therefore allowed the

company to make more profits. Interventions in the high school will be finished in 2023, Interventions in the high school end in September 2023, the site is continuing with a team of technicians who are updating and installing new electrical installations. From the new security system to the removal of equipment from old buildings, everything is done to meet the customer's specifications and to make the students' studies as pleasant and efficient as possible.

KEYWORDS : electrical engineering, business management, project studies, site meeting



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Business manager
Smart building



Tom JUBARD

Academic supervisor : Christophe CACHONCINLLE
Industrial supervisor : Stéphane GUILLOT



Company/institution : SDEL Berry (from Vinci Énergies)

OBJECTIVE/MOTIVATION

My project consists in upgrading the life time of about ten kilometers of an electrical line high-voltage level A (20 kV). The operations varied from the restoration of cable fixations at the head of an existing support to the replacement of a support by a new one and also replacing the three cables.

My main tasks were to manage the relations between all the representatives around this project, so be the link between the client: ENEDIS, the other companies, our field teams, our boss, the residents on the work zone and others.

In this project, it's necessary to always have an eye on the financial part like the initial quote, the time spent on the worksite by the workers and the invoicing to optimize the balance between money spend and money won and increase the outcome of this business.

RESULTS

The project started in 2020 and ended in September 2021. The final outcome of the site was not as expected due to some disruptions.

The latter were due to external things. For example, we had to access a support in a field but as the weather was bad, the farmer did not allow us to enter his field and degrade it to perform our operations. The major problem that we faced was a city council (in the work zone) which changed their mind and decided to refuse to move the line along their municipal road. These problems decreased the turnover of the project of about 20%.

Generally, all the operations were performed by our field teams. The residents were conciliatory and the client delighted about our good job, which is encouraging for our similar works.

KEYWORDS : electricity, management, public works, urban equipment

An example of a support which was replaced



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Globally performance market
of Saint-Maur-des-Fossés
Smart building



Maëlig LEMITRES

Academic supervisor : Rodolphe WEBER
Industrial supervisor : Anne-Christine DE-FROBERVILLE



Company/institution : ENGIE Solutions

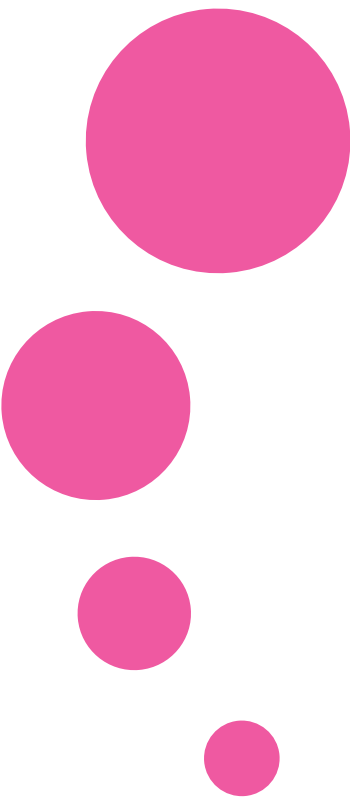
OBJECTIVE/MOTIVATION

During my apprenticeship, I worked on a call for tender which is named Globally Performance Market. The aim was to renovate and upgrade the street lighting heritage of Saint-Maur-des-Fossés. I was responsible for the technical report. It was important to be coordinated with the others unit. A few streets were already equipped with LED lighting, so we were forced to find models that fit well into the heritage already present. In addition to the lighting, we worked on the renovation of a few crossroads with traffic lights. We also worked on the renovation of the underground and aerial networks. We were a small team but we put all our energy into this project. It was important for us to make the perfect bid and get the contract because it was complex and there were many contestants.

RESULTS

After one year of work, we finally won the market with a better technical offer. In fact, we managed to have a 62% decrease in energy consumption. We were above expectations especially on network burials which was one of the most important points for the customer. To guarantee our success we worked with graphists and oral professionals to prepare the different auditions hearings in the best possible way. During hearings, we were supposed to explain in front of the customer the different points of our offer which was not clear and which required more explanation. That's why we called on a professional who helped us to do the best presentation possible and convince the customer to choose our offer. This contract has allowed the company to gain credibility and will allow it to gain skills to carry out other similar contracts.

KEYWORDS : call for tender, global energy performance market, energy transition, street lighting, technical report



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Implementation of a building management system for the comfort thanks to artificial intelligence and direct current

Smart building



Noémie PALMIER
Academic supervisor : Guy LAMARQUE
Industrial supervisor : Kevin DOS SANTOS



Company/institution : Ubiant

OBJECTIVE/MOTIVATION

Ubiant's mission is to further the deployment of "ambient intelligence" in living areas to improve the future wellbeing of individuals while preserving natural resources. Ubiant has therefore developed a Building Operating System that aims to exploit a building's smart resources and thereby provide a wealth of scalable services over time. One of Ubiant's objectives is to reduce building energy use while improving users' well-being as the world transitions to a carbon-neutral economy.

In this context, Ubiant took part in the "Evidence" project, in the heart of the ZAC de Docks in Saint-Ouen. This is a project consisting of a green and quiet island, surrounded by 2 new buildings offering 37 805 m² for office and service use.

We work on the comfort building management system for the control of lighting, HVAC and blinds for office trays sold blank for which re-partitioning is essential.

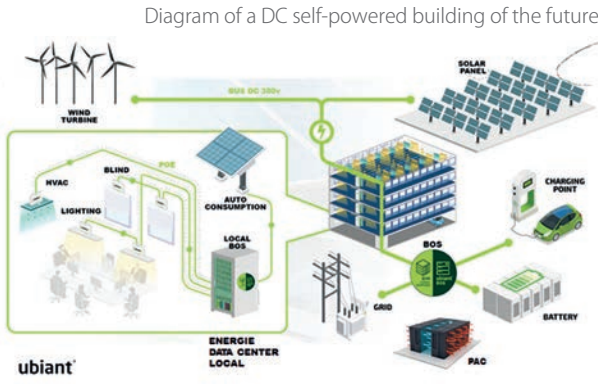
prediction, self-organization, self-commissioning of devices via tags and continuous re-partitioning. For this project, the cabling is fully POE for all blinds, lighting and HVAC equipment. Thus, the drivers are supplied with direct current from the switches and provide the necessary energy to the terminals.

The digital twin and the 3D visualization enable a predictive maintenance and a good supervision. The office in the building can be piloted by users thanks to the application.

KEYWORDS : digital twin, artificial intelligence, BIM, POE, BOS

RESULTS

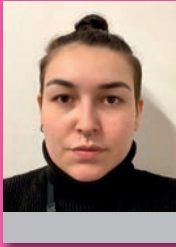
The intelligence and algorithms built into the BOS allow real-time balancing of energy and occupant comfort through learning and self-calibration. The BOS allows monitoring, the management of instructions and schedules, the remote control of equipment but also the management of zone tags for data access and the management of services related to comfort for each zone. The BOS also allows energy optimization thanks to its algorithm, presence



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Research on energy meters and implementation of an energy management system

Smart building



Sarah JOUANNET
Academic supervisor : Titaina GIBERT
Industrial supervisor : Alexandre MARTIN



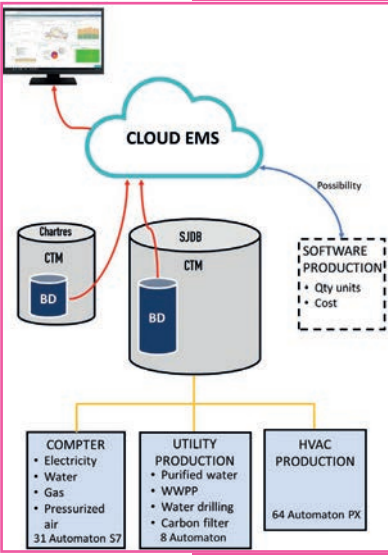
Company/institution : Parfums Christian Dior

OBJECTIVE/MOTIVATION

The main purpose of my project is to reduce energy consumption, which an energy manager makes it possible to monitor each SEU (Significant Energy Use). In order to save energy, an energy planning offering solutions for innovation and/or improvement of equipment can be set up thanks to the EMS (Energy Management System). The EMS makes it possible to monitor results over time as well as reporting allowing us to set up IPE (Energy Performance Indicator) such as kWh/production unit. It is also necessary to know that an SME is eligible for ISO50001 certification. The EMS is useful for many departments in the company, it allows to retrieve the consumption values and check the consumption drifts as well as analyze areas for possible improvement. This project requires lot of investment. The objective is to have a reliable and efficient system.

the ease of implementation or the reliability of the service provider. Without BACnet / IP or Modbus TCP communication on site, I sent our points via our CTM (Centralized Technical Management) by accessing its database. This EMS allows you to create custom reports and many other features.

KEYWORDS : smart Building, energy management system, energy performance indicator



