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School of Engineering of the University of Orléans

Student Projects Catalogue 2016-17

Polytech Orléans

Ecole Polytechnique de l'université d'Orléans

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Message from the Director

One essential element of the activites 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.

Christophe Léger
Director, Polytech Orléans

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Civil Engineering

Analysis of the life cycle for recycling concrete used in building

Civil engineering


B. GOUSSARD


I. HAMELIN

Benjamin GOUSSARD / Irwin HAMELIN
Academic supervisors: H. RAMEZANI

Company/Institution: undisclosed

Objective/motivation

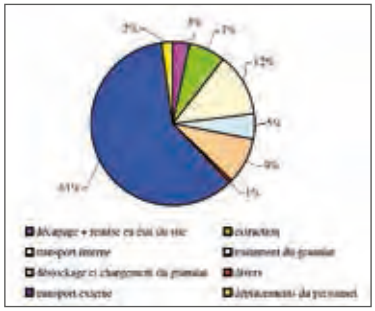
The civil engineering field produces a lot of waste and this includes concrete. European countries want to reduce waste by four before 2050. That's why we have to work on a method which permits the use of recycled concrete in construction. The objective is to reuse the concrete of a former building for a new one and evaluate whether the emission of CO2 is less. Due to this method, we can determine whether it is interesting to reuse concrete in new structures and whether the impact on the environment is better with recycling concrete. Moreover, we have to study the concrete after the demolition of the building until its reuse for a new building. By studying this life cycle, we will analyze all steps of the transformation of the concrete and the consumption of CO2 which is needed.

Results

During this project, we have seen that we need to study the impact on the environment of all resources needed by using recycled concrete. Indeed, we studied engine emissions and electricity and water use, for example. We worked on three different types of structures based on their dimensions. The engine and method used vary with the type of building and that is what we have to study. In this project, we saw that it is not always inexpensive to use recycled concrete. Indeed, the maximum cost is transportation of resources from one point to another, and that is the major problem. The benefit of recycling concrete is that we can save a lot of space because there is less waste on the construction site.

Keywords: pollution, sustainable development, waste, concrete

Life cycle of the material


Repartition of the emission of greenhouse gas

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Anti-seismic system for a propylon in the museum of Nîmes

Civil engineering

A. A. EL ALAMI

A. LOUAFI

Ahmed Amine EL ALAMI / Abderrahim LOUAFI
Academic supervisor: D. HOXHA

Institution: PRISME Laboratory

Objective/motivation

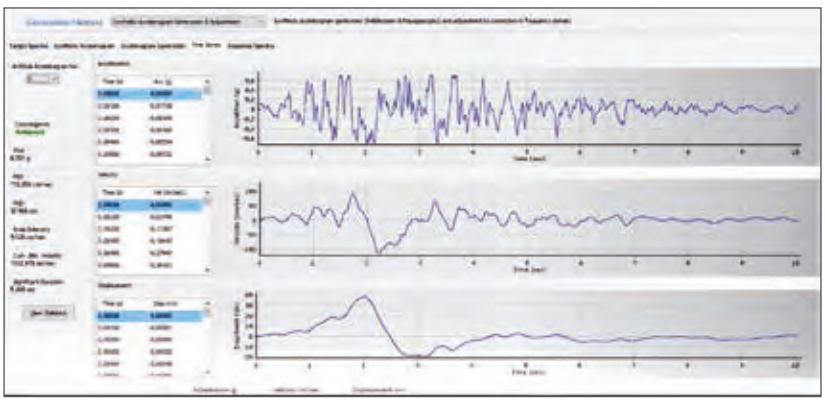
In order to bring out the historical heritage of the city of Nîmes, the historical museum is being restored. The technical studies office in charge of this project proposed an anti-seismic system to protect a propylon dating from the Roman era. This propylon, composed of three parts, will be assembled in the museum in order to avoid any risk. Our work in the first place consists of studying the behavior of our platform as it is subjected to a random movement using the software ANSYS. Then, based on this analysis, we will decide whether the system should be resized. The platform is composed of three plates and twelve cylinders distributed on two levels (six cylinders at each level) and placed along the two axes (x,y) in order to have two degrees of freedom.

Results

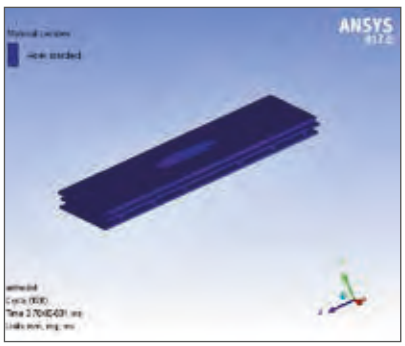
First, we began with learning how to use the Software ANSYS. Then we imported our structure to the workbench platform in order to create a meshing and launch Autodyn. After a long period of calculation, we finally had a representation of the movement. This representation is in the form of a GIF file, showing the displacement of one of the plates which was submitted to a constant velocity. This displacement is proof that our system is well-designed and that there is no problem related to contact between the different components. During the second step, we used a new software called SeismoArtif to generate an earthquake accelerogram based on real data. We will import this accelerogram to ANSYS so as to recreate the conditions of a real earthquake and then check the design of our platform.

Keywords: archeology, propylon, seismic, ANSYS, SeismoArtif

Propylon with mesh covering



SeismoArtif



Antiseismic system

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BIM project, sizing from digital model

Civil engineering

E. ALEPEE

T. BERTOLUCI

Eva ALEPEE / Thomas BERTOLUCI
Academic supervisors: N. BELAYACHI, D. HOXHA
Industrial supervisor: G. LECOEUR

Company: Bouygues Construction

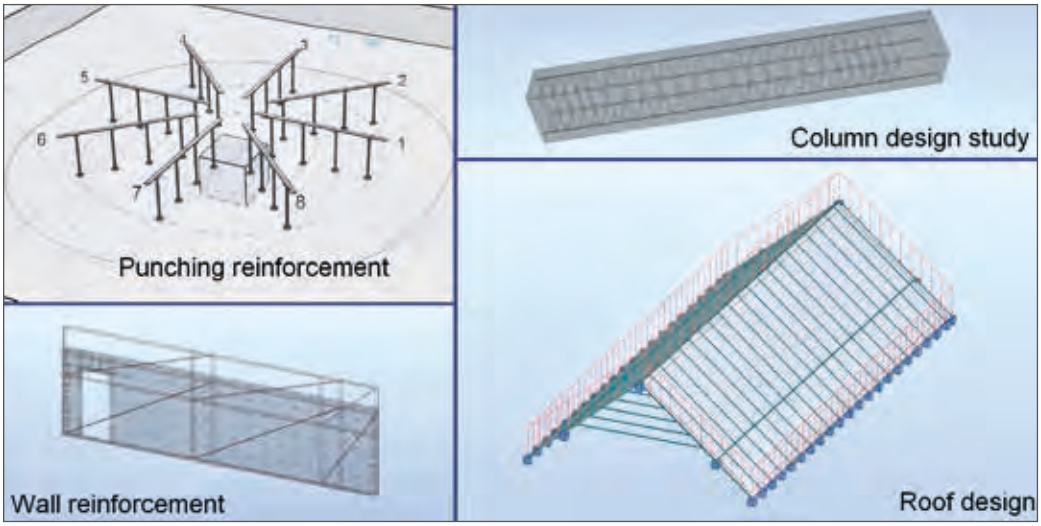
Objective/motivation

Our project mainly relates to the sizing of a building, but our project concerns an innovative subject which is quite new for all companies: BIM. This acronym means Building Information Modeling and the purpose is to create a digital model with which all trade bodies can work. Our task consists of using the digital model created by the architect and sizing the structure of the building. This project is very interesting for us because the construction will begin in April so we can work simultaneously with the company and compare our calculation methods and results. Moreover, we will learn about the BIM technology and all software useful in this domain, so this project allows us to increase the value of our résumé.

Results

First, we analyzed construction methods and then compared them with those of the company to make a choice for the construction site. Second, our task was to size the elements of the building. Thanks to the software Robot and calculations, we sized walls, slabs, columns, foundations and the flat slab, first geometrically, then the reinforcement dimensioning. Moreover, we updated the digital model at every step. After the comparison of our results with the company's, we made a document with all the details in order to send it to the estimating department for a pricing study. Our project was very interesting for us because it has allowed us to work with different software programs that we studied at Polytech and to work on an innovative project, new for a lot of companies. Furthermore, this project appeals to several skills that we see in our three-year training, consequently it completes our last year.

Keywords:
digital mock-up, sizing, Building Information Modeling



Project schematic

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Biogeochemical processes in the rhizosphere of plants involved in the phytostabilisation of soils polluted by metals and metalloids

Environmental engineering

Quentin PATRY / Ludovic PHANUEL
Academic supervisors: M. MOTELICA, L. LE FORESTIER


Q. PATRY


L. PHANUEL

Companies/Institutions: IISTO, BRGM, CNRS, LBLGC, Labex Voltaire, University of Orléans

Objective/motivation

Our fifth-year project is part of the research project Phytoselect which is carried out by the ISTO. This project deals with the rehabilitation and treatment of a technosols polluted with cadmium, zinc, lead and arsenic during the mining of lead and silver. The objective of our project was to define the metals and metalloids speciation of the initial and phytostabilised soil samples and with and without biochar using a sequential extraction method. With the comparison of the different samples and fractions, it is possible to understand the effects of phytostabilisating plants (willow and ray grass) on the metals and metalloids speciation in the soil. Knowing these effects, it is possible to determine if the plants can be used for the rehabilitation of the soil studied and if biochar is needed.

Results

The biochar increases the pH and water-holding capacity of the technosol and boosts the growth of plants by providing the nutrients which are not present in the soil. The results we obtained from the sequential extraction of As show the quantity of As in the third phase (As adsorbed specifically) is twenty times higher than in the second phase (As adsorbed not specifically) and forty times higher than in the first phase (water-soluble). In all the phases, the tendency of the results show that the plants have almost no effect on the quantity of As in each phase. However, the biochar has a noticeable effect: it increases the quantity of As in each phase. The biochar improves the mobility of As.

Keywords: phytostabilisation, soil, metal(loid)s, biochar, plants


Centrifugation


Grinding


Plants cultivated

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Call to tender for the construction of the Leclerc drive in Olivet

Civil engineering


L. CAZABAT

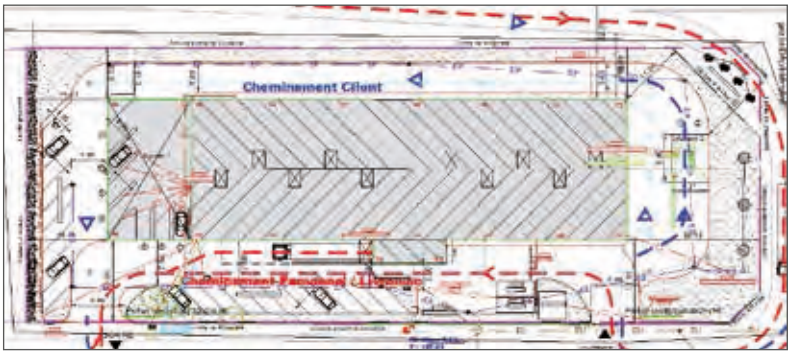

N. DIFALLAH

Laura CAZABAT / Narjass DIFALLAH
Academic supervisor: L. JOSSERAND

Company: Leclerc

Objective/motivation

Our project consists of answering a call to tender concerning the construction of the E.Leclerc drive in Olivet. The main point was to come up with a price for the work. Mensura is the software that we used mostly. It enabled us to model the project but also to choose a solution to store the rainwater onsite since Leclerc wasn't authorized to use the community's pipes. After estimating the quantities of materials needed for the works as well as the machines and the work force required, we were able to state a price for this construction site. These different steps for answering a call to tender are exactly the same as those used in real civil engineering companies. This is why we chose to work on this specific project: to learn real methods that we will need in our professional lives.



Plan of the project

Results

As a result of our project, we estimated the cost of the construction site. Also, we had to think about other alternatives to the original project that may help us save time and/or money. Thanks to manual calculations we performed, we compared the results given by Mensura to our own. Thus, we were able to evaluate the realism of the software's results. Finally, we had to do the project schedule. This project helped us feel more comfortable with Mensura. We also learned always to have a critical eye on the results given by the software and to check our work with manual calculations.