Explanatory diagram of the selected energy manager

RESULTS

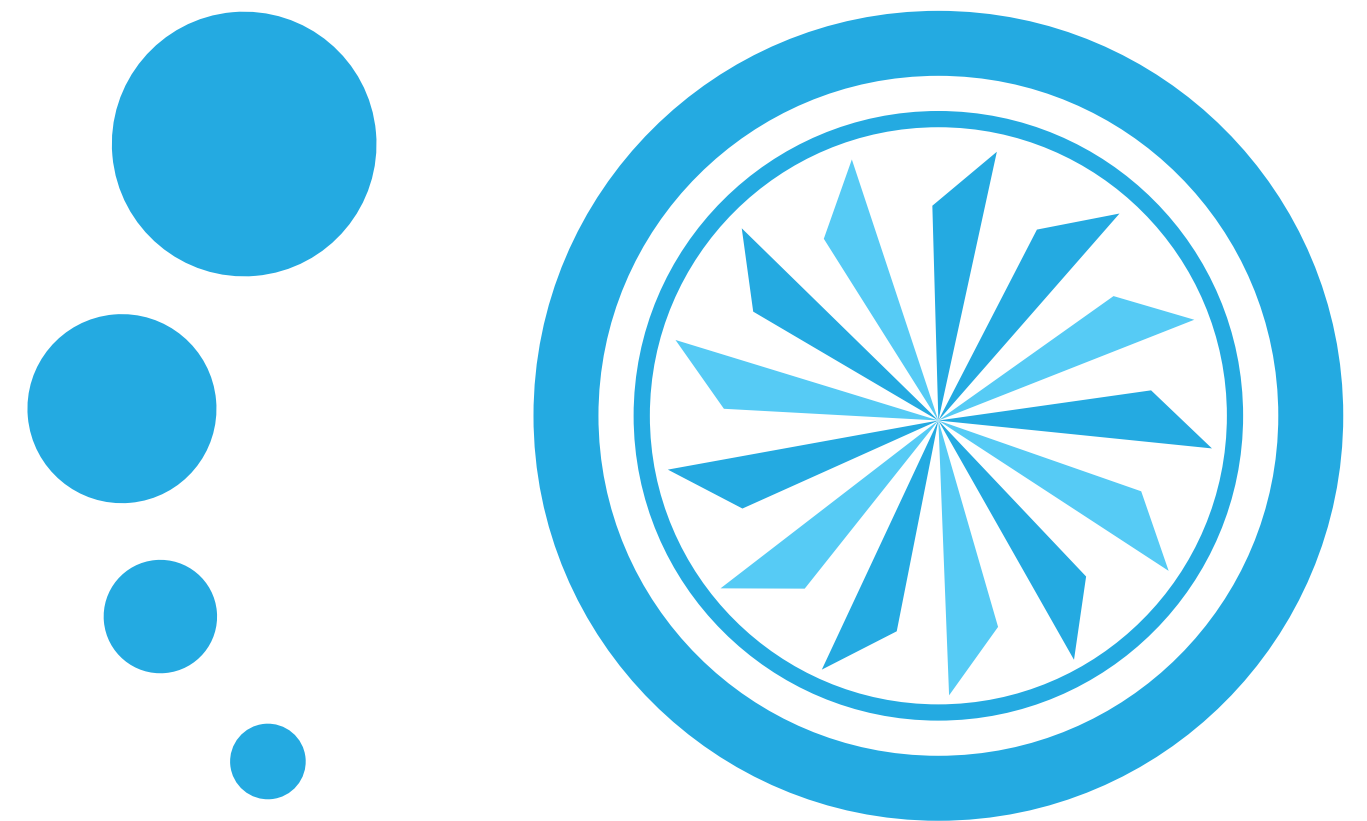
I centralized all the data associated with our energy meters in order to develop a metering plan. It was very clear that the energy management system had to meet different requirements, in particular the integration of energy meters included in the quote, the software having an unlimited number of licenses as well as a one-time purchase of them. It was also necessary to take into account each aspect, such as the cost of the annual royalty, or also the cost of the maintenance contract. If the software allows partial or complete user autonomy,



View of a dashboard of the selected energy manager

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Technologies for **Energy, Aerospace and Motoring sciences**

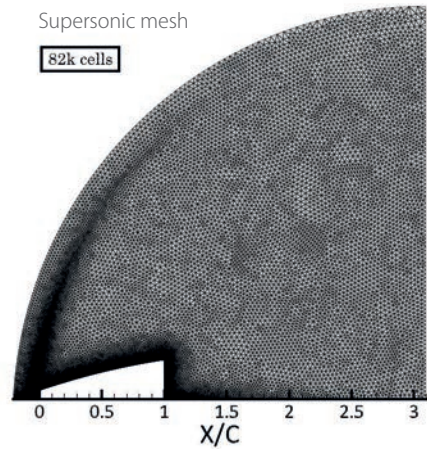


Aerodynamic heating of an artillery projectile

Aerospace engineering

Andrei UNGURAN / Mathis CHOTARD / Théo ROLAND / Guillaume CAZADE
Academic supervisor : Azeddine KOURTA
Industrial supervisor : Nathan GRANGE

Company/institution : Nexter Munitions



becomes necessary to accurately calculate the temperature of the projectile depending on flight conditions.

RESULTS

In this project, two models for estimating the temperature along the wall were created and compared. It was shown that the difference between these two models is very small, which initially supports the consistency of the results. Subsequently, a numerical study was conducted to validate the response of the models. Very good results were obtained when comparing the CFD and the models.

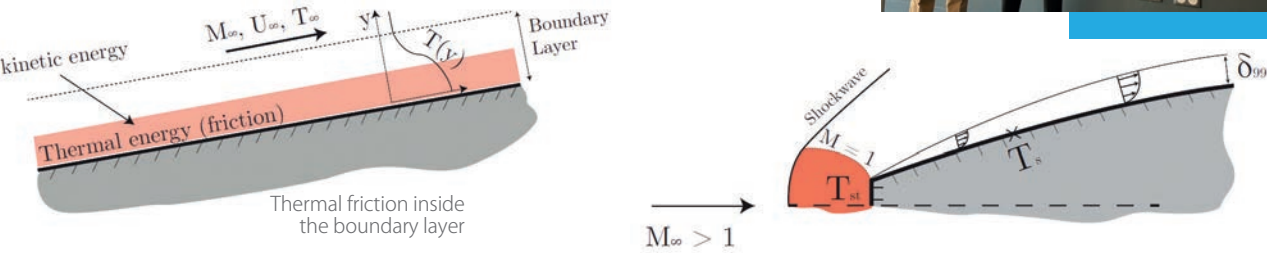
The most important thing of the project is to predict the temperature inside the ammunition, where equipment is located. A new 1D analytical conduction model was thus built.

KEYWORDS : aerodynamic, heating, models, CFD, defense

OBJECTIVE/MOTIVATION

NEXTER, a French weapons and ammunition manufacturer proposed a study on the estimation of the surface temperature of a 155 mm ammunition shell shot out of an artillery canon along different flight lines (trajectories).

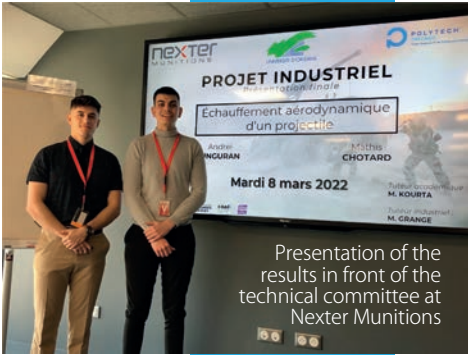
High speed flights generate a strong temperature increase at the front of the ammunition. The objective being to integrate heat-sensitive equipment inside the warhead. Therefore, it



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Numerical simulation at M=2.85



Aerodynamic heating of an axisymmetric warhead

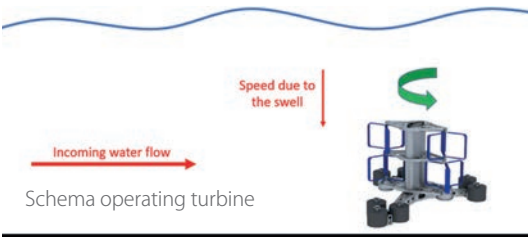
Calculation of verticals forces on a tidal turbine

Industrial engineering

Maxence CACHERA / Volodia DELEFORTRIE
Academic supervisor : Cédric RAIBAUDO
Industrial supervisor : Guillaume MAURICE



Company/institution : HydroQuest



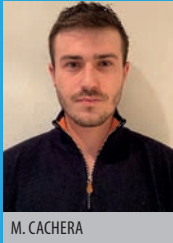
OBJECTIVE/MOTIVATION

We have two main goals during this project. The first one, is to analyze experimental data provided by our industrial supervisor. The purpose of this data analysis is to understand the influence of the swell on the vertical forces on the tidal turbine. This part of the data analysis is the most important part for the industrial supervisor, and it is therefore the one that we will treat as a priority. In addition, our second objective is to build two models to predict the vertical forces on the turbine. The first modeling will be done on Fluent to find theoretical curves while the second will be done on Matlab and will make possible the prediction of the vertical forces starting from an analytical wave model.

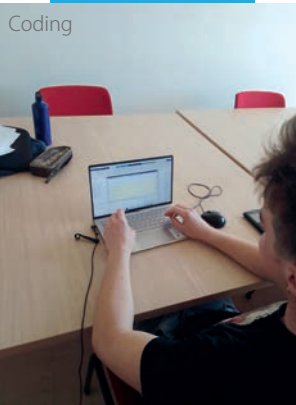
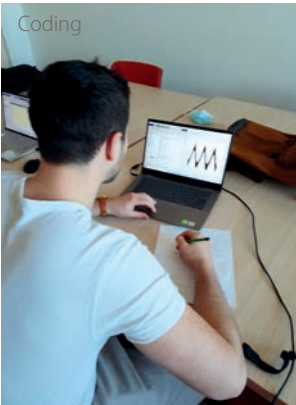
RESULTS

First of all, we treated our data with an average approach of our variable differences. We can clearly see that the TSR influences the average vertical force applied to the tidal turbine. In addition, the presence of a median arm on the tidal turbine significantly increases the vertical force. We also observed the impact of the height of the swell on the vertical force.

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Presentation of results

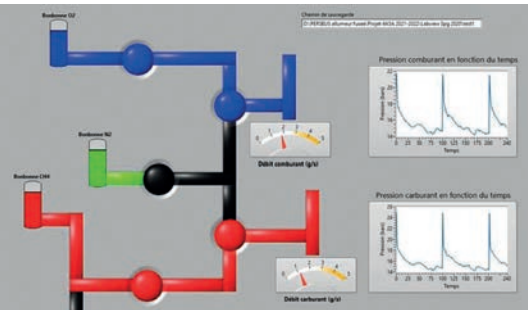


Design and test on a rocket igniter test bench (PERSEUS project)

Energetics

Titouan FESSARD / Nathan ROHRBACHER
Academic supervisor : Benoît BELICAUD
Industrial supervisor : David TCHOU-KIEN

Company/institution : CNES (Centre National d'Etudes Spatiales) **Selected participant**
16th annual final year projects forum



Panel diagram tab in man-machine interface

OBJECTIVE/MOTIVATION

This project is a part of the PERSEUS project (acronym in French for Projet Etudiant de Recherche Spatiale Européen Universitaire et Scientifique). The PERSEUS project aims to carry out innovative solutions such as a prototype of a reusable launcher: ROAR rocket (acronym for Reusable Oxygen ethanol/methane Rocket). This project in Polytech Orleans result from a partnership with the CNES created in 2016. The engineering school was commissioned to deliver a rocket igniter with a

power output of about 50 kW using either ethanol or methane as a replacement for hydrogen mainly used in previous launchers. The igniter has been designed and manufactured. This project aims consequently to design a test bench and test the igniter. The project is also being supervised by the PRISME laboratory (acronym in French for Laboratoire Pluridisciplinaire de Recherche Ingénierie des Systèmes Mécanique Energétiques) for mechanical assembly.

RESULTS

Firstly, the mechanical assembly is done. The hydraulic panel have been assembled with pipes, bends, supports, valves, solenoid valves, pressure sensors, etc. The junction between the hydraulic panel and the igniter inside the bench has been assembled. Pressure and temperatures sensors have been installed next to the igniter to record the combustion. Secondly, all the electronic assembly is done. The circuit diagram has been designed. All the electronic wires are on the hydraulic panel and linked so that the bench can be controlled by a man-machine interface. The man-machine interface has been updated with the data saved and CFD simulation results have been included. We are beginning to do the first tests on the bench with water. They aim to validate some of our pressure-mass flow rate conversion models.