Keywords: call to tender, Mensura, rainwater storage, sanitation network, estimating

View of the E.Leclerc Drive from the N20 side

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Characterization of a post-mining site polluted by metals and metalloids

Civil engineering, environmental engineering

S. DOSSING

Y. RUAN

Sarah DOSSING / Yanting RUAN
Academic supervisor: L. LE FORESTIER

Institutions: ISTO, University of Orléans

Selected participant
11th Annual Final Year Projects Forum

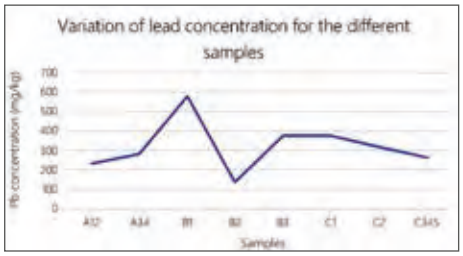
Objective/motivation

Pollution and rehabilitation of soils has become a more and more focal problem during the past few years as soil pollution represents a high risk for human health and the environment. Our fifth-year project fits into this context as it consists of the characterization of a post-mining soil contaminated with metals and metalloids. This step is essential in the process of soil depollution as it allows us to determine the parameters of the soil and the type of pollution. In this way we identified the pH, the granulometry and the cationic exchange capacity of the polluted site, but also the metals and metalloids bound to particular fractions of the soil. As our project is a part of a 3 years' time research, these results are very important and will be reused afterwards in order to find out an appropriate decontamination method.

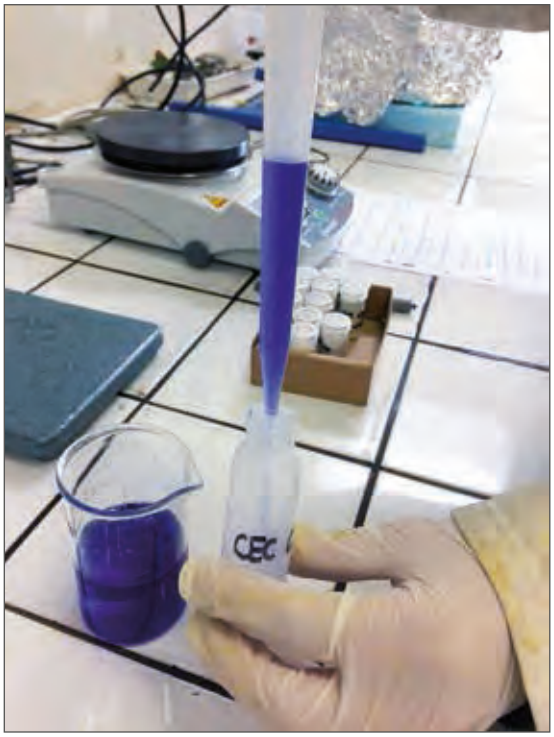
Results

As a result, for the physical part, we used the granulometry method to analyze the soil property. We obtained that the nature of the soil is globally sand, and the deeper the extraction, the thinner the sand. For the chemical part of the characterization, we have first measured the pH that is around an average of 4 and 5. As one part of the chemical analysis, the cation exchange capacity (CEC) showed us that the variation of the copper compared before and after the reaction is 0, which means that the CEC of this soil is negligible. These results are closely related to the nature of this soil. With the help of an atomic absorption spectrometer, we found that the concentration of lead in the soil depends on the different fractions, but the general lead concentration of this soil is higher than normal soil.

Keywords: soil pollution, metals, characterization



Variation of lead concentration in the soil



Cation exchange capacity experimentation

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Characterization of mechanical and thermal properties of recycled sand mortar

Civil engineering

B. BRILLON

Baptiste BRILLON / Orhan ERGUN
Academic supervisor: N. BELAYACHI-BELAICHE
Industrial supervisor: A. TEGUER

Company/Institution: IFSTTAR, PRISME Laboratory

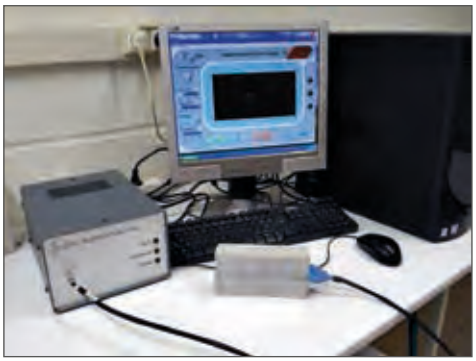
Objective/motivation

Sand is the second most used resource after water. However, sand is a non-renewable resource. Our project falls within this context, being based primarily on studying the influence of the use of recycled sand in the development of mortar. The goal of this project is to compare the thermal and mechanical properties of recycled and regular mortars. In addition to the influence of the recycled sand, the influence of other parameters such as the saturation or the type of sand have an impact on the thermal and mechanical properties. This work requires mechanical and thermal tests on the samples. These tests were carried out by PRISME laboratory on samples made by researchers from IFSTTAR.

Results

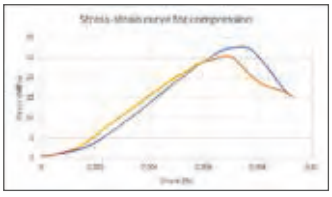
The mechanical and thermal tests we carried out allowed us to define the advantages and disadvantages of using recycled sand in mortars. From a mechanical point of view, we could conclude that the use of recycled sand generated a loss of mechanical strength. In addition, we have concluded that the curing conditions and the type of saturation made it possible to obtain better mechanical properties. A dry cure and unsaturated samples improve the thermal properties even though their compression and bending strength decrease. Although their mechanical performances are lower, mortars made with recycled sand may nevertheless be used in different types of works such as in shreds or non-load-bearing walls. Therefore, this type of structure does not require a big mechanical performance and the use of recycled sand allows us to obtain better thermal insulation, thus a better comfort. This solution may be useful nowadays and in the near future when we try to save energy and make building more environmentally friendly.

Keywords: thermal insulation, cement mortar, recycled sand, thermal properties, mechanical properties



Thermal testing

Mechanical testing



Stress-strain curve for compression

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Cracking induces anisotropic attenuation of ultrasonic waves in porous materials

Civil engineering


H. MALAFOSSE


K. MARTIN


R. PEZERON

Hugo MALAFOSSE / Killian MARTIN / Robin PEZERON
Academic supervisor: D. DO

Institution: PRISME Laboratory

Objective/motivation

This project consists in using a method, called tomography, that permits us to determine where cracks are, in a sample, without destroying it. We used circular samples in PLA and aluminum. We had to put sensors all around them for data acquisition; each sensor transmits an ultrasonic wave and receives it. The ultrasonic wave through the material is reduced and this attenuation is due to interactions between the wave and the propagation medium. The main issue is to compare the coefficient of attenuation calculated with the theory of wave propagation.

Results

The results were not totally good because of the complexity and the fact that it's a research project and it's almost impossible to have what we want in the first row. To conclude about this first part and determine if the problems come from the experiences or if the theory chosen is not adapted for our case. We made a numerical part and we created a homogenous sample in a software program called Flac3D. We studied two cases, as for the experiments: one case with a blank space in the sample and one without space, to determine the attenuation of ultrasonic waves inside the material.

Keywords: tomography, attenuation, cracks, ultrasonic waves, Matlab, Flac3D

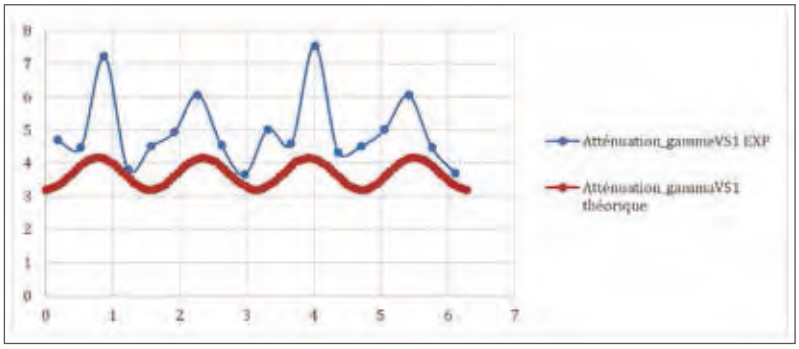

Fig. 1 : Comparison between attenuation of experimental and theoretical ultrasonic longitudinal wave

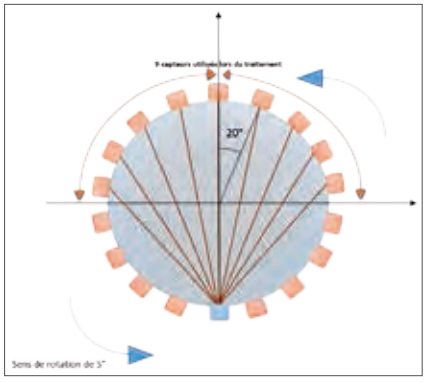

Fig. 2 : Schematic representation of the experimental setup

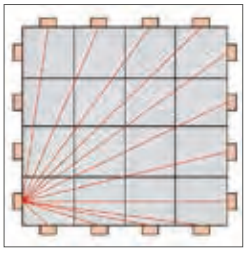
Fig. 3 : Meshing of the sample with Flac3D

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Creation of a new method to detect and quantify pollutants from soil and water

Environmental engineering

Alexis BLANC
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CETRAHE

Company: CETRAHE

Objective/motivation

The interest of this project is to create a new method to detect pollutants in soil or in water. This will allow us to make a preview of present pollutants. Currently, others methods exist to know the pollutant, but they are expensive and take a long time (approximately 2 weeks) whereas this method is very quick. Indeed, it takes only around ten minutes to analyze a sample. This method is based on fluorometry, which is the fluorescence of particles. However, using this method, we cannot detect all the pollutants because some of them, like metalloids, are not fluorescent. My work consists of continuing the investigations on the fluorometrics characteristics of different pollutants and analysis of the results. I have to look for the practical application of this method. This project is interesting for me because I will work in soil decontamination, and it improves my knowledge.

Results

I analyzed a new family of pollutants and determined a link between pollutant concentration and the intensity of fluorescence for some species. I analyzed samples from a garage. Indeed, we often found these kinds of pollutants in soil and water. Some of them are fluorescent but others we don't know because they can damage the equipment. Moreover, we got in touch with people working for ADEME, a French institute working in the environment sector, who gave us advice for practical applications. Now, we know that the method can be used to follow the evolution of a pollution, or to research its origin. Moreover, we know that the method is more financially competitive to analyze a specific pollutant than a lot of them. Finally, this project brought me rigor, precision in my work and the opportunity to become aware of how research is conducted.

Keywords: new method, detect, pollutants

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Design of experimental equipment

Civil engineering

Maria Sofia ARAUJO E SOARES / Léa MEISSONNIER
Academic supervisor: C. MALLET
Industrial supervisor: C. MALLET

Institution: PRISME Laboratory

Objective/motivation

Currently at the university's laboratory there is non-automated equipment to analyze cracking on different samples with a tomography method that measures the ultrasonic wave velocity on the sample with the use of sensors applied all around it to send and receive those waves. However, to be able to take these measures at the same time the sample is being compressed by a hydraulic press, we need to automate this process. This automation would also improve precision, reduce the time of the experiment and facilitate the whole process. Thus, the main objective of this project is to design an automated device that meets these requirements.

Results

We were able to successfully accomplish the objective of our project. After testing some materials and trying different possibilities, we designed the equipment and made the technical drawings to send to several companies to then ask for their quotations for the fabrication of this device. After contacting various enterprises in the region and receiving many negative answers, finally, in the last week of the project, we obtained a quotation of 7500€ from the enterprise Rossier Mécatronique. Now, even though we finished our task in this project, our instructors will still continue it. Their next steps are to try to get the necessary funding to fabricate this equipment and then think about a solution for the case of a cylindrical sample.