KEYWORDS : space, combustion, mechanics, electronics, fluid dynamics



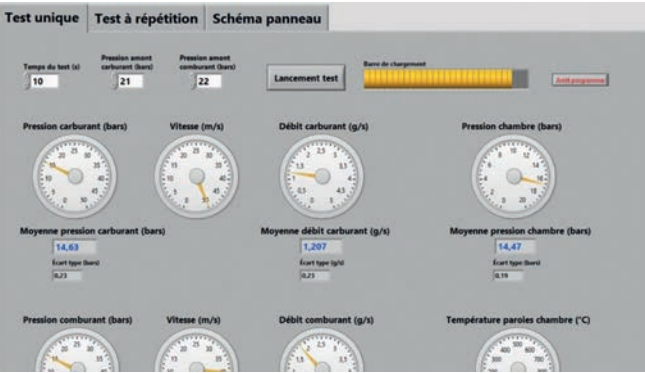
Solenoid valve test



Assembled test bench



Rocket igniter



Unique test tab man-machine interface

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Deployment of a mobile agricultural stand-alone energy system during harvest periods in a temporary storage area

Energetics

Marie LEBEAU / Hugo JOURDAIN / André FERNANDES MARQUES
Academic supervisor : Jean-Michel FAVIE
Industrial supervisor : Antonio TEIXEIRA



Company/institution : Axéreal

Second place
16th annual final year projects forum

OBJECTIVE/MOTIVATION

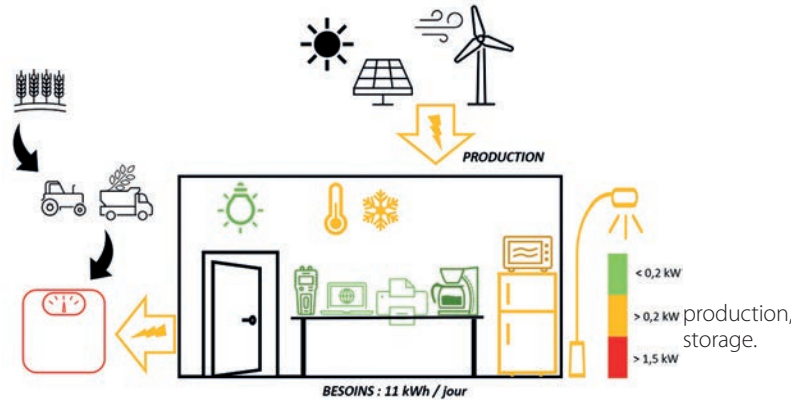
The project consists in creating a complete stand-alone system to power an agricultural bungalow in a remote location. The trend is to reduce the number of isolated silos to industrialize the harvesting process by Axéreal. Here, the creation of the site hosting the project meets a need for proximity with the farmers around the town of Cormeray (41, Beauce). The problem to be solved is that it is too expensive to bring cables from a grid point to a field. The client wishes an energy production and storage system to meet the electricity needs of an administrative bungalow (lighting, heating, cooling, and a computer, a fridge, a coffee machine, and a micro-wave) and a complete weight bridge for trucks outside. The system must be autonomous, non-intrusive and finally sustainable to be part of the current energy transition.

RESULTS

The solution for the energy production is including 21m² of photovoltaic panels and a small 1 kW

wind turbine, and about the storage there are 12 solar batteries to reach a 3-day autonomy. To get those results, it was necessary to do a technical solutions comparative study, a risk analysis, a solar and wind data analysis of Cormeray, followed by the sizing, based on the second harvest period in November which represents the worst case in terms of solar energy. The batteries are an efficient way to uniformly distribute the irregular electrical production of the two renewable systems. Before establishing the total cost, we created an aluminum transportable structure to host the PVs and batteries so that the energy will be available for free to the inhabitants of Cormeray outside the harvest periods as a sustainable social project.

KEYWORDS : energy transition, sustainable agriculture, stand-alone system, electrical



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M. LEBEAU



H. JOURDAIN



A. FERNANDES



Dimensioning of a hybrid electric and muscular vehicle

Mechanical engineering

Yao KOBENAN / Thibault NICOLAS / Valentin PANNIER
Academic supervisor : Pascal HIGELIN
Industrial supervisor : Denis BAULIER



Company/institution : SCARAMOB

OBJECTIVE/MOTIVATION

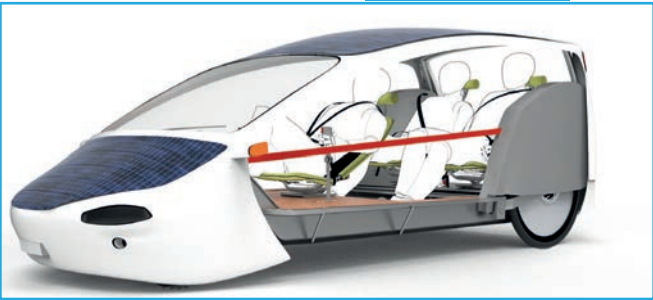
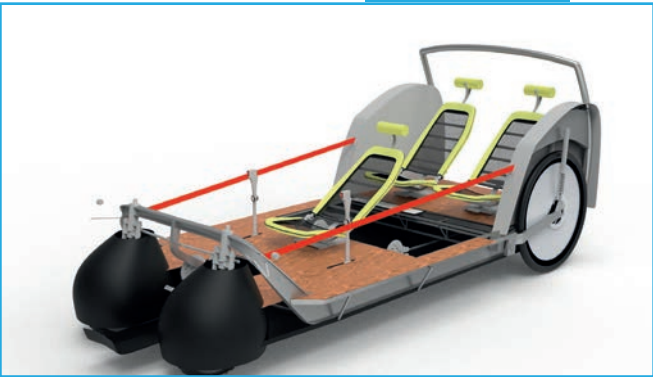
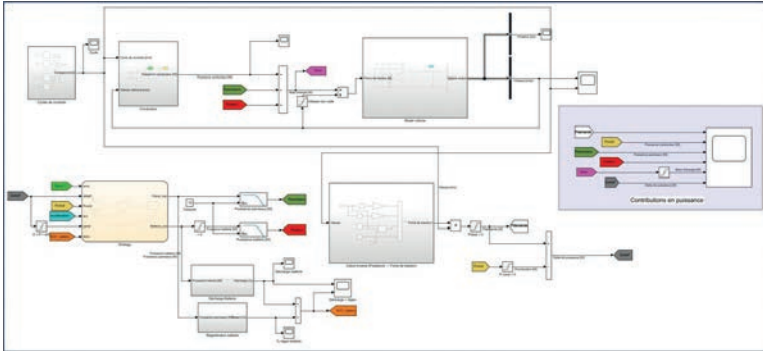
Scaramob wants to create a new concept of hybrid muscular/electric vehicles allowing to obtain a low energy consumption. It is a pedal quadricycle with electric assistance. The environmental objective is to relieve congestion on the outskirts of cities by offering a vehicle that can carry up to 3 people and has a loading capacity of 300 kg. The specifications include a maximum speed of 80 km/h, a maximum empty weight of 250 kg and the recovery of energy during the braking phase. In order to verify the viability of the concept, the Scaramob structure asked us to determine the maximum forces applied to the vehicle, to dimension the brakes, the tires and the electrical components. And also, to propose an energy management strategy.

RESULTS

Using excel software, we created a file allowing us to dimension the brakes according to the different parameters which will be chosen by the company. We also studied the dimensioning of the tires, finding the optimal characteristics according to

the specifications. Finally, we developed an energy management strategy. The aim was to provide the additional energy needed with an electric motor and solar panels by taking into consideration the muscle power the driver delivers. To achieve this, we calculated the energy needed, coming from the driver and the solar panels. The driver's muscular energy will be used first, followed by the energy from solar panels. Finally, the rest of the energy needed will be provided by the battery. The aim is to avoid losses during storage in the power chain between the different electrical modules. We created a parameterized model with Matlab/Simulink software.

KEYWORDS : vehicle, electric, energy



Feasibility study of an autonomous charging station module for an electric vehicle in an isolated environment

Energetics

Tiffany TROUILLEUX / Timothé HATTE / Clément DE ALMEIDA CLARA
Academic supervisor : Jean-Michel FAVIE
Industrial supervisor : Louis PELLERIN



Company/institution : Bouygues Energies et Services

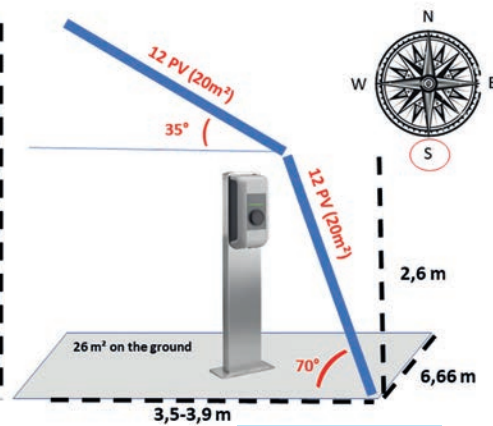
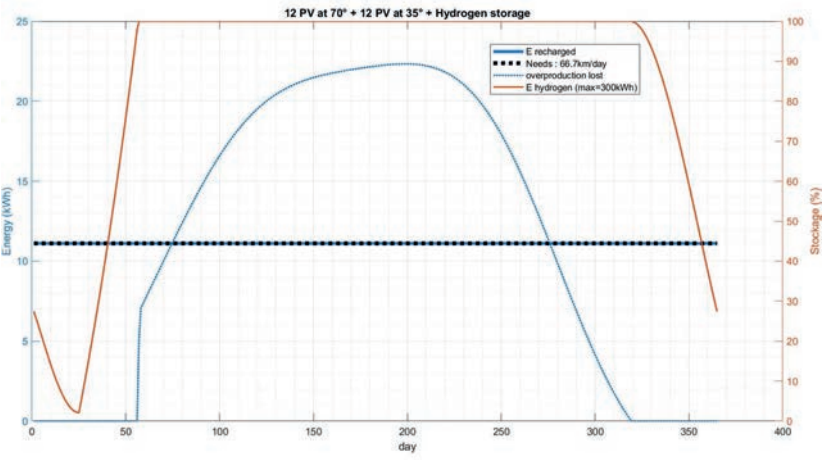
OBJECTIVE/MOTIVATION

Electric cars are now at the heart of the energy transition. This is why the creation of charging stations is becoming essential, especially in isolated areas to facilitate access to users. The aim of the project is therefore to study the feasibility of an electric charging station for electric vehicles in an isolated environment. The project was carried out in partnership with Bouygues Energies & Services, which usually installs charging stations connected to the electrical grid. The project could be innovative by giving access to electric vehicles in the most remote places. The station will not be related to the grid and will be placed in the Orleans region. For that, the electricity production must be carried out through sustainable solutions such as solar or wind power.

RESULTS

We sized the installation thanks to an iterative method of calculation in order to relate production, consumption and energy storage. We finally obtained the best solution which can meet the needs in the specifications for all the scenarios. It is composed of photovoltaic panels with a particular configuration. And an energy storage system is added to complete the intermittence with batteries. Hydrogen storage will enable it to transfer summer overproduction to winter underproduction. We calculated that with 24 well-oriented panels and batteries, the user will be able to recharge at least 150 to 200 km every 3 days on his car.

KEYWORDS : renewable energy, charging station, storage



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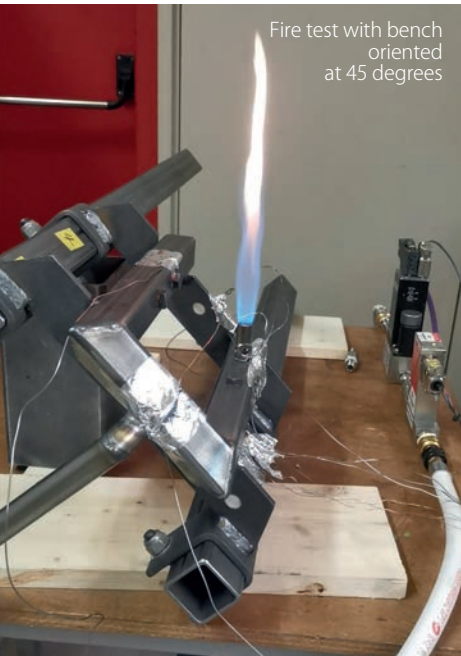
Fire test with an H2 tank on a propane burner

Mechanical engineering

Guillaume WATTELAR/ Xueyi GOU
Academic supervisor : C. ROUSSELLE/ P. BREQUIGNY
Industrial supervisor : J. CABILLIC



Company/institution : Faurecia

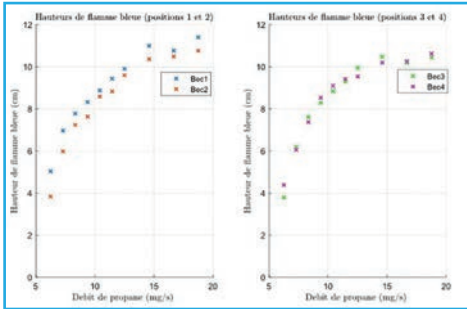
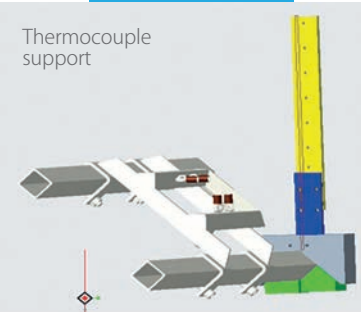
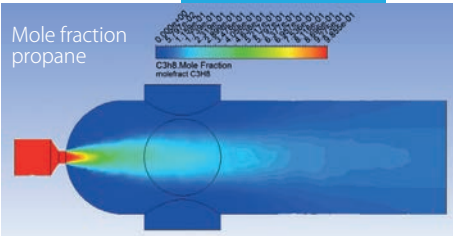


with a variable flow. And then we aim to acquire accurate data of the heat transfer between the distant plate and nozzle by changing the distance. Finally, we analyze the stability diagram after the data has been processed using Matlab.

RESULTS

The tests of flame characterization include two parts, one is a temperature test with thermocouples, and the other is a flame sensibility test using a camera to get flame configurations. And we ran the tests of each nozzle in the same position; each position with the same nozzle; and two nozzles in the same line with the same variable flow. For the first part, we designed a support to fix these fine and sensitive thermocouples in precise positions and reduce the measurement error. Next, for the sensibility test, we plotted the flame height for each condition, and we found the blow off flow for each nozzle is different.

KEYWORDS : combustion, hydrogen vehicle, propane burner, flame stability, CFD simulation



Flame height of each position with same nozzle



Life cycle analysis of Transition-One activities

Environment engineering

Abdoulaye FOFANA / Clarisse LÉGER / Mathéo LONGEAT
Academic supervisor : Chantal PROUST
Industrial supervisor : Aymeric LIBEAU



Company/institution : Transition-One



OBJECTIVE/MOTIVATION

Transition-One understands the climate emergency and seeks to act quickly. In addition to this, Europe is planning to end sales of thermal cars by 2035. It is therefore necessary to find alternatives. Electric cars are expensive and the production of new cars has a big environmental impact. Transition-One offers a virtuous, affordable and low-impact solution : retrofitting. They transform thermal vehicles into electric vehicles by removing the thermal engine and replacing it with an electric motor.

To support its concept with customers and reduce the environmental impact of its activities, Transition-One wants a life cycle analysis of the company. This will allow to see which parts of their activities emit more pollution, so they can work on them, and also to show customers that retrofit is a good choice.

RESULTS

The Life Cycle Analysis is the method we used to study the indicator we chose: The Global Warming Potential. We looked for CO₂, N₂O and CH₄ emissions during the different phases related to the retrofit : raw materials, manufacturing, transport, distribution, use and end of life. We had to first understand and complete the entire process chain. We counted all the components removed and

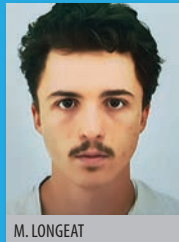
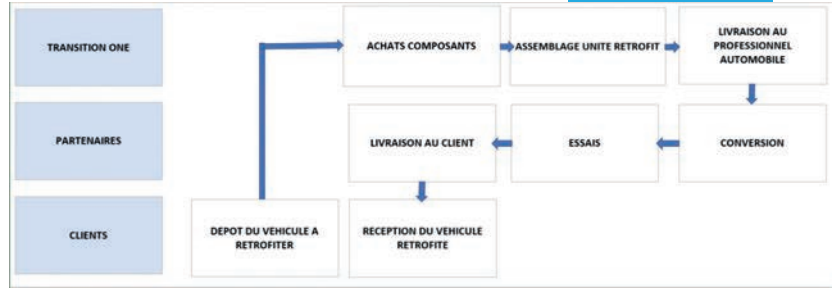
added to the retrofitted car. We then developed a referenced database where we listed all the emissions discussed above. The director of Transition-One can therefore have access to the environmental impact of all the cars he retrofits. It helps him suppliers, components

Transition-One's Fiat 500

make decisions about and processes used. We also had to determine the subcontractor selection criteria, by taking into account the environmental impact of each.

KEYWORDS :

automotive, retrofit, Life-Cycle Analysis, referenced database, Global Warming Potential



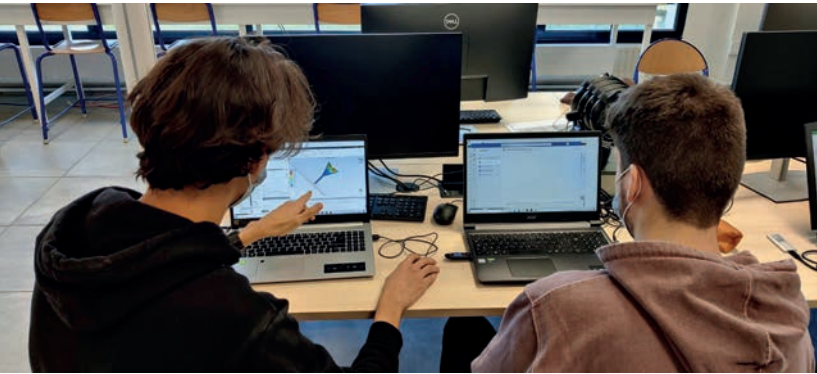
Study of an innovative funnel design

Energetics

Atef GHALAYINI / Lucien JOUENNE
Academic supervisor : Ivan FEDIOUN / Pierre-Yves PASSAGGIA
Industrial supervisor : Christian SERAIN

Company/institution : Mr. Christian Serain

Selected participant
16th annual final year projects forum



elements for a rotating flow in a funnel. First, contrary to common belief, the Coriolis force generated by the rotation of the Earth is of negligible importance for the flow in the funnel. We also determined that naturally, the flow in a funnel is purely radial and is not a swirling flow. The initial

OBJECTIVE/MOTIVATION

Our project focused on an interesting invention which is an octagonal funnel with special characteristics, that hypothetically accelerates the drainage of any liquid compared to an ordinary conventional funnel, with a conical geometry.

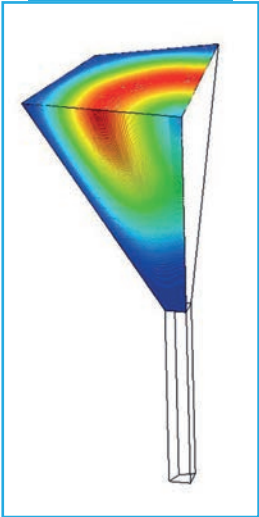
Our main objective was to prove whether this new octagonal funnel could improve the draining speed by developing a mathematical model of the flow through the funnel. Using CFD simulations jointly with theoretical foundations, we were able to analyze the flow features in this new and atypical funnel geometry. Alongside our model and simulations, we completed multiple tests to evaluate the efficiency of the octagonal funnel in comparison to the conventional geometry.

RESULTS

Our results can be divided into two distinct parts, the first considers the theoretical analysis while the second describes the results from our simulations and experimental tests. Concerning the theoretical model, we were able to identify different key

condition of the pouring of the liquid is the main driver behind the swirling flow while the geometry plays little to no role at all. From our experiments and simulations, we concluded that the hypothesis behind the invention of this octagonal funnel is barely validated. The special octagonal geometry does actually reduce the strength of vortices in the funnel, but in a limited proportion, and thus contributes only slightly to the increase of the flow rate through the device.

KEYWORDS :
fluid mechanics, funnel, vortex, optimization



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Mixing and heat-exchange improvement by optimizing the pulsation of a simple shear flow

Energetics

Lucas KURICA / Daniel OLIVEIRA
Academic supervisor : Christian CAILLOL / Pierre-Yves PASSAGGIA
Industrial supervisor : Fabien HARAMBAT / Gaétan ANDRIANO



Company/institution : Stellantis

OBJECTIVE/MOTIVATION

The energy transition and the decarbonization of the automotive sector go through the development of a novel generation of vehicles (hybrid or fully electric) where cooling remains a major issue. For the development of future vehicles, the design of the cooling system is a key challenge to have a reliable and efficient propulsion system, in particular when the vehicle is at rest.

Nowadays, the heating elements such as the propulsion system are nearly in contact with a cooling fluid in the cooling system. This method allows for an active control of the propulsion system temperature. Different types of strategies are presently studied in order to increase the thermal performance of this cooling system while keeping an acceptable pressure drop. The approach investigated in this project aims at studying the ability of different pulsatile profiles to improve heat transfer.