Keywords: experimental equipment, sensors, tomography, waves

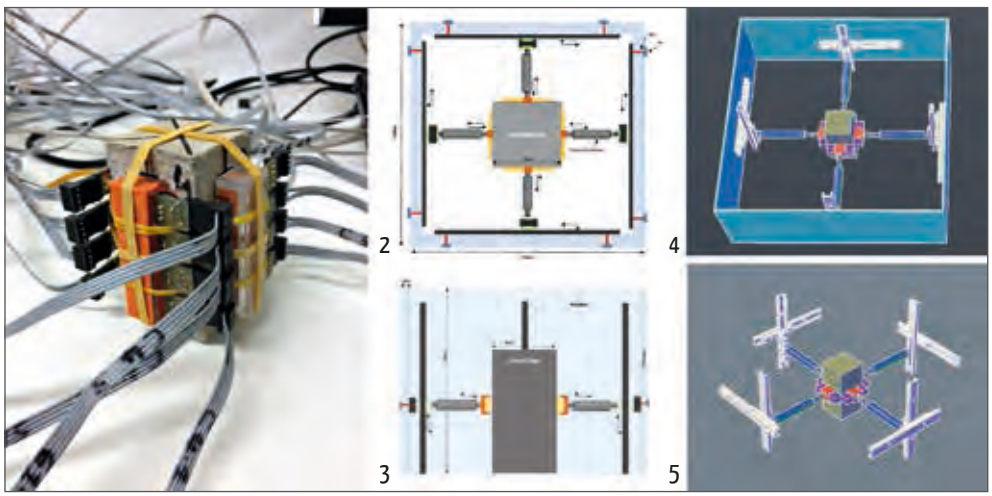
Fig. 1: Current non-automated equipment

Fig. 2: Top view of the 2D drawing of the automated equipment

Fig. 3: Front view of the 2D drawing of the automated equipment

Fig. 4: 3D drawing of the automated equipment with the plexiglas box

Fig. 5: 3D drawing of the automated equipment without the plexiglas box



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Design of temperature evolution in a pavement structure

Civil engineering

Zaccaria AMCHOU / Corentin TORZEWSKI
Academic supervisor: L. JOSSERAND

Company/Institution: undisclosed

Objective/motivation
This fifth-year project, proposed by the research and development center of a public works group, concerns the layers of roads. The R&D center led the students to design a software allowing estimation of some values according to input data. The project began with the apprehension by the students of the reasons adduced for the company. The students then gradually undertook the design of this software. Very regular meetings were organized to refine the relevance of the results.

Results
undisclosed

Keywords: pavement structure, temperature evolution, external conditions

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Development of an automated technique for 3D digitization of samples submitted to laboratory ageing

Civil engineering


I. ISSA BECHIR


K. PITARD

Ismael ISSA BECHIR / Klyd PITARD
Academic supervisors: X. BRUNETEAUD, S. TREUILLET

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

Institution: Polytech Orléans

Objective/motivation

The purpose of the project is to automate a protocol for 3D digitization of stone samples used to characterize the morphological features of their degradation. In order to identify in-situ degradations thanks to 3D digitization, a preliminary work consists in creating identity cards of stone degradation resulting from laboratory ageing. To do this, it was necessary to optimize the automation of the turntable used in the photogrammetric process and to optimize the processing of images and point clouds for the colorimetric and morphological analysis of the degradation undergone by the stone.

Results

We have optimized the system elements by using gears with a ball bearing system for the rotation of our turntable. We have also improved the lighting system and the tent to have the clearest picture possible with a light as homogeneous as possible, to obtain the best contrast while avoiding shadows as much as possible. Finally, we have automated the stepper motor control, the camera control and created a web server with the help of our student colleague from electronics and optics option.

Keywords: degradation, 3D digitization, photogrammetry, stone, automating


3D image of stone


Camera and tent


Altered stone

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Identification of cracks in different mortar samples using elastic waves

Materials

J. DELBECQUE

H. DIABI

Jérémy DELBECQUE / Hussein DIABI
Academic supervisors: C. MALLET, B. NDAO

Company/Institution: undisclosed

Objective/motivation

The objective is to determine the crack density into mortar samples in different cases. The principle is that these waves move more or less quickly according to the type of materials that they cross. So if we measure the speed of the elastic waves which have crossed our sample, we could deduce if there are cracks into it and where these cracks are located. For that, we worked with Ms. MALLET and Mr. NDAO who lead research on this topic. My colleague and I enjoyed doing experiments in the laboratory and observing the evolution of cracks following thermal shocks. Furthermore, the data analysis is very repetitive but necessary to deduce and localize the cracks in the sample.

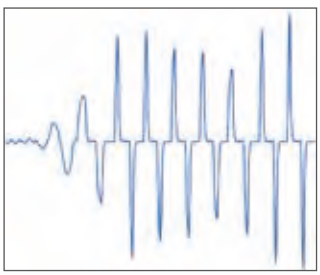
Mortar sample

Results

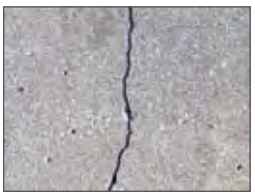
After we did all the experimentations, we proceeded to the data analysis. After interpretation, it led us to some conclusions. First, for each thermal shock (we did three with different temperatures), we observed differences between the captors which shows that there are some irregularities linked to the experimentation errors. Second, we could see the evolution of the cracks in the sample after the different thermal shocks. Indeed, the hotter it is, the more the elastic waves take time to cross the sample. Third, the thermal shocks influence the sample cooled with air less than the sample cooled by water, probably because the shock is bigger. The thermal shock at 180°C was very successful and impressive because we saw the cracks open in real time just before being put in the water. Finally, many of our results are coherent for the elastic waves P. However, it is difficult to do conclusions with the elastic S-waves data because they are incoherent.

Keywords: cracks, ultrasound, elastic waves, thermal shocks, tomography

The sensors



Processing signal of a P-wave



A crack created by a thermal shock

Sample ready for the experiments

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Improvement of facade coatings

Materials

Emilie ESGUN / Mohamed HAJJI
Academic supervisor: K. BECK

Company/Institution:
Vega Industries, PRISME Laboratory

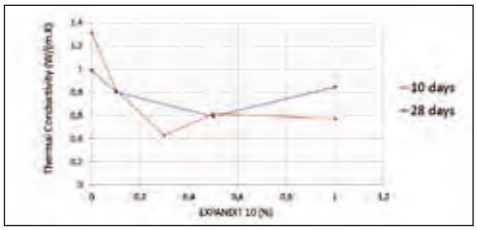
Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

Nowadays, companies responsible for the restoration of buildings whose walls are made of stone rubble are often faced with a problem of durability and stability of facade coatings when stones are polluted by soluble salts. The point is, how could we offer a decennial guarantee if the support is not healthy during the restoration? The first part of this project is to observe the reaction of a facade rendered with mortar on stones polluted with soluble salts during an ageing test in the laboratory. The second part took part in partnership with a company named Vega Industries. It is a manufacturer of facade renders and mortars. The aim was to find an insulating coating. To do this, we studied a product, "Expandit", provided by the partner company. It is a powder rich in aluminum.

Results

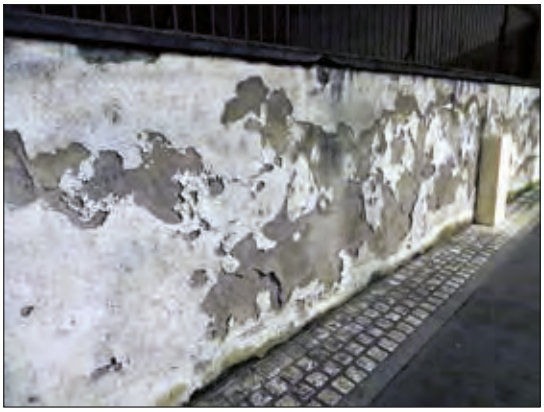
For the first part of our project, the results will be interpreted by a 4A group project because it will not be finished within the deadline of the project. In fact, we created the protocol and they will carry out the following tests. For the thermal part, regarding our results, we can observe that the thermal conductivity is decreasing in terms of Expandit percentage. Unfortunately, compared to the products we can find in the trade (aerated concrete, insulating coating...), our product is not insulating enough. As Expandit is not expensive, what we should do next is to do some new tests by changing the formulation and the technical process.



Thermal conductivity in terms of Expandit percentage

Keywords: stones, thermics, durability, salt, coating


Some samples of "stone-mortar"


Example of facade coating altered by salt

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Karstic and underground network studies

Environmental engineering


A. DAMIANS


H. TIGHADOUINI

Arnaud DAMIANS / Hamadi TIGHADOUINI
Academic supervisor: C. DEFARGE
Industrial supervisors: C. DEFARGE, N. JOZJA

CETRAHE

Institution: Cellule R&D CETRAHE

Objective/motivation

This project is about artificial tracing. The study is supervised by CETRAHE and financed by « l'agence de l'eau Loire-Bretagne ». The aim is to discover and to map a karstic and underground network in a specific area : La Petite Beauce. It is located between Blois and Vendôme in France. This project will permit better water management and prevent water from being polluted. There are various steps; one of the most important is to organize trips to observe and to check the information in data (websites, documents). The method used is called artificial tracing. It consists of injecting a fluorescent tracer in a place. Then we use an autosampler to collect water in another place. The samples are brought to CETRAHE's laboratory and they are analysed with a spectrofluorimeter. We can show an underground connexion between the two places if we find the fluorescent tracer in the samples.

Results

During this project, we did research about the geology and the hydrogeology of the area of "Petite Beauce" to prepare the tracing there. Among the places given by our colleague Mr. De Bretizel, we found that the drill proposed isn't appropriate. However, there is a fracture in the ground that can be interesting for the experiment. This point should be verified at a time when there is more rain. We also organized and conducted field trips to observe and check all the places proposed. We noticed that the weather conditions and water flow were not sufficient for the work that we intend to do, so it was necessary to postpone the tracing. However, we prepared all the other steps of the experiment (determination of the amount of tracer, preparation of the order). Moreover, we reviewed all the previous tracing done by CETRAHE and we concluded that, compared to other experiments, one plotting was underestimated. We propose to do that again later. We prepared and presented the project to 4th-year students who are going to resume this project.


Spectrofluorimeter

Keywords: hydrogeology, karst, water management, artificial tracing


Fontaine Saint-Georges, restitution point


Fluorescein, most used tracer

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Lean construction and building information modeling

Civil engineering

M. CARPENTIER

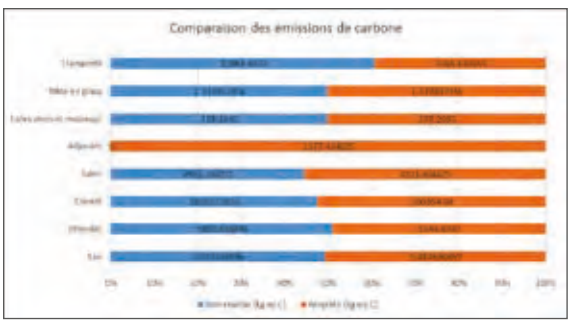
J. MARETS

Mathilde CARPENTIER / Jeremy MARETS
Academic supervisor: H. RAMEZANI

Company/Institution: undisclosed

Objective/motivation

This project consists of modeling and analyzing a building to know its carbon footprint. The first part is to use a software called Revit from Autodesk and to model and extract the different quantities of materials, especially concrete. The second part is to create an Excel file to analyze the difference of cost and carbon footprint between recycled concrete and new concrete. A lot of waste is produced by construction companies and it would be very useful to find a solution to reduce this waste. We also worked on the deconstruction phase to determine which type of deconstruction is the most ecologic. To conclude, the final goal is to know which method is more harmful to the environment and also determine which is the most expensive.

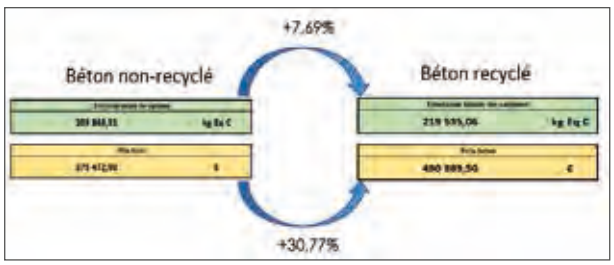


Carbon footprint graph

Results

At the end of the project, we managed to model our building which is located in Château-Thierry (France). We found that our building is composed of 1855 m3 of concrete. With the Excel file, we are able to determine the quantity of carbon emitted during the construction and deconstruction phases. The software can analyze each phase with different types of trucks, types of cements, or different types of deconstruction. This software is very complete because it can be used in any situation, not only for our building. Contrary to preconceived ideas, recycled concrete is not always the least polluting material because this depends on its quantity, on its distance from recycling centers and many other non-linear parameters. In the studied case, the recycled concrete is 33% more expensive and 7% more polluting than non-recycled concrete.