RESULTS

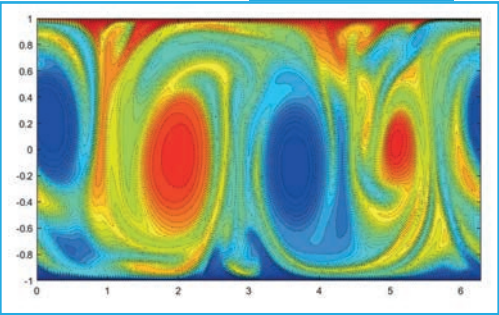
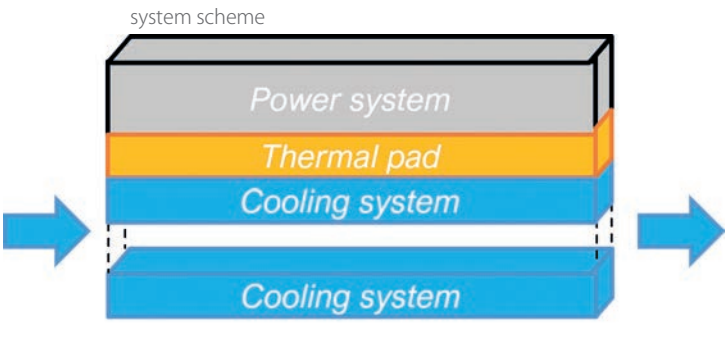
During this project, numerical simulations with several pulsation profiles (sawtooth and square wave among others) and different fluid conditions

were used to quantify mixing and the cooling capability of the flow.

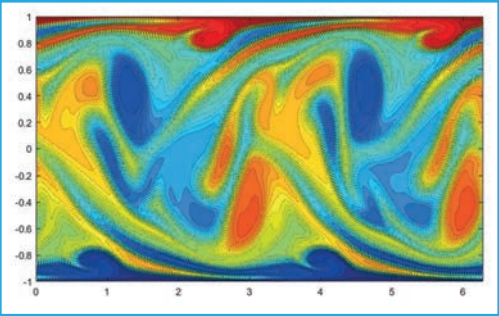
Some of the configurations show that cooling is greater than without pulsation or with classical sinusoid pulsation. The new pulsation profiles lead to different velocity profiles which produce strong instabilities which lead to a better mixing.

However, our results need practical validations, which is the future work planned in a doctoral thesis. Another task is to quantify the energy induced by the pulsation and compare with the energy saved with the better cooling to measure its efficiency.

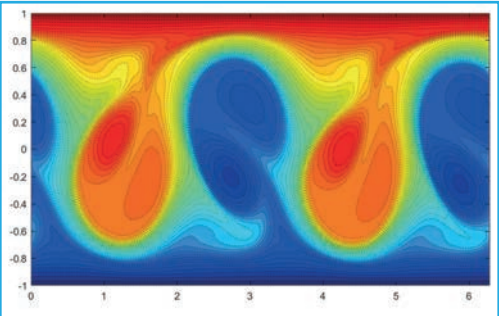
KEYWORDS : heat-exchange, pulsatile flows, CFD, automotive



Temperature field for an invert sinus pulsatile velocity signal



Temperature field for a square pulsatile velocity signal



Temperature field for a sawtooth pulsatile velocity signal

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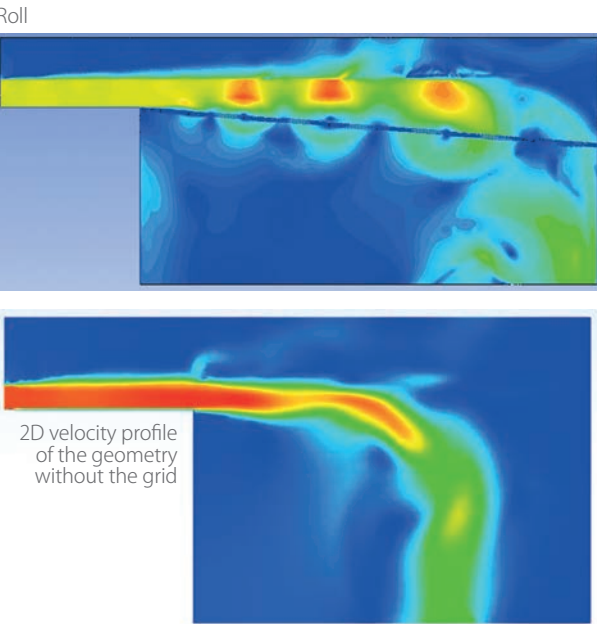
Modeling of a hydroelectric plant water intake

Energetics

Pierre HOUIS / Hugo VASSEUR
Academic supervisor : Régine WEBER
Industrial supervisor : Stephane VIENNET



Company/institution : Hydreole



further increase the precision and obtain some sizing laws that will be used by the company in their projects

RESULTS

After some adjustments on our geometry to fit the limited computational capacity available at Polytech we were able to produce two 2D geometries and one 3D geometry. The two 2D geometry are sectional views of the equipment, while one is without grid (for reference) the other is a model with 90 degree rotated bars. The 3D geometry represents a slice of the flow between two bars.

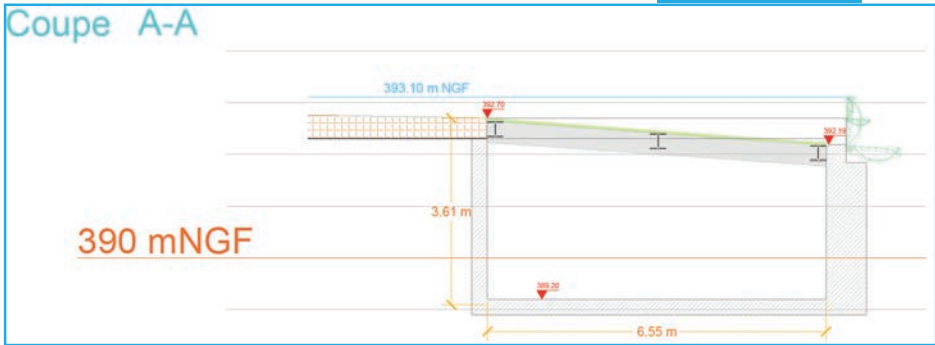
With the 3D geometry we were able to have a global idea of the flow between bars. As a result, we should be able to tell the appropriate dimensions needed for the grid to respect the initial constraints.

KEYWORDS : computational fluid dynamics, grid, tyrolean weir

OBJECTIVE/MOTIVATION

The project is presented by the company Hydreole, a hydroelectric powerplant specialist. Based on a future plant with an installed power of 1 MW and a special type of water intake known as submerged tyrolean weir. This type of water intake is immersed down the river and covered with a grid for filtration and fish preservation.

The aim of our project is to optimize the size of the tyrolean weir water intake. In order to achieve that 2D computational fluid dynamic computations will be necessary to understand the globality of the process. Following the 2D there will be the 3D to



Schematic of the water intake with the grid (green)

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Modeling the response of a Bunsen type laminar premixed flame to fluctuations in natural gas equivalence ratio, flow rate and composition

Industrial engineering

Guillaume ARMENGAUD / Lucas PERDOUX
Academic supervisor : Christian CAILLOL / Pascal HIGELIN
Industrial supervisor : Marcos PAGOTO



Company/institution : VAILLANT

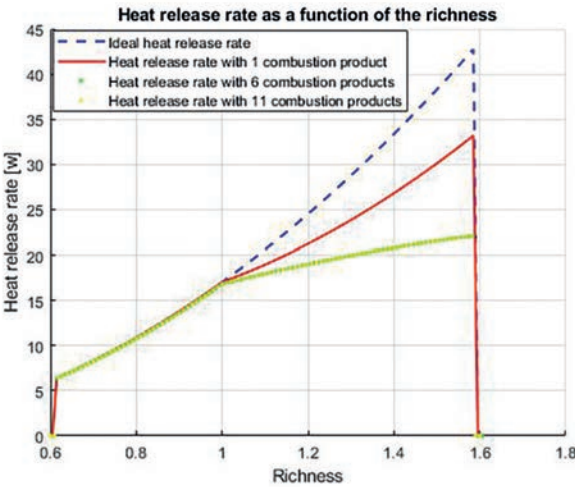
OBJECTIVE/MOTIVATION

Within the framework of the development of new condensing boilers, Vaillant group must regularly imagine new solutions to face the problems of resonances caused by the pressure peaks generated by the combustion of air-gas mixtures. To increase the efficiency of solving these problems, Vaillant group wishes to develop the simulation of this type of phenomena. To decouple the acoustic response of the system from the combustion instability phenomena, a first 0D model of a stationary Bunsen type laminar flame is developed. For this purpose, the MATLAB environment is used. The model integrates the effects of equivalence ratio, flow rate and composition of natural gas fuel on the flame stability. After validation, this model is integrated into a system model considering the dynamics of the boiler feed line using GT Power software.

RESULTS

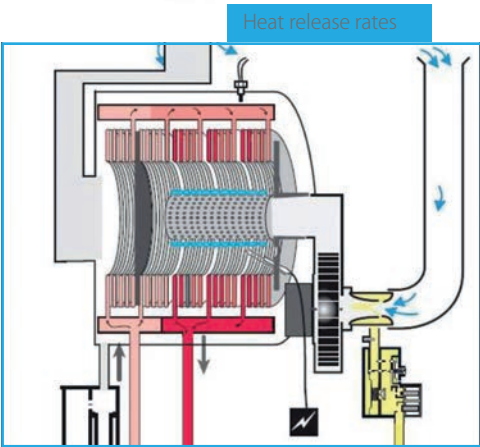
The stationary model assumes a smooth conical flame and the combustion model assumes a

thin flame front (flamelet model), meaning the chemistry is assumed infinitely fast (which is consistent with the calculation of equilibrium chemistry for the composition of the burned gases). The model can calculate the composition of the burned gases, the heat release rate considering incomplete combustion for rich mixtures, and the cone angle at the top of the flame. This angle is compared to a criterion derived from literature to characterize the stability of the premixed flame. After validation, this model is



Student working on GT Power software

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Gas boiler diagram

Modelisation of NH3 combustion for Internal Combustion Engine

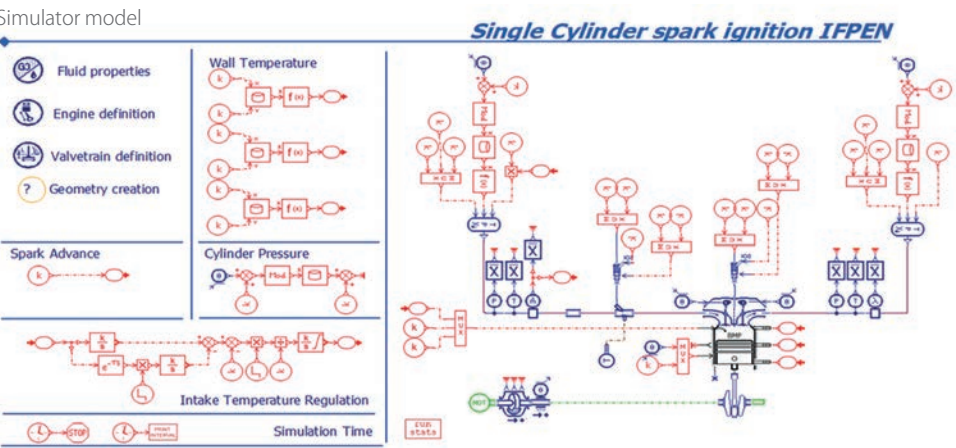
Mechanical engineering

Noé MONNIER / Romain RIGOT

Academic supervisor : Christine ROUSSELLE / Pierre BREQUIGNY
Industrial supervisor : Alessio DULBECCO



Company/institution : IFPEN



OBJECTIVE/MOTIVATION

Nowadays, European laws and regulations tend to decarbonate transport to reach carbon neutrality before 2050. Ammonia (NH3) could be a good candidate for that, especially for maritime transport and for applications where Hydrogen (H2) and electric batteries cannot be used. The project will focus on the study of ammonia combustion which is particularly interesting redefining ecological aspects (no carbon dioxide in exhaust gases) and economical ones (fewer engine modification than Hydrogen use).