Keywords: environmental impact, carbon emission, building information modeling



Results

Revit model of the building

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Making a digital model of a school building using a 3D scanner

Civil engineering


A. PERRIN


D. RIBEIRO

Antoine PERRIN / David RIBEIRO
Academic supervisors: X. BRUNETAUD, S. JANVIER

Company/Institution: undisclosed

Objective/motivation

Our objective is to make a digital model of the Darcy school building. To that end, we used a FARO 3D scanner for a full day to get the exterior and the interior of the building. Then we obtained a cloud of points with approximately 110 million points. We had to make some modifications on it to clean up the outliers and artifacts, and also to work more easily on the computer. We ended up with 1.5 million points. Afterwards, we started to work on REVIT software to model the building. We were glad to do this project because we wanted to work with a BIM (Building Information Modeling) software programme. BIM software products are used more and more by building companies and it is important to know them. Moreover, we will both use this software during our internship and maybe in our future work.


Darcy building exterior

Results

After the acquisition, we had to treat the point clouds by cleaning the wrong points (a lot because of the windows), registering each station by defining reference points and reducing the density of points. We inserted the point clouds in the background of Revit. First of all, we set up the elevation views to work in the different plans, then we adjusted the segment of each view. Afterwards, we were able to model walls, beams and slabs by working simultaneously on longitudinal and transversal views. Once the general shape of the building was done, we had to work more in detail by placing doors, windows, ceiling, stairs, lamps and a lot of other items. We took many pictures because we wanted to be as precise as possible. To model the building, we either used the model library available on REVIT by adapting the characteristics or we created the families needed by drawing them.


Scan image of Darcy building exterior

Keywords: BIM (Building Information Modeling), 3D scanner Revit (Autodesk software)

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Modeling of the fire resistance of tunnel linings

Civil engineering


A. ELAYDI


N. SAHIFA

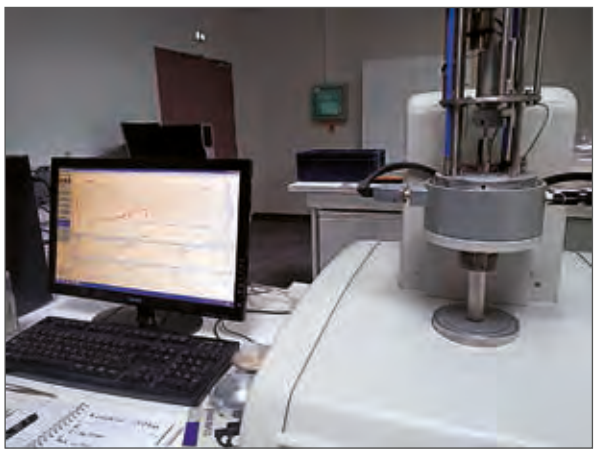
Abderrafiq ELAYDI / Nabil SAHIFA
Academic supervisors: N. BELAYACHI BELAICHE, D. HOXHA

Company/Institution: undisclosed

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

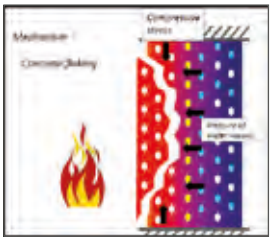
In the past few years, major fires in tunnels have caused significant damage which is why a lot of research has been conducted on fire behavior. In fact, fire behavior covers two aspects: reaction to fire (the ability of a material to react to a fire to which it is exposed, and fire resistance (the ability of an element to retain its role despite the development of fire). For tunnel safety, the main aim of fire resistance is to prevent the fire from spreading outside the areas which have become dangerous. The objectives of a sufficient fire resistance are to allow the self-evacuation of the users, the intervention of the emergency services at an acceptable level of risk, and the preservation of the structure to ensure the safety of the surrounding structures. An additional objective is the durability of the structure to minimize costs and repair times in the event of a major disaster.

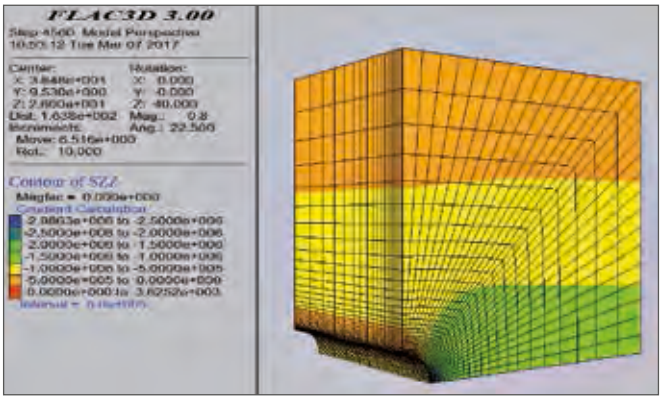

Measurement of the coefficient of thermal expansion

Results

The aim of this study is to understand the main mechanisms of degradation which can be at the origin of the flaking of the concrete constituting the tunnel linings exposed to extreme conditions as the temperature rapidly exceeds 1200°C. In fact, concrete degradation shows through the bursting of concrete, which generally occurs at temperatures between 250°C and 400°C. However, the heating of concrete causes a high thermal gradient, which causes significant deformation. These deformations, when prevented, induce thermal stresses. The compression stresses created in the vicinity of the heated surface can reach extremely high values and exceed the compressive strength of the concrete. The thermal instability of the concrete can also be compared to a buckling mechanism under the bi-axial compression stresses of the heated zone.

Keywords: fire resistance, tunnel linings, numerical modeling, experimental testing, concrete spalling


Mechnanisms of concrete flaking



Stress distribution in the tunnel

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Modelling and economic analysis of a real project: construction of a police station and official housing

Civil engineering


M. LE FLOCH


H. MARSANI

Marion LE FLOCH / Haithem MARSANI
Academic supervisor: L. JOSSERAND

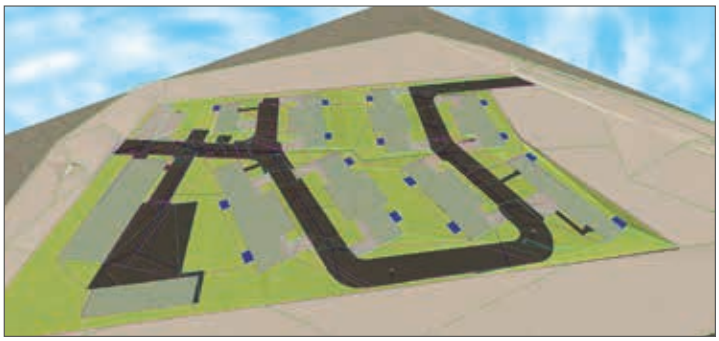
Company/Institution: undisclosed

Objective/motivation

The objective of our project is to respond to an old call for bids. It concerns the construction of a police station and official housing in Neuville-aux-Bois. This project was built at the end of 2011. The construction site includes 15 houses for policemen and their families, 1 general service building and several car parks in an overall area of 1.2 hectares. For this study, we have several documents coming from the call for bids. We have plans (altitude of natural ground, works plans) and technical documentations (soil tests, special technical specifications). The aim of the project is to simulate the works using the software Mensura. This permits us to estimate the quantities of materials needed for the construction. Based on these results we have to get the final price and works schedule.

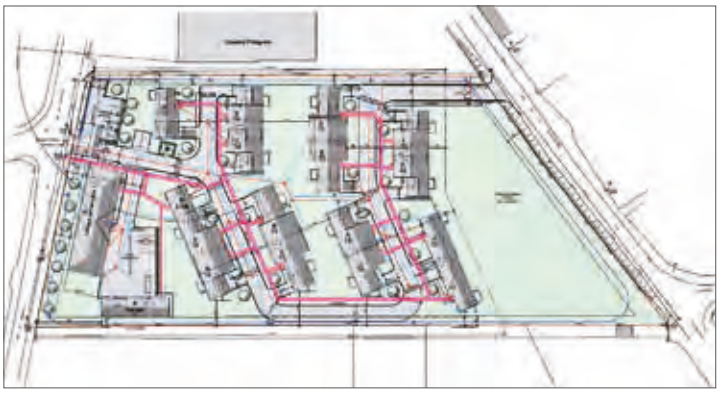
Results

The modelling is one big step of this project. We have modeled the whole project: establishment of platforms with attention to their height (building foundations, green spaces, roads and walkways), installation of networks (sewage, gas, electricity...). After that, we were able to determine the quantity of excavation and backfill induced by the project. The software Mensura gave us all the design details for the sewage networks. We compared these results with theoretical calculations. Finally, we were able to establish a quantitative estimation of materials, machines and human needs for the whole works. Our result is to determine the final price and the details of the works to meet the bid requirements and to respect every specification required by the client. This is followed by the identification of building phases and the work schedule.


Modelling using Mensura

Keywords: Mensura Genius, economic costs, call to tender, public works, planning


View of the police station in Neuville-aux-Bois


Plan coming from consultation files

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Setup of a water pollution control station

Environmental engineering


A. DUVILLIER


A. TARDIVO

Arthur DUVILLIER / Alexis TARDIVO
Academic supervisor: S. BINET

Institutions: CNRS, ISTO, University of Orléans

Objective/motivation

Our project consists of observing the pollution rate in the main spring in Loiret. This spring is called the Bouillon. It is located in the park of our university named Parc Floral d'Orléans. This project is divided into three main tasks. First, we have to maintain the existing probes, add new sensors and perform the calibrations. Second, we have to archive the existing data and to make graphs to visualize the evolution over the last three years. Third, we have to create a website in order to visualize data in real time. As students of the sustainable construction option, we have done many projects concerning concrete, structure dimensioning or steel constructions but none about water pollution control. We are interested in this subject and we seized the opportunity to learn about it.

Results

We created a website with several graphs to visualize the evolution of data in real time. We made the program code which drives all the system from the station to the website. The data of the last three years was processed in order to archive them properly. We deleted incoherent data and smooth curves to obtain readable graphs. Four types of measures are available online: the water temperature, the conductivity, the turbidity and the dioxygen concentration. We learned interesting and useful things, mostly in water analysis, VBA (excel macro) and web designing. It was also a good experience to work for the CNRS and be part of the improvement of a project.

Keywords: water, analysis, probes, website, archiving

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Study of Brenne's pond dynamic sedimentation

Environmental engineering


D. PAILLAT

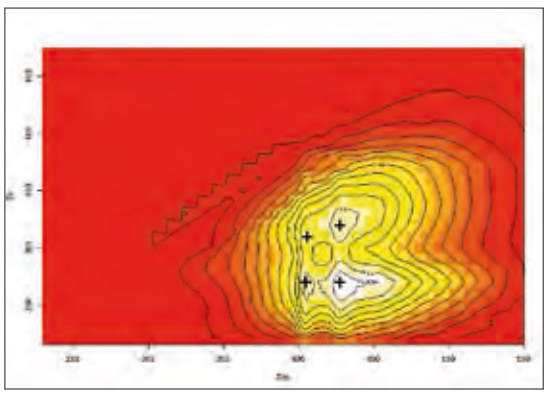

A. PEREIRA DOS SANTOS

David PAILLAT / André PEREIRA DOS SANTOS
Academic supervisors: C. DEFARGE, M. MOTELICA

Institutions: CETRAHE, ISTO, Parc Naturel Régional de la Brenne, Région Centre -Val de Loire

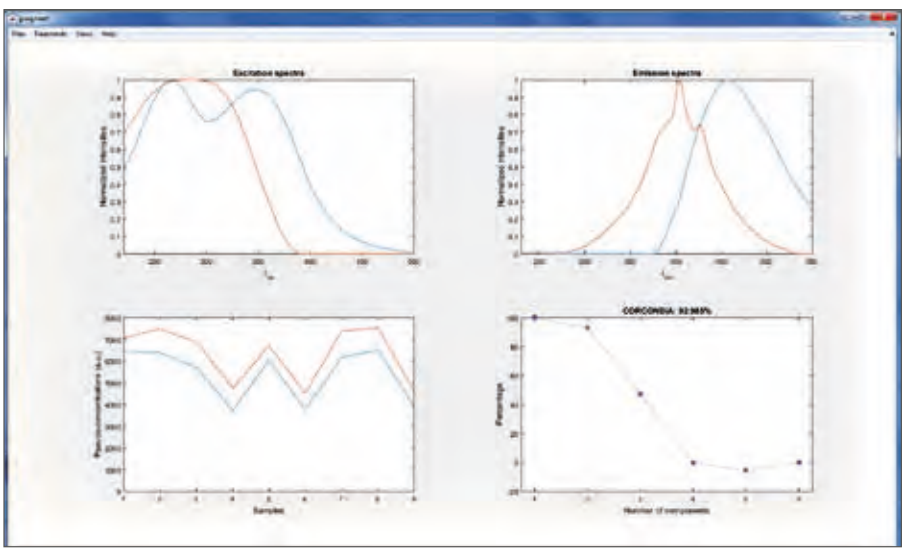
Objective/motivation

This three-year project was carried out with the help of the ISTO and CETRAHE, two laboratories/ institutes of the University of Orléans specialized in the environment. It deals with dynamic ponds in Brenne and the influence of the ponds on the climate. The main objective is to analyze different samples of water in contrast ponds and different depths in order to obtain data. The main thrust was to understand hydrogeology and sedimentary dynamic in the ponds in order to be able to manage water. There is no data in this project. It is a new area of study and it requires a method to choose the study ponds. We used a statistical method (ACP) which gives the most influent parameter for ponds and which ponds are best to study and analyse.