The actual combustion model used in Simcenter Amesim, Coherent Flamelet Model (CFM), is perfect for modelling combustion for Internal Combustion Engine (ICE) using conventional fuel. However, this model hasn't been tested for Ammonia combustion. The main objective of this project is to modify the current model to support ammonia combustion.

KEYWORDS : automotive engineering, ammonia, combustion, simulation, energetic transition

Combustion equation

$$0,9\text{ NH}_3 + 0,1\text{ H}_2 + n_{Ox}(O_2 + 3,76\text{ N}_2) = 1,45\text{ H}_2O + (0,9 + n_{Ox} \times 3,76)\text{ N}_2$$

| EP6DTS Engine | |
|-----------------------------|-----------------------|
| Bore x Stroke (mm) | 77 x 86,8 |
| Compression ratio | 10,5 |
| Intake Valve Diameter (mm) | 29 |
| Exhaust Valve Diameter (mm) | 27 |
| Maximum Valve Lift (mm) | 9 |
| Engine speed (rpm) | 650, 1000, 1500, 2000 |

Engine characteristics

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Numerical and experimental study of the external aerodynamics of an Urban Concept for the Shell Eco-Marathon

Aero engineering

Pauline GUILLOT / Thomas VIGNON

Academic supervisor : Pierre BREQUIGNY / Nicolas MAZELLIER
Industrial supervisor : Lucas WALTER



Company/institution : Hyperbole, Exergie

OBJECTIVE/MOTIVATION

The Shell Eco-Marathon is a student competition created by the Shell oil company, which is inspired by sustainable mobility challenges and consists in designing, building, and driving the most energy efficient vehicles. The student associations Hyperbole ++ and Exergie from the technology institute and engineering school of Orléans, wish to develop a new prototype to compete in the Urban Concept category. This project was created in 2020, where the goal was to dimension and model the shell of the vehicle while respecting the standards of these eco-marathon to compete in 2024. This year, the project goal is to investigate the aerodynamics performances of a 3D-printed scale-down model, which incorporates the wheels. Besides, CFD (Computational Fluids Dynamics) studies are carried out at the real-life scale. Then, numerical results are compared and assessed against the wind tunnel experiments using the model.

explained by a blocking effect due to the wheels reducing thereby the underneath mass flow rate, which, in turns, yields, an overpressure under the car leading a lift increase. These results have been verified by wind tunnel tests thanks to a setup allowing the measurement of aerodynamic forces and the identification of flow separation regions.

KEYWORDS : aerodynamics, performance, race car, competition, wind tunnel

RESULTS

Our results are intended to characterize the vehicle aerodynamics. Measurements of aerodynamic forces (lift and drag) have been carried out for different wheel configurations. During CFD studies, the wall under the car is moving at a speed of 30 km/h in order to simulate the road. With numerical setup, we can see that the drag is more important with wheels because of a larger front surface. We also have seen that the viscosity drag represents 20% of the total drag. Thus, it emphasizes the importance of skin friction. Moreover, we can see a noticeable difference for the lift between all configurations: it can be

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Optimal energy management strategies on a hybrid electric vehicle.

Engineering, energetics

Yuqi LIU / Bastien PERRIER / Marin POUJOL

Academic supervisor : Guillaume COLIN / Alain CHARLET

Industrial supervisor : Willy COTTIN

Company/institution : Stellantis



Peugeot 308 Hybrid

OBJECTIVE/MOTIVATION

This project is related to the need to reduce automobile CO₂ emissions. We are working on a Hybrid Electric Vehicle, powered by an internal combustion engine (ICE) and an electric motor (EM) assisting the thermal one to reduce the fuel consumption, and consequently CO₂ emissions. The degree of freedom given by the introduction of the electric machine must be smart controlled to minimize the fuel consumption. This energy management strategy can so be written as an optimal control problem. There are a lot of methods and solutions in optimal control. To answer the question of reducing the consumption, it is necessary to compare several of those methods.

Being aware of environmental issues, this project was very motivating for us. Moreover, we are all automobile enthusiasts, so this project caught our attention.

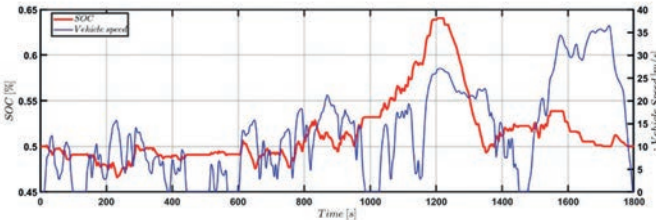
RESULTS

The hybrid electric vehicle was first physically modeled. Based on this model, a dynamic programming (DP) optimization with 1 state variable (State of charge) and 1 control variable (torque split between ICE and EM) was implemented. This DP was extended with a second state (Electric

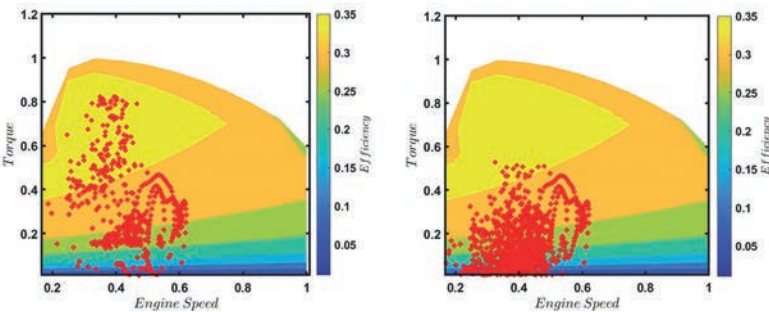
motor temperature) and a second control variable (Cooling flow), this constraint should extend the lifespan of the electric part of the vehicle. The fuel consumption decreases from 6.4 L/100 km to 5.3 L/100 km on the cycle WLTC. We compared and analyzed the results of the optimization of the hybrid solution and the conventional solution. Several control solutions were compared : DP, Equivalent Consumption Minimization Strategy (ECMS) and Deep Reinforcement Learning. We built neural networks and algorithmic structures for reinforcement learning. Preliminary simulations were implemented.

KEYWORDS :

energy management, hybrid electric vehicle, equivalent consumption minimisation strategy, dynamic programming, reinforcement learning



Cycle WLTC SOIC evolution



Internal combustion engine efficiency versus speed

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PEM Electrolyser - Bill of process modeling and simulation

Energetics

Jean-Louis BERTHOLIER / Robin LEMAIRE / Loïc STRICHER

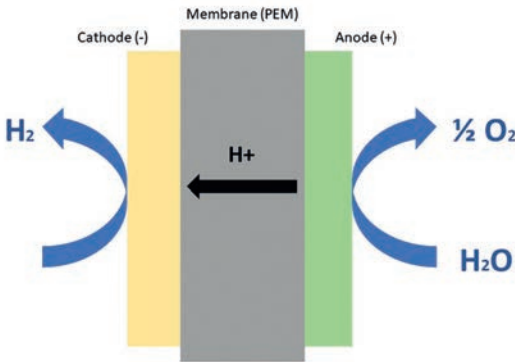
Academic supervisor : Christian CAILLLOL

Industrial supervisor : Nicolas BORDET



Company/institution : OSE Engineering

Simplified PEM electrolyser scheme



OBJECTIVE/MOTIVATION

In the context of energy transition, hydrogen is meant to have an important role. The PEM (Proton Exchange Membrane) electrolysis process allows to separate water into oxygen and hydrogen using electricity. The goal of the project is to improve an electrolyser modeling in Matlab Simulink which is provided by the OSE engineering company. The objective is to find and implement improvements in the components model. Thus, allowing to better consider the physical phenomena involved and of the dynamic aspects such as thermal, fluid and chemical phenomena. This will allow to assemble the electrolyser and simulate its functioning under a variable load or with malfunctions.

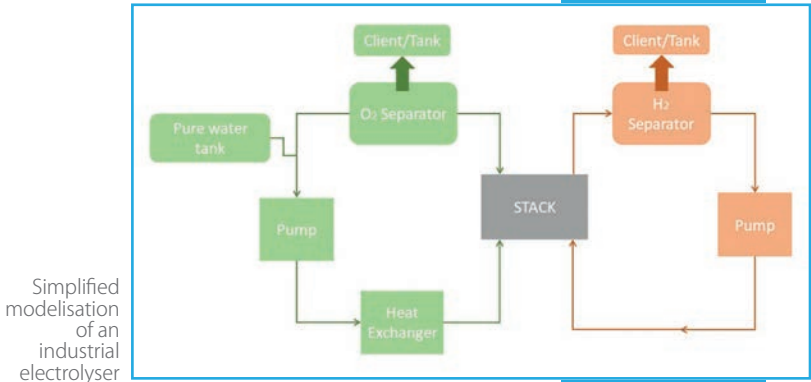
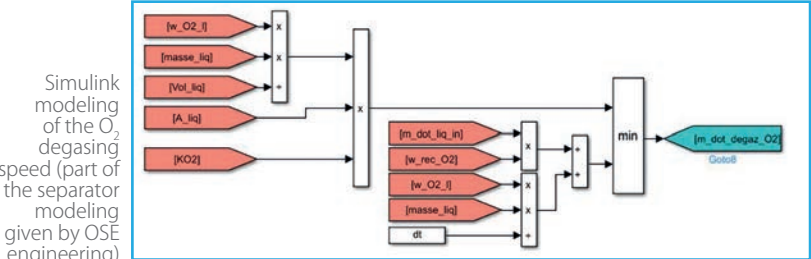
RESULTS

To begin with, we studied all the given components and their modeling. We then focused our work on three components: The three-way valves, the separators and the cooling unit.