Results

The different measures show that we have two components in the water. The first one reacts to a 456 nm emission wavelength and is excited between 270 nm wavelengths. The second reacts to 404 nm wavelength and is excited between 280 nm wavelengths. We know what these components are. We have humic acid (c/α) and fulvic acid (α/α'). We have a third component proteinic (β) but for so little we ignore it. Moreover, our Dissolve Organic Carbon results give us values around 13.5 ml/g which is a little more than a river.



Keywords: pond dynamic, sediment, Brenne, anion, cation, DOM, OC

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The importance of variating special properties of soils in the design of geotechnical structure

Civil engineering

O. ASAN

P. BODENANT

Ozgür ASAN / Pierre BODENANT
Academic supervisor: D. DO

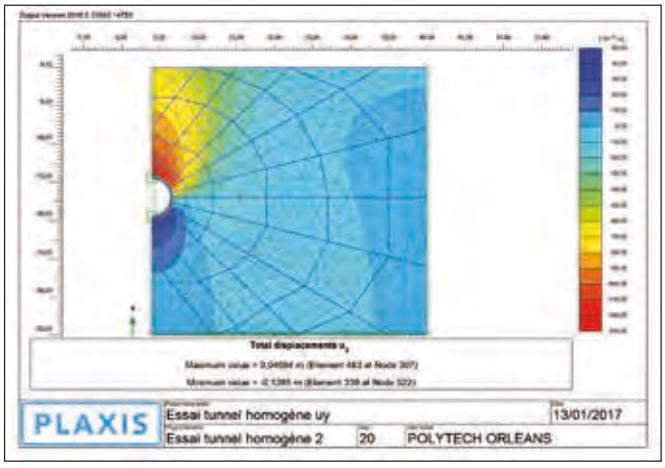
Institutions: PRISME Laboratory, Polytech Orléans

Objective/motivation

The goal of our project is to take into account the presence of heterogeneous soils around geotechnical structures and make the process of calculating their characteristics autonomous by linking a geotechnical analysis software programme (Plaxis2D, Flac3D) with a mathematical calculus one (MATLAB). To reach our goal we had access to two major software products: PLaxis2D and FLac3D. The former, easier to use, helped us understand the subject of the project better and gave us a general view of how soils behave. The latter was used to go more into details in the properties of heterogeneous soils and help us achieve more precise results. This project gave us an insight into how today's work is done and how we could improve civil engineering with more precise work, which will allow us to use what is necessary instead of taking huge safety measures.

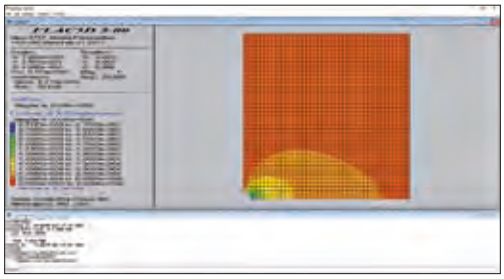
Results

Our first results came from the software Plaxis2D. Those results were about the displacement of the soil around a tunnel. We found that, under the stress of the soil, the tunnel shrank and its wall took the shape of an ellipse (the tunnel was circular before applying any stress). Plaxis2D worked fine with homogeneous soils but when we tried those tests with heterogeneous soils, the results were not satisfactory. We then switched to Flac3D. With this software we could gather all the necessary results to make some statistics about the differences. The next step with Flac3D was to gather even more results to make our statistics even more precise. To do so we created a program with MATLAB to make the process of making the calculus with Flac3D and gather the information on an automatic Excel sheet.

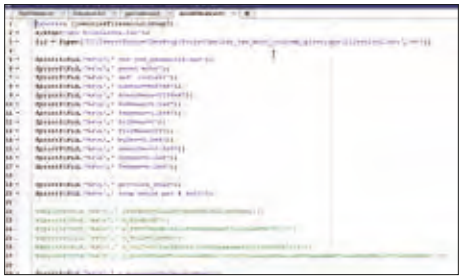


Displacement on the y-axis of homogeneous soil / Plaxis2D

Keywords:
heterogeneous soils, simulation of Monte Carlo, geotechnical structure, software Flac3D, coding



Displacement on the x-axis of heterogeneous soil/ Flac3D



Automatic process coding / Matlab

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The numerical modelling and structural analysis of the wooden frame of the Sainte Croix cathedral of Orléans

Civil engineering


A. CAUET


A. PINATEL

Alexandre CAUET / Alexandre PINATEL
Academic supervisors: X. BRUNETAUD, S. JANVIER
Industrial supervisors: L. BRIAND, X. BRUNETAUD

Institutions:
Direction Régionale des Affaires Culturelles (DRAC) – Centre Val-de-Loire, PRISME Laboratory

Objective/motivation

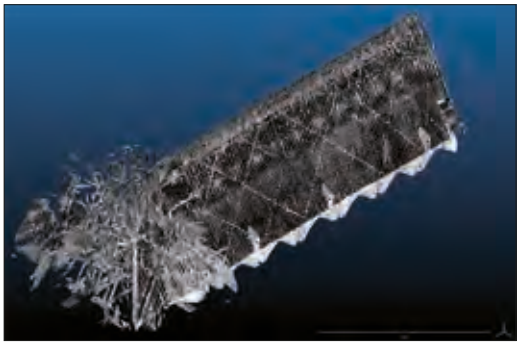
In order to obtain a maximum of data to complete the technical documentation of the Sainte Croix cathedral of Orléans, the DRAC (Regional Direction of Cultural Affairs) put us in charge of the scanning, 3D modelling and 2D planning of the cathedral's wooden frame. The first part of the project consisted of visiting of the wooden frame, carrying out the lasergrammetry scanning, taking notes, photo and making sketches. The second part is the exploitation of our collected data, on site. To do that, we used several complementary software programmes such as SCENE, for the compilation of the scanning data, and CloudCompare, for the global exploitation of the scatter plot. Eventually, we must use all the collected data to get through a simplified report about the existing wood junctions and the potential weaknesses of the wooden frame. Using AutoCAD, we will draw a simplified 3D digital model of the wooden frame and, using an automatic laser cutting, we will create an on-scale physical 3D model of a part of the structure.


2D drawing of the wooden frame

Results

This project has been carried out for the first time at Polytech Orléans and also at the DRAC. All the issues that we will bring are going to be used for potential renovations and the improvement of the wooden frame for tourism. Thanks to DRAC archives and documents found on the internet, we could make a brief summary of the history of the Sainte Croix cathedral, mainly based on the wooden frame creation and reconstruction during religious wars and the siege of Orléans. The physical 3D model will be used as a pedagogical structure to explain the wood junctions. The 3D digital model on AutoCAD and the 2D plans, on scale, can be considered as a mapping of the wooden frame.

Keywords: Cathedral of Orléans, wooden frame, plans, digital model, scatter plot


CloudCompare 3D rendering of the wooden frame


Model of the wooden frame

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The study of mortars and limestones

Civil engineering

T. ASLANIAN

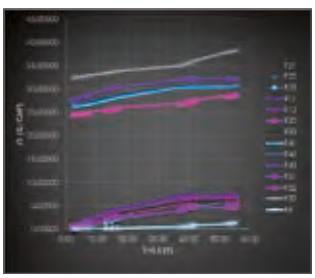
Y. DUPIRE

Thomas ASLANIAN / Yoann DUPIRE
Academic supervisor: I. AALIL

Institution: PRISME Laboratory

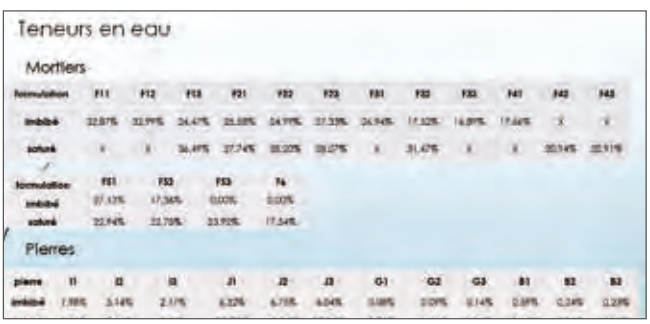
Objective/motivation

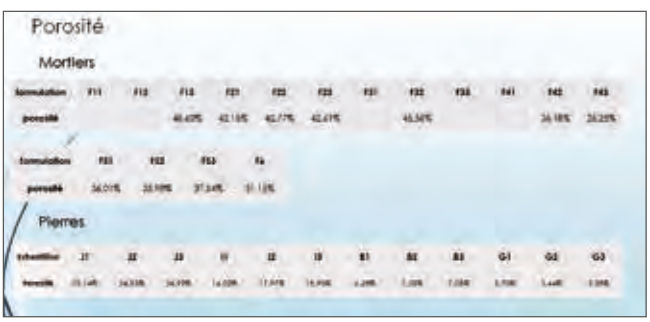
The objective of our project was to compare the features of four different types of limestone from the ruins at Volubilis, Morocco. To do so, we studied limestone samples extracted from the same quarry as the stones used to build the ruins. We had to compare their sound velocity, surface strength, colorimetric, capillarity, porosity, thermal conductivity/effusivity and Young modulus. We also had to compare their features under different moisture rates. The same study had to be done with mortars using different quantities of sand/water/brick/lime in order to study the effects of different materials on its features. Moreover, we have also studied the effects of heat at various degrees on the limestones and mortars. We have done this in order to check the stones' strength under harsh weather, and their resistance throughout time.



Results

We noticed that the more water there is inside our samples, the higher the sound velocity is, the higher the conductivity is, and the lesser the surface strength is. The sound velocity increases because water is denser than the air contained inside the pores, and sound moves faster in dense material. Moreover, water is more efficient than stone when it comes to transferring heat. Therefore, the conductivity increased with the water content. Finally, water softened the samples, therefore the surface strength decreased. Unfortunately, the features of the stones and mortars are really different. Therefore, we would recommend making mortars with different dosing in order to find a recipe that would bring the stones and mortars features close to each other.





Keywords:
limestones, dosing, sound velocity, thermal conductivity, effusivity

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The study of shear wave splitting to the characterization of porous material damage

Civil engineering

K. CISSE

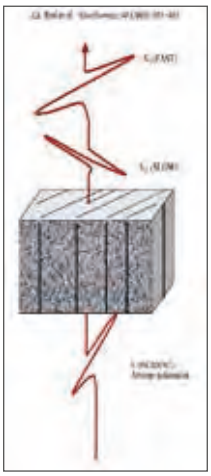
W. ZINE

Khartoum CISSE / Wafaa ZINE
Academic supervisors: D. DO, B. NDAO

Institution: PRISME Laboratory

Objective/motimation

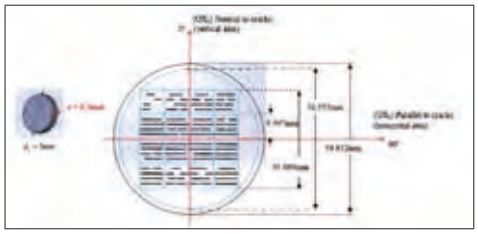
The purpose of our project is the study of shear wave splitting to the characterization of porous material damage. When a shear-wave enters an anisotropic volume, it is split into two perpendicularly polarized waves that travel with different velocities. The polarization direction of the faster wave and the time delay between the two split shear-waves are the two measurable data used to define a material anisotropy. Shear wave splitting measurements have been used to successfully predict earthquakes. The petroleum industry also uses these measurements to map the fractures throughout hydrocarbon reservoirs. In this regard, we are expected to start with bibliographic researches. Then, perform scientific manipulations on two different test pieces in the DARCY lab and eventually analyze the results collected by using the software MATLAB.