For each of these components we wrote down

all the equations and studied the inputs and outputs of the models. We have identified possible improvements on the dynamic aspects and on the modeling of the physical phenomena. For example, we worked on the liquid gas separation phenomena that take place inside the separator. For this component, it appeared that we could upgrade the modeling of the physical aspects by considering the variation of degassing speed depending on different parameters such as temperature or pressure in the tank.

KEYWORDS : hydrogen, electrolysis, modelisation, simulink



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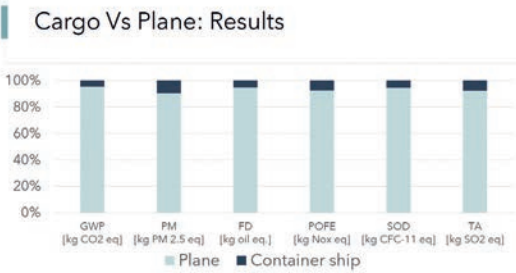
Polytech Cargo : assessing the future of maritime transport

Energetics

Kylian BARDOUL / Lucas CROCHET / Obelin OUTREQUIN
Academic supervisor : Christine ROUSSELLE



Company/institution : Réseau Polytech



OBJECTIVE/MOTIVATION

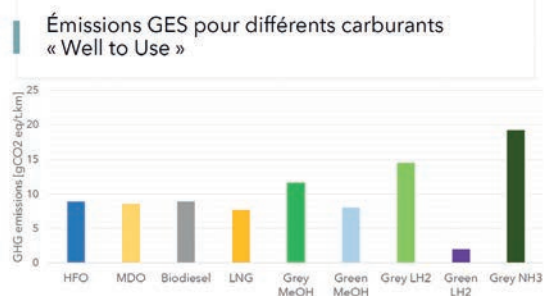
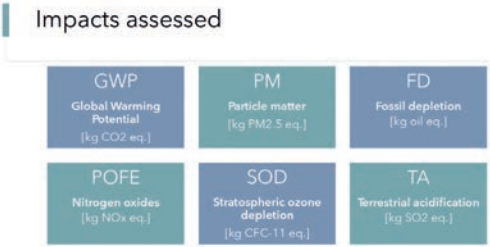
The main goal of this project is to assess the feasibility of sending students going on an international abroad via container ships. Three main objectives are defined. The first goal is to compare the ecological impact of a trip using a container ship and using a plane, using a life cycle analysis (taking production of fuels and all means of transportation in account). The second objective is to find shipowners willing to take students onboard. Lastly, an assessment of the upcoming technologies has to be done, in order to understand how new fuels and propulsion means, such as wing sails, rotor sails or kite sails, can change the impacts of maritime transportation. This assessment is conducted using life cycle analysis, in the same fashion as the first objective.

RESULTS

Regarding the first objective, calculations showed that travelling using a loaded container ship is a better option than travelling via plane for the 6 impacts studied. As the container ship is loaded with thousands of tons of merchandise, a few more people onboard have very little impact on the global carbon footprint of the container ship.

Once this was established, the next step was to find shipowners willing to take students onboard. Few shipowners used to take civilians onboard before Covid 19, and currently there is none operating these services. However, the situation might change in the upcoming months, depending on the evolution of the pandemic. Lastly, the assessment of new fuels (LNG, Methanol, Biodiesel, Hydrogen, Ammonia) showed that their production process has a critical impact on the final ecological impact. The manufacturing of technologies relying on wind has very small ecological impact compared to the reduction of emissions they induce.

KEYWORDS : life cycle analysis, sustainable, container ships, alternative fuels, international mobility



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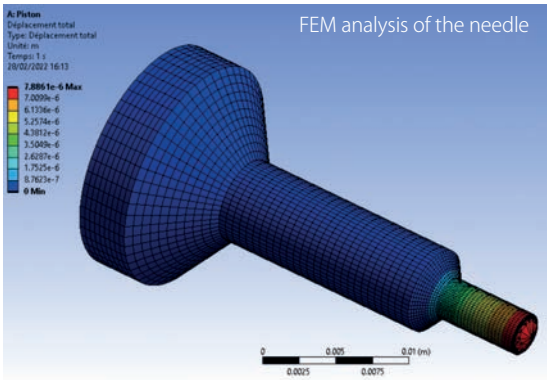
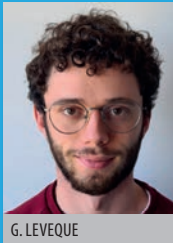
Pulsed injection by hydraulic amplifier

Aerospace engineering

Mathieu PARLANT / Gabriel LÉVÊQUE
Academic supervisor : C. HESPEL / A. CHARLET
Industrial supervisor : E. TOPENOT



Company/institution : MBDA



OBJECTIVE/MOTIVATION

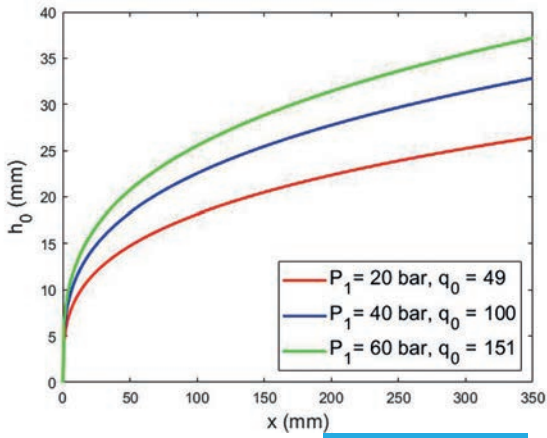
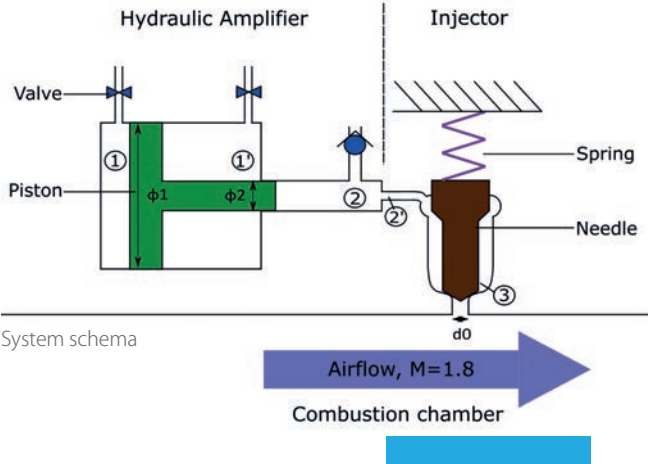
The objective of the project is to develop an early concept of an injector using a hydraulic amplifier to get better combustion control in a scramjet engine. This system should be able to provide variable injection pressure. The variation of injection pressure modifies on one hand the size of the drops (the higher the pressure the finer the drops) and on the other hand the air/fuel mixture or the penetration of the jet. The objective is therefore to propose two models, one simulating the penetration of the jet as a function of different parameters of the injector: inlet pressure P1, diameter of the injection hole, ratio of jet flow to air flow (q0)... the other one concerning the dynamic response of the different moving parts of the amplifier, injector and the different pressure levels involved. Finally, a first CAD design of the system is also expected.

RESULTS

A first bibliographical analysis allowed us to establish the penetration of the jet of kerosene (figure 1) and

to define the range of pressure necessary at the amplifier outlet. The dimensions of the various parts of the amplifier and the injector were defined (figure 2) and a first simplified model under Matlab Simulink was validated ensuring the desired flow rates and quantities injected. The first CAD design helped us to picture the final product and size it with the FEM analysis. The input and output valves of the amplifier have also been chosen to fit the characteristics of our model. This project will be carried on by one of the team members during his internship

KEYWORDS : scramjet, injector, hydraulic amplifier, modeling, design



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Small Evolutive Scales for Air Breathing Engine

Aerospace engineering

Hugo KREMER / Sophiane OUAATI
Academic supervisor : Pierre BREQUIGNY / Alain CHARLET
Industrial supervisor : Marc BOUCHEZ

MBDA
MISSILE SYSTEMS
Company/institution : MBDA

OBJECTIVE/MOTIVATION

The main goal of this project is to make use of this engine for the practical classes of Polytech Orléans and to give more information about its working and its control for the MBDA compagny.

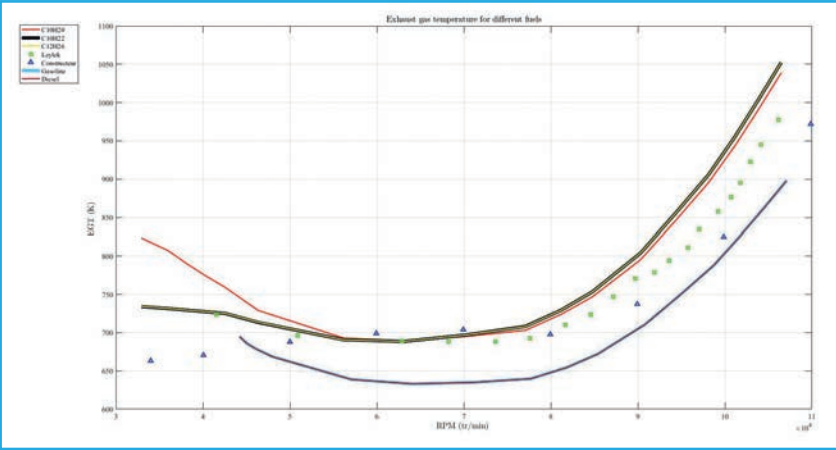
Our objectives are :

- ▶ To simulate and compare the working of the engine with different fuels and lubricants
- ▶ To study different geometries of nozzles and the impact of a lower temperature of the airflow which enter the engine
- ▶ To improve the CAD model and add other elements (like an airflow coolant system)
- ▶ Finally, to realize several assays on the real engine and create a notice for practical classes

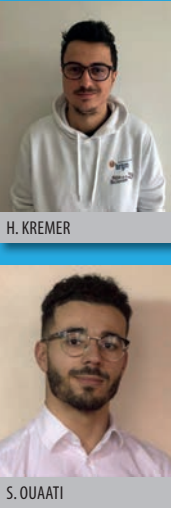
RESULTS

Since the beginning, the project has made a lot of progress. Some studies are finished and others are taking a bit more time than we thought.

For the finished studies, the geometry of the nozzle of the engine is behaving as we expected and the current geometry is the best for this kind of applications.



Exhaust gas temperature



Air breathing engine



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Which hydrogen vehicle for which use ?