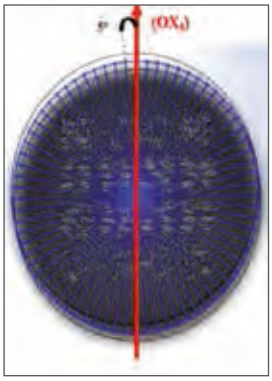


Results

The samples used in our manipulations were fabricated by the civil engineering team of the PRISME Laboratory. The first consists of a synthetic medium damaged by a system of horizontally aligned micro cracks. The second has the same characteristics but doesn't contain any crack which is isotropic and is used as the reference. The acoustic measurements we performed through a specific device captured three types of waves at each incidental direction. We determined the delay of time of flight (TOF) of the two modes of shear wave through which the crack density can be determined through an inversion process. Finally, through the principle of tomography, the image of the crack density can be constructed. The validation of this process allows application of this method to characterize damage in real civil engineering material like rock or concrete.

Keywords: anisotropy, crack density, shear waves





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Thermal rehabilitation of a public building

Energetics


E. BEAUREGARD


C. CONTEJEAN


A. DEVALLAN

Elodie BEAUREGARD / Corentin CONTEJEAN / Aurélien DEVALLAN
Academic supervisor: N. BELAYACHI
Industrial supervisor: J. BOULNOIS

Company: BHPR

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

We have shared our time between architecture workshop and school since January 2. We work on the thermal rehabilitation of an entertainment centre in Saint-Jean-de-Braye. The goal is to propose an alternative to the architect's project with straw-concrete. We have to test different ways to use straw-concrete and we verify the building energy performance with Passive House Planning Package software. The goal is to have the Passivhaus label (German label) or an equivalent. The thermal renovation is a main issue to reduce housing energy consumption and to achieve the goal that the government has set. Several techniques exist and they have advantages and drawbacks. Contrary to a standard insulating material which requires a load-bearing system to be grabbed, straw-concrete can support its own weight. Therefore, this material saves time in the buildup of the wall.

Results

Straw-concrete is an innovation in the civil sector to solve this matter. Straw has good environmental properties and is an excellent insulating material which also absorbs carbon dioxide. Straw concrete is used as a non-structural material and can be prefabricated, so we can reduce construction time. Yet this rapidity of construction is not at the expense of the structure's durability. We started researching different construction labels such as enerPHit or Minergie. They showed us building plans and gave a demonstration of PHPP software. We started to examine plans and to fill the PHPP software. The goal is to evaluate the architect's solution to insulate the building and the one which we will propose. Later, we will do a budget estimation. Since straw-concrete is an innovation, its price is not competitive in comparison to other insulating materials. However, in the long term, the question is to know if straw-concrete has better properties.

Keywords: straw-concrete, Passivhaus label, thermal rehabilitation


Straw-concrete


BHPR solution


Close-up image of straw-concrete

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Thermal study of individual houses, regulatory calculations and extra costs

Civil engineering

A. BERTRAND

Aurélien BERTRAND / Mickaël MARTINS
Academic supervisor: A. REKIK
Industrial supervisor: L. LE GRUIEC

Company: ENERWEO

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

Our project involved performing calculations to check if the RT2012 standard is respected. We worked with a software called PERRENOUD. First of all, our tutor gave us blueprints of a house which was scheduled to be built in a few months. Therefore, our first job was to carry out our own study with a choice of materials, heating equipment, ventilation, and source of energy, and check to see that RT2012 limits were not exceeded. After that, we would improve the thermal capacity of the house so that it is close to a passive house, which is a house depending on itself using indoor equipment and human and outdoor (solar). That will be the aim for every new building from 2020 (or 2021). For each scenario, we compared the cost of the investment for improvements and calculated how many years would elapse before it would be profitable.

Results

We performed several scenarios to study our house in the thermal regulations of 2012 and 2020. We conducted a test using only electricity for heating and ventilation needs of the house, which was not conclusive. Thus we reached our goal which was to be lower than the values of the Cep and the Bbio which recommends the thermal regulation. For this purpose we have to choose the best insulation on the market with a very good value for money, as well as effective exterior carpentry. Following this, we made a study of return on investment. This allowed us to have a more relevant vision of the economic impact for the customer. We found that the transition in the thermal regulation 2020 was not very interesting if we compare it with the other one.

Keywords: thermal regulation, return on investment, insulation, Perrenoud, energy system

Blower door test

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Thermo-mechanical study of a heating concrete floor

Civil engineering

N. FEBVAY

Q. RECOUR

Nicolas FEBVAY / Quentin RECOUR
Academic supervisor: A. REKIK

Company/Institution: undisclosed

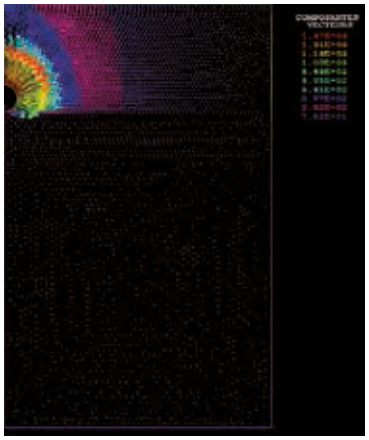
Objective/motivation

This project is the thermo-mechanical study of a heating concrete floor. This study will be made with a finite element method with which the software Cast3M will help us. This software uses the language called GIBIANE and is made by the CEA (Atomic Energy Control). It is useful to study the physical phenomenon. The purpose of our project is to find the temperature field, the flow field and finally the deformation field in a heating concrete floor. The temperature in the pipes induces the deformation of the floor. Initially, the objective is to study a simplified model and then a model closer to a real heating floor with its different layers so as to be able to best evaluate deformations.

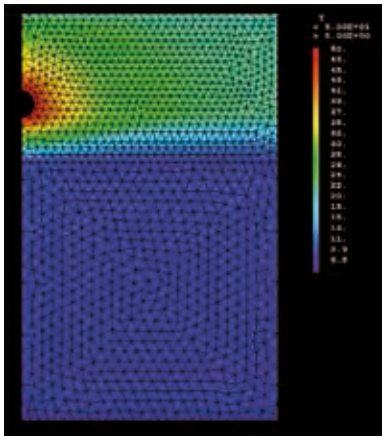
Results

To achieve these goals, we first modelled the heating floor on the thermo-mechanical software Cast3M. After a lot of research, we succeeded in finishing our code on Cast3M. To complete our study, we added materials to have a model closer to reality. We first have the concrete support plate layer, the insulating layer, the concrete cover layer, and finally the coating layer. Then, we have compared differences between the two models. The insulating layer change d the direction of the temperature field and, thanks to it, we avoided heat loss. Moreover, the deformation with the insulating cover is lower on the outer side of the floor (thanks to the insulating material) and on the other side it is approximately three millimeters with a temperature of 50 degrees in the pipe.

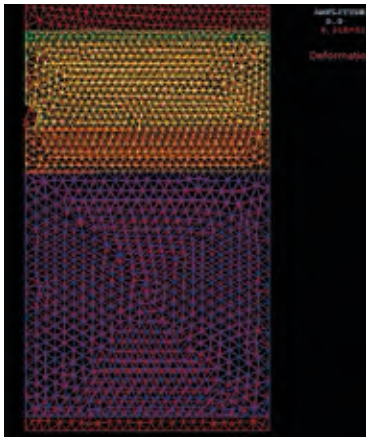
Keywords: Cast3m software, heating concrete floor



Flow field



Temperature field



Deformation field

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Water test bench to determine water vapor permeability

Civil engineering

Z. BENNANI

A. ROHAIMI

Zaid BENNANI / Anass ROHAIMI
Academic supervisor: M. SLAIMIA
Industrial supervisor: D. HOXHA

Institution: PRISME Laboratory

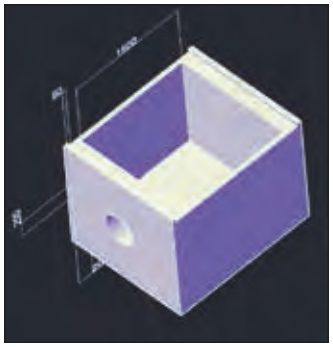
Objective/motivation

The use of biosourced materials in the renovation of buildings remains increasingly significant in France. Consequently, the problem of evaluating the water properties of such materials has arisen, so studying its potential responses is very important, mostly in terms of predicting the quality of houses and assessing the sustainability of structures. In fact, conventional methods for determining water parameters (essentially permeability to water vapor) remain valid only for homogeneous materials of small sizes. The objective is therefore to design and produce a water test bench to determine the water vapor permeability of large heterogeneous biosourced materials. In this case, the reason to choose this kind of project is to discover the water properties that are important in civil engineering.

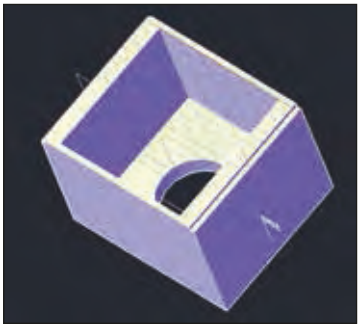
Results

We have finished the design of the test bench under Autocad 2017, and also made a professional presentation with many views of the object and all dimensions under the same software. In fact, we have been discussing with Mr. Slaimia about different issues we may face during both manufacturing and assembly, so we had to make choices in terms of materials we will use and their durability. We still have to decide of the type of sensors we will install and also validate the source of water vapor which will certainly be a deep fryer. In addition, we have suggested a bine sustainer that will be between the first bine and the deep fryer.

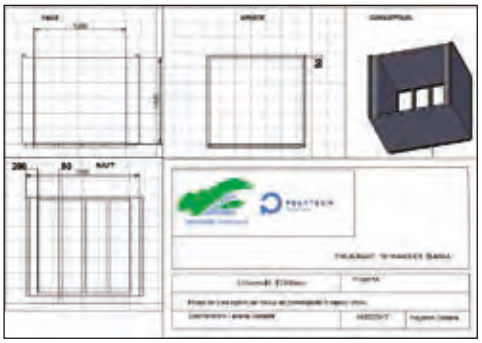
Keywords: water, vapor, permeability



The bine on the top



The bine in the bottom



The intermediate bine

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Engineering physics and embedded systems

Advancing robust background removal in ID images

Electrical engineering

Hang YANG
Academic supervisors: R. HARBA, F. ROS
Industrial supervisor: F. ROS

Company: Gemalto

Objective/motivation

Gemalto, an international company in the digital security field, aims to segment the object from the background in order to refill a unified background or a background with numeral security information. The objective of the project is to raise the success rate of robustly segmenting the person from the background among 4897 ID images without any interaction from the operator. Therefore, an algorithm by OpenCV in platform Visual studio applied to all data sets is to be created. The previous intern, Yacine, has already reached a rate of 95.91%, so the objective is to raise it as high as possible, preferably to 98% or 99%. The bonus objective includes reducing the time cost of image treatment, beautify the interface and so on.

Results

We have classified the type of problematic among nearly 200 failed segmentation samples, 4% of the whole data set, discovering that the "hair" issue ranks first with 88 relevant images and a 50% proportion of the problematic. Therefore, we regard these images with the hair issue as a primary target sub data and aim to improve the segmentation. A solution of the algorithm has been proposed by calculating the colorimetric distance of the pixels in the background and foreground. As a result, the majority of images in the "hair issue" sub data has been well-segmented.

Keywords: segmentation, ID image, OpenCV, Visual Studio 2015, c++

Original image, the previous segmentation and our new segmentation
(faces blurred for reasons of confidentiality)

The Display Window for Developpment
(faces blurred for reasons of confidentiality)

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Analysis of impedance matching network by Smith plot in LabVIEW

Electrical engineering

Lun WO
Academic supervisor: R. DUSSART
Industrial supervisor: R. DUSSART

Institution: GREMI Laboratory

Objective/motivation

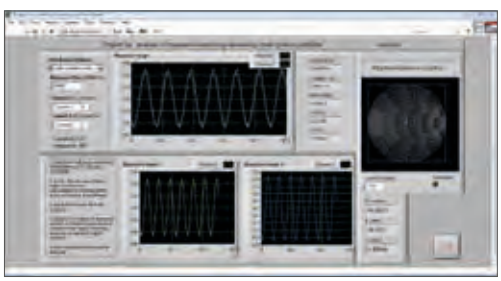
As RF waves behave much differently than low frequency waves, impedance matching is critically important. To reach the maximum energy efficiency, a matching network is mounted to precisely monitor the power injected into the plasma, matching the resistance and reactance of the plasma to the 50 ohms. The objective is to determine the precise values resistance and reactance in LabVIEW which can accomplish the functions like data acquisition, virtual oscilloscope, Smith plot. In this project, the signals are measured by a VI probe.

Results

The signals are first transferred to an oscilloscope and to the computer, which gives the values of resistance and reactance. The data will be plotted on a Smith chart. The NI-VISA, a software that can communicate with and control the NI data acquisition, was successfully implemented in the LabVIEW. It transmits the signals from the real oscilloscope to the virtual one that we built in the LabVIEW VI interface. The VI interface displays the values of resistance and reactance. Also, it contains a Smith plot that gives the impedance points dynamically.

Keywords: matching network, LabVIEW, Smith plot, impedance

Front panel



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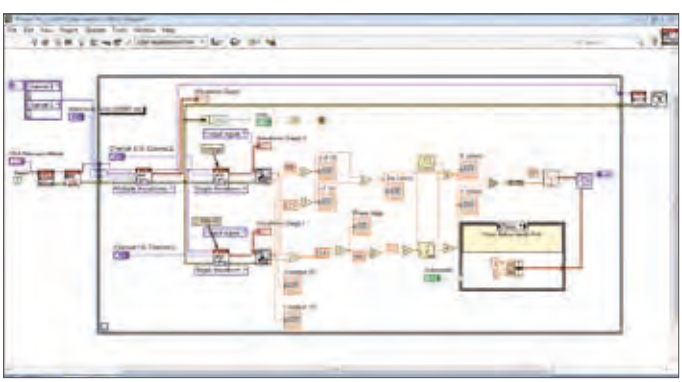
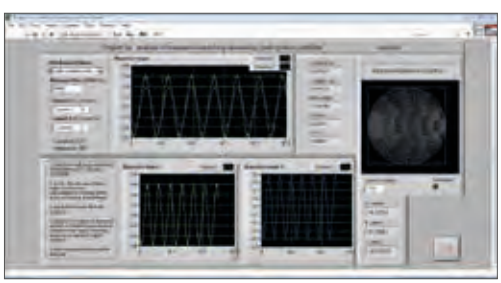


Block diagram



Ar 50 sccm 200W 25W

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Automatic extraction of information and OCR

Smart buildings

Pierre THAVELIN
Academic supervisor: R. JENNANE
Industrial supervisor: F. FOURREAU

Company: BEserious

Objective/motivation

In the context of computerization of the world of work, companies need new tools to make the link between physical supports and computers. To this end, BEserious is working to develop solutions which allow people to digitize their work. Thus, the aim of this project is to develop a software which is able to automatically extract different bits of information in a picture taken by the user. The program must detect regions of interest in a scene and extract relevant data (hand-written text, shapes, colours...). After some analysis, the results will be organized in a synthesis file to be obtainable by all participants via their computers. Optical Character Recognition (OCR) technologies will be studied so as to process writing.

Results

At the end of this project, we have an operational prototype of the software matching the specifications. With a simple graphical interface, the user can choose a picture, process it, and export results to an Excel file. The image processing part is achieved with OpenCV library and the user interface has been done with Qt framework. The solution is cross-platform, i.e., it can be exploited on Windows, Apple and Linux operating systems. A study has revealed that main open source OCR libraries are not effective with manuscript writing. Therefore, in the first version, all text will be replaced by the corresponding extracted image in the synthesis file. New solutions can easily be added in the future to achieve this functionality.

Keywords: digitization, image processing, OCR, software, pattern recognition

Aruco marker

Work illustration

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Autonomous master node

Electrical engineering

R. ATTAOURTI

V. KALKAL

Reda ATTAOURTI / Vijeta KALKAL
Academic supervisor: R. WEBER
Industrial supervisor: M. BOSQUET

Company: MORPHOSENSE

Objective/motivation

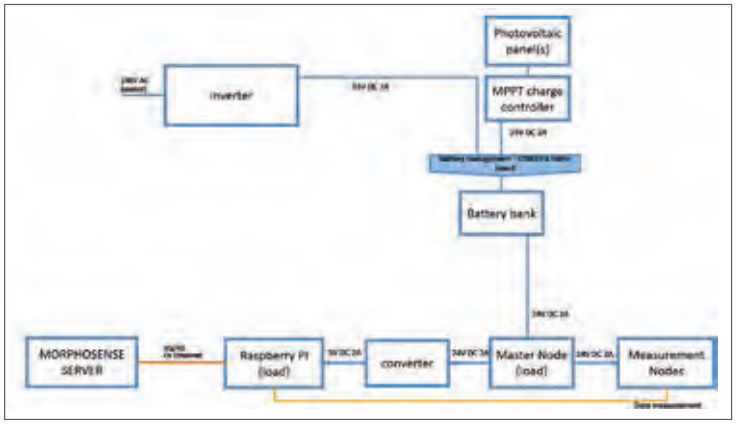
The MORPHOSENSE system allows the measurement of 3D distortion and high frequency vibration. The system is composed of a single master node, along with ten measurement nodes and accompanied wiring. The Master Node is the component of the system that is used to power up and control the measurement nodes whereas the measurement nodes perform the acceleration, control the magnetic field, and assess temperature measurements. MORPHOSENSE wishes to have a fully autonomous system. Since some equipped sites are isolated without access to the plug sector, and/or offer an unstable supply network that is likely to be subject to intermittent brownouts, it is in this context that the project comes into play.

Results

The output is that of a photovoltaic system source of renewable energy, which is best for a low-consumption system such as MORPHOSENSE's. Solar panels, an MPPT charge controller, and a well-designed solar battery bank creates an appropriate infrastructure to supply the Master Node in case of brownouts. With a correct dimension and identification of the architecture of the Photovoltaic system's components, it may now be possible for the MORPHOSENSE to have three operating modes: A sector mode, a semi-autonomous mode, and an autonomous mode. A Nucleo STM32F401RE board through the KEIL embedded development tools and a NUCLEO STM32F4 Cube HAL Library masters the management of the switch between the modes.

Master node and measurement nodes

Keywords: renewable energy, autonomy needs, battery management



System architecture

STM32F401RE Nucleo board for the Master Node's intelligence

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Characterization of an Inertial Motion Sensor using the humanoid robot Nao

Electrical engineering

Pierrick FROMENTIN
Academic supervisor: K. ABDEN-MERAIM
Industrial supervisor: H. NASSER

Company: Eco Steering

Objective/motivation

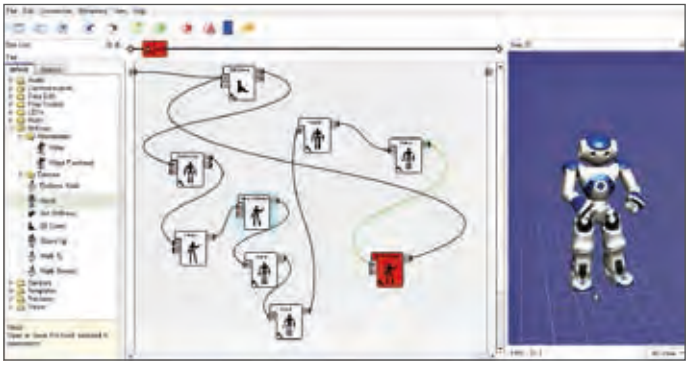
This industrial project, given by EcoSteering, a French company located in Paris, is to characterize an Inertial Motion Sensor with the Robot Nao. The goal is to define the reliability and the resolution of the sensors. This data can be measured following the three axes, X, Y and Z, and can be different for each axis. The sensors can measure both translation and rotation motions. The characteristics of this sensor must be measured for each movement in each direction. The Robot Nao will help to find the characteristics of the inertial motion sensors. Nao will do the same movement a great number of times, and the sensor on its arms will measure this movement. With some statistical calculations, the reliability and resolution of the sensors can be defined. Thanks to this data, the characterization of a new unknown system can be done.

The robot Nao

Results

For the experimentation, Nao has some movements programs saved in it. The sensors are attached to Nao's arms. When the robot moves, the sensors can measure this movement. If the robot does the same movement a great number of times, the reliability of the sensors can be measured. Some statistical tools can determine the difference between each measure and find the mean of the measure and the error. Some graphics of this measure can help to understand how the sensors work and where the best sensibility of the sensors is. If Nao does a very small movement, the sensors can detect it. To find the resolution of the sensors, Nao will do smaller and smaller movement. When the sensors can detect the motion, the resolution is found. The resolution is the smallest movement the sensors can detect.

Keywords: inertial motion sensor, characterization, Nao



Choreography

MPU

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Conception of a nanoparticle injector in a cold low-pressure plasma

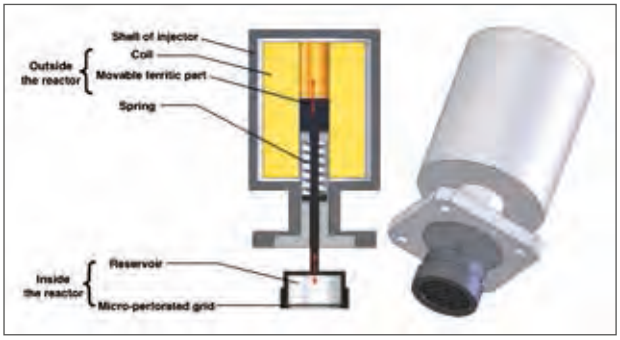
Electrical engineering

Yi LIU
Academic supervisor: M. HENAULT
Industrial supervisor: M. HENAULT

Institution: GREMI Laboratory

Objective/motivation

As part of a research project carried out by the powder plasmas team at the GREMI laboratory, we are interested in improving the injector of nanoparticles in low-pressure capacitive plasma. Currently, injecting nanoparticles into the plasma reactor is effected by an electromagnet mechanism, which helps to stir the reservoir to produce and inject nanoparticles but presents significant inconveniences (supplying air into the reactor in order to charge nanoparticles, etc.). Furthermore, because of characteristics of the current injector, another inconvenience is that only one type of nanoparticles can be injected at a time, and each time the powder sample needs to be changed, the plasma reaction has to be stopped in order to dismantle the whole injector, which takes a long time. Thus, a new conception of the injector is necessary to avoid those inconveniences.

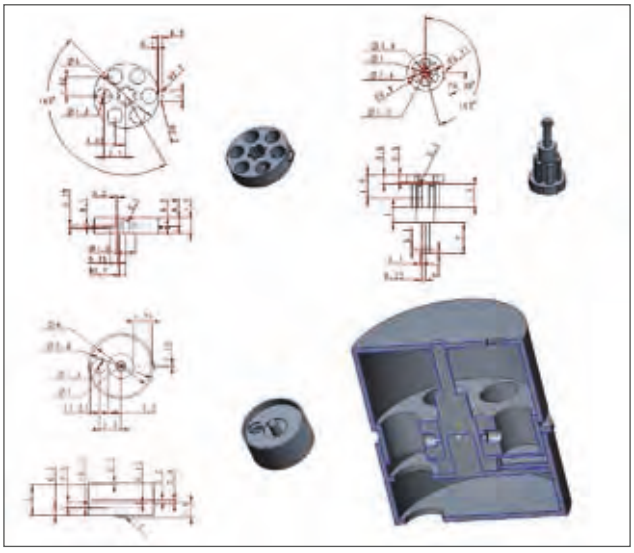


Construction of current injector

Results

A new conception of nanoparticle injector now is done with a software program CREO. The whole new conception is divided into three parts: a reservoir, a sample charger and a vibrating system. The construction of the sample charger is designed according to a revolver mechanism, an electromagnet connected with a construction of a gear and a rack is used for pushing the reservoir towards the vibrating system as well as for pulling it back into the charger chamber. Furthermore, under the sample charger, there is a chamber for putting the new vibrating system, which is effected by another electromagnet mechanism, the chamber is connected to the plasma reactor by a channel with a micro-perforated grid in the end. Finally, the whole injector can be put inside a covering box which can provide a vacuum situation.