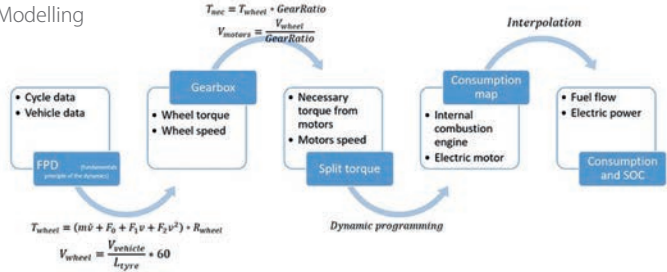
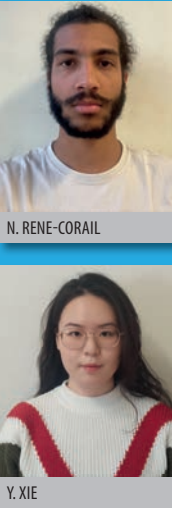
Mechanical engineering

Nathan RENE-CORAIL / Yixuan XIE
Academic supervisor : Kristan GILLET



Company/institution : Stellantis

Selected participant
16th annual final year projects forum



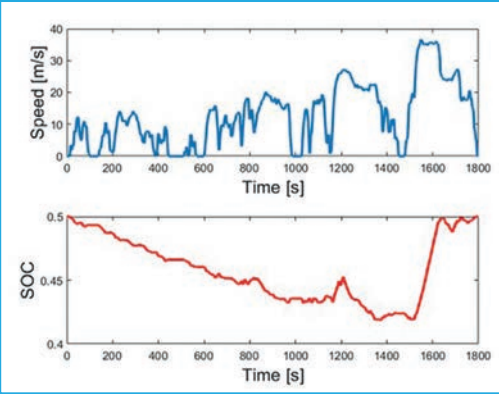
OBJECTIVE/MOTIVATION

To reduce the CO₂ emission and pollution from the automotive sector and engines using classic fuels (with carbon), Stellantis is interested in the development of hybrid vehicles using fuel principally composed of hydrogen (dihydrogen or ammoniac).

Our objective is to create a program with a model of vehicle for different configurations, and this program will allow us to put every data of a vehicle like the engine, electric motor, fuel cell, weight, different force and have the results of a driving cycle at the end the fuel consumption, the pollution or other information.

RESULTS

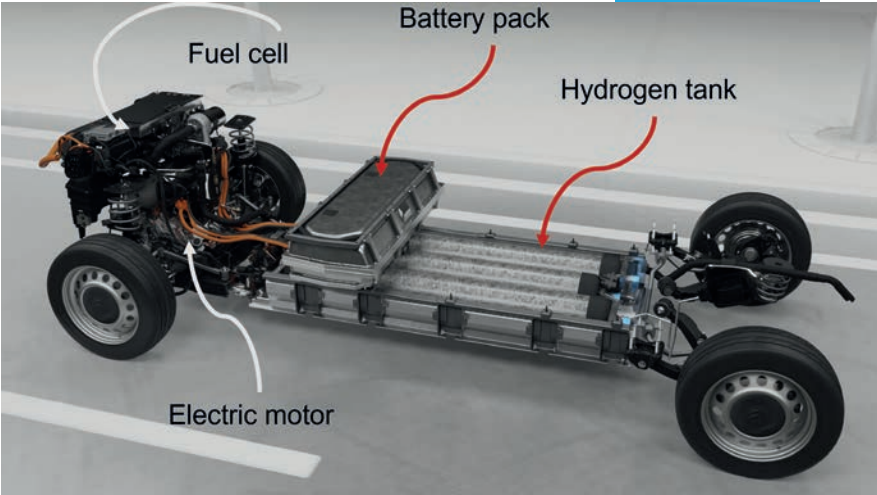
With a classic hybrid system (with an engine using carbonated fuels), we have good results concerning consumption and pollution. We can observe, with our models that both are below the conventional vehicle model, and so we have a reduction of the fuel cost per kilometer. For the conventional vehicle we have a consumption of 8,7 l/100 km whereas for the hybrid vehicle we have 4 l/100 km. We



SOC speed

want to show that with a hybrid vehicle with an engine using hydrogenated fuels or a fuel cell, we decrease the fuel cost per kilometer while reducing the pollution emissions.

KEYWORDS : automotive, dynamic programming



Plateforme hydrogene

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Unpublished projects

The details of the project completed by these students have not been authorized for publication by the company/institution.



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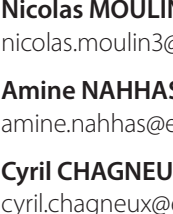
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The final year projects forum

Each year, students who are completing their final year of studies at Polytech Orléans compete to participate in the Final Year Projects Forum. Students may present their projects individually or in groups, after which a selection is made by each department head of those projects which will compete before a jury of knowledgeable professionals from businesses and institutions in the wider community. During the Forum, each student or group of students presents their project over the course of an entire day, beginning with a general assembly during which a brief oral description and PowerPoint® presentation is made. This is followed by in-depth discussions with each jury member at individual stands constructed by the students, where they are able to give a more detailed explanation of their work. The jury selects and makes an award to each of the five best projects of the Forum, and also presents the Innovation Award and the High Schoolers' Choice Award.

The Final Year Projects Forum promotes the relationship between the school, its students and the business community, and allows students to make direct contact with those companies who might wish to recruit graduates in their field.

★ ★ ★ ★ ★

SAVE THE DATE

MARDI 8 MARS

16^e FORUM

DES PROJETS D'ENTREPRISES DE FIN D'ÉTUDES

POLYTECH ORLÉANS

Ecole d'ingénieurs de l'université d'Orléans

Our remarkable equipement

Wind Tunnel

The Lucien Malavard wind tunnel of the PRISME laboratory is used by Polytech Orléans students for aerodynamic systems studies typical of the automobile, aeronautics and environmental industries. Those who specialise in these fields have the opportunity to do their practical work and projects in this exceptional environment.

Clean Room

A class 10 000 clean room of 100 m² is in service at the GREMI laboratory of Polytech Orléans. Students working in the Engineering Physics and Embedded Systems specialty carry out their practical work study projects in micro/nano-technologies and plasma processes in this facility.

Material Mechanics Hall

Experimental devices in the Material Mechanics Hall of the PRISME laboratory are used by our engineering students during their projects to determine the mechanical behavior of innovative materials. This equipment may also be used to test materials such as woven composite reinforcements for aerospace and medical applications (biaxial tensile benches, benches to test shear, bending, wear and shaping) and materials in extreme conditions, such as ceramics for high temperatures with

applications in new energies (mechanical test furnace for traction, compression, bending, and creep, under controlled atmospheres (nitrogen, argon, air) from ambient temperature up to 1 600°C).

Engine Test Benches

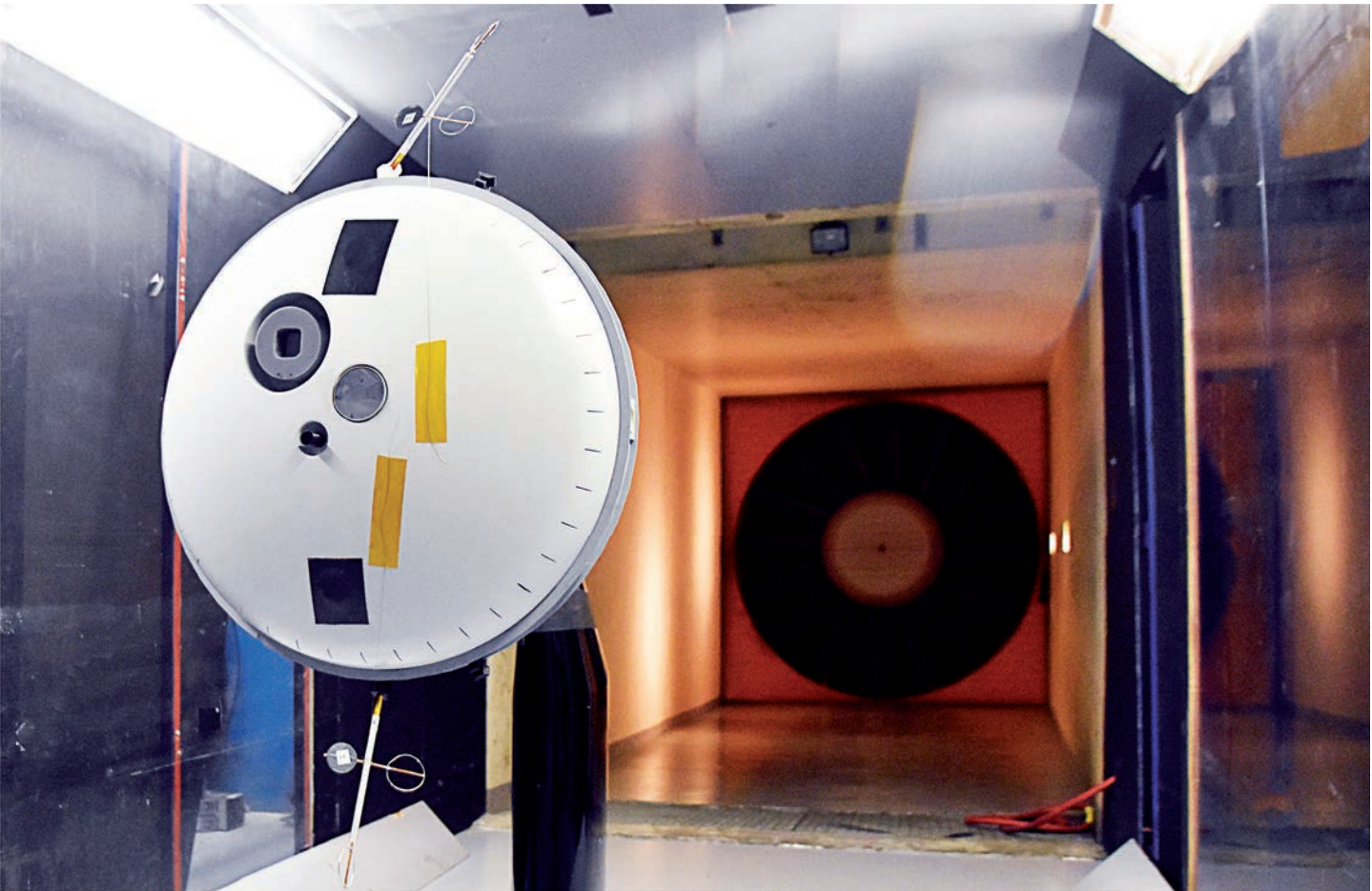
The engine test benches of the PRISME laboratory are used by Polytech engineering students and by students of the international Master's degree "Automotive Engineering for Sustainable Mobility" for projects and practical work in the fields of combustion, energy efficiency, pollutant formation and engine control.

Computer science labs and WIFI network

Polytech Orléans provides twelve self-service computer science labs with 300 computers and all necessary software for the use of its engineering students for lessons, projects, and personal work. WIFI access points are available in Polytech facilities and on campus for internet connection using laptop or tablet computers and smartphones.

Robots

Polytech Orléans has both industrial and domestic robots for use as part of the robotics coursework.






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Final year projects
forum awards

- 1st place
- 2nd place
- 3rd place
- Innovation
- High schooler's choice
- Participant

Worldwide ATOS IT Challenge

- First place

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