Keywords: powder plasma, sample charger, vibrating system, electromagnet



Design of new injector construction

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Conception of a printed circuit board for a movements measure module

Electrical engineering

Thomas COELHO
Academic supervisor: R. LEDEE
Industrial supervisor: H. NASSER

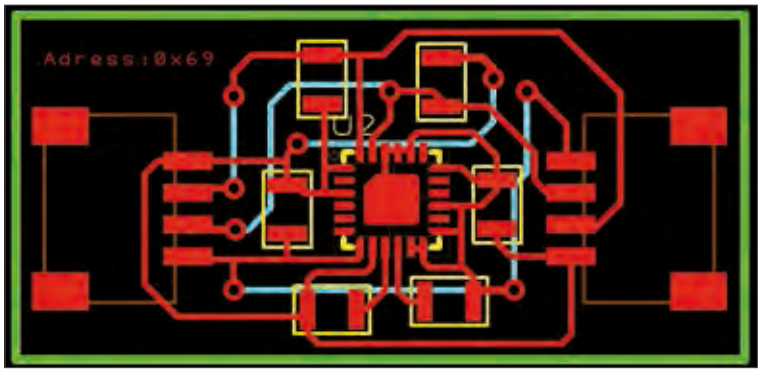
Company: Eco Steering

Objective/motivation

The goal of this project is to develop a module which can measure and record movements of the user's arm. It was attributed to me by EcoSteering. This company wants a module which records the movements of their employees to measure the difficult working conditions. Some modules already exist but they are not totally adapted to size, shape or consumption, so EcoSteering is looking to fabricate a new board which is well-adapted for a specific use. To record the movements, I am to use a new module called IMU InvenSense MPU9250, which contains a gyroscope, an accelerometer and a magnetometer. They have requested that one sensor be on the arm and the other on the forearm linked together by a wire.

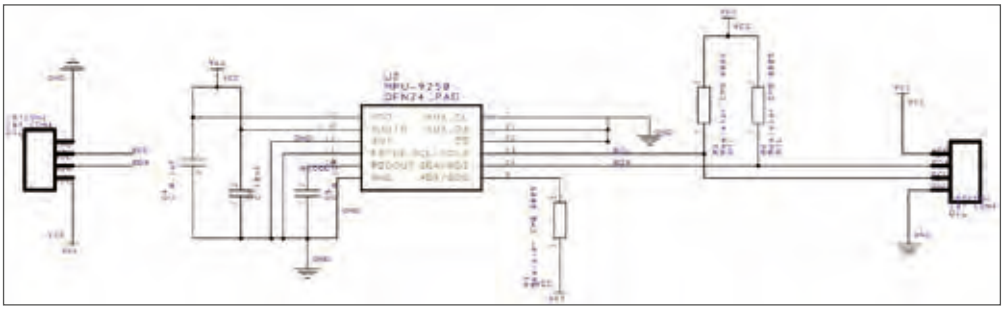
Results

To begin, I will have to know how to recover the data from the sensors. To do this, I must know which kind of data this sensor is sending. Indeed, it sends 3 different kinds of data (gyroscopes send data in degrees, accelerometers in g (g-force) and magnetometers in Tesla), I will have to stock all this data in memory. The sensors communicate via I^2C communication. I will have to choose a microcontroller which has to be well adapted in order to recover the data. Ideally, I should develop my own board but it takes time. Therefore, I have used an already existing development board. I have to make a functional test board of all the modules with the microcontroller and memory, and then make the schematic and the Printed Circuit Board of the module with an EDA (Electronic Design Automation) software.



PCB schematic

Keywords: inertial measure unit, electronic board, printed circuit board



Schematic design

Contact: thomas.coelho@etu.univ-orleans.fr

Cubomaton, study of the artificial aging of stones

Electrical engineering

Daniel LY
Academic supervisor: S. TREUILLET
Industrial supervisor: R. JANVIER

Institution: PRISME Laboratory

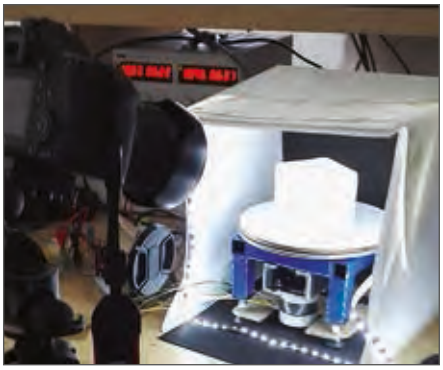
Objective/motivation

This project aims to determine how stones which make up monuments age through time and weather. For that, the PRISME laboratory makes a sample stone age artificially in order to compare it with the actual stone of the monument. To analyze the aging, we have to visualize the sample in 3D and compare it with itself after a "cycle of the aging process". We need to take photos of the stone, create a 3D model with them using photogrammetry and then, with data given on the stone, 3D models can be compared through time. The aim is to create a swift and automated process of this with a user interface. Any operator can launch the acquisition without any advanced knowledge on the aging of stone as the user Interface will be in the form of a walkthrough.

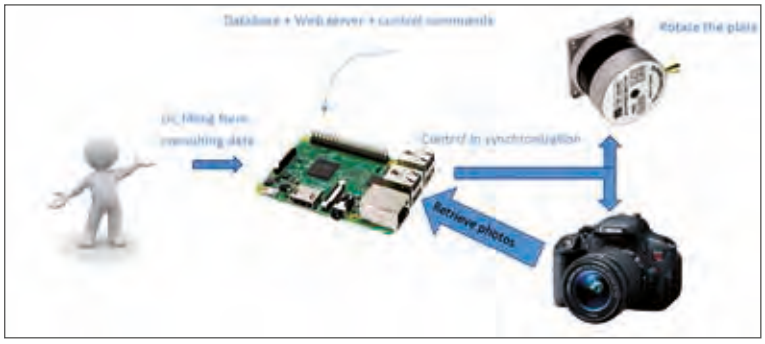
Results

Photos are taken around the stone by rotating a plate carrying the stone. Both plate and camera are controlled by a Raspberry Pi 3. A Web interface allows the operator to look at the results and, if they are authenticated, the user can launch acquisition (take photos and rotate the plate) and access and modify data. There will be a database storing data given by the operator that can only be modified by an administrator. A MEAN Stack (MongoDB, Express, Angular 2 and Node.js) will launch Python scripts on the Raspberry Pi 3 synchronizing the control of camera and motor.

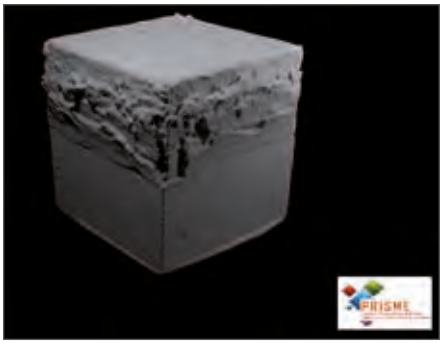
Keywords: user interface, 3D volume visualization, study of aging stone



Acquisition system of images in automation for photogrammetry



Schematic of the Cubomaton



3D model of a stone aged artificially by photogrammetry

Contact: thanh-tri.ly@etu.univ-orleans.fr

Demonstration board for movement detection technology

Electrical engineering

Alban HIVER
Academic supervisor: R. WEBER

Company/Institution: undisclosed

Objective/motivation
In the last few years, more and more IOT devices have been developed. In order to improve the reliability of their service based on their own connected device, the company has decided that the detection of a movement is a good solution. Accordingly, they have asked me to think about and test an add-on for their system. The proposed solution has to have very low energy consumption and use an ARM processor in order to be easily added to the entire system of the device.

Results
To find a solution, I made an autonomous test board that uses MEMS accelerometers, gyroscopes, magnetometers, barometers, and also piezos and mechanical sensors from different brands. The base of this board is a Nucleo STM32 from ST. The board communicates through bluetooth to an Android device. From this device we can program different strategies with different sensors, test it, and collect data to analyze it and find the best solution.

Keywords: Iot, detection, MEMS, embedded systems, ARM

Communication

Contact: alban.28@live.fr

Detect solar radio bursts automatically in real time domain

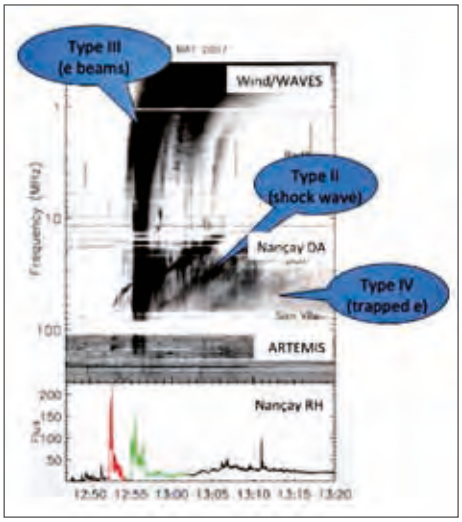
Electrical engineering

Junda LIU
Academic supervisor: H. SALMANE
Industrial supervisor: R. WEBER

Institution: Paris Observatory

Objective/motivation

The variability of the solar corona, including flares and mass ejections, affects the Earth's space environment. Electromagnetic emissions are one of a solar radio burst event which, depending on wave propagation in the ionosphere, might affect in particular airborne technology and radio communications. A method had previously been developed to detect solar radio bursts automatically in the environment of Matlab by using data from the Nançay Decameter Array (NDA). This first method contains two main parts: noise removal and the event detection. On that basis, another new method is presented to detect solar radio bursts which could allow us to realize the detection in real time domain. The main idea is to divide the big process for the overall data of one hour into several small processes which are repeated every minute.

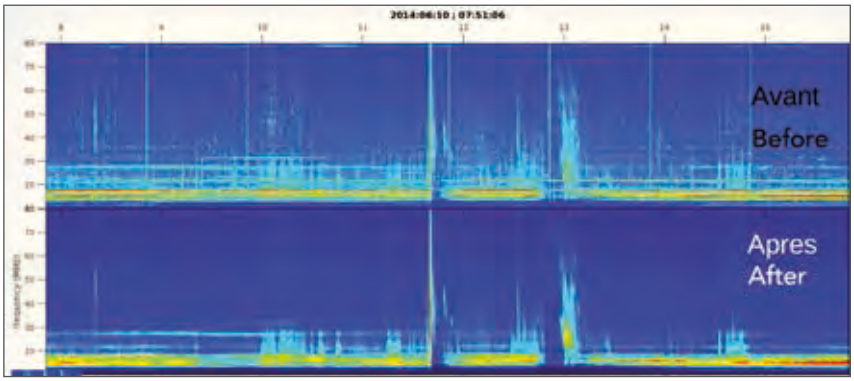


Time-frequency representations of solar radio emissions acquired from several instruments: above 10 MHz, terrestrial radio telescopes, below 10 MHz spacecraft. Three main examples of solar bursts (Type II, III and IV) are indicated.

Results

Transfer all of the files in the version of Matlab to the version of Python. Get time information, frequency information and the pixel values of the file which is in form of '.RT1'. Divide each group of data into two polars: left polar and right polar. Show the data received of two polars in images of grey level. After applying the Median filtering in order to minimise the noise, we could get a clearer result of solar radio bursts finally.

Main process



Time-frequency representations of solar radio emissions acquired from the decametre radio telescope (8 hours, 10 MHz to 80 MHz. Top: raw data; below: time-frequency plane after processing

Keywords: solar radio bursts, real time domain, automatic detection

Contact: jundaliucc@gmail.com

Embedded electronics design for an experimental rocket

Electrical engineering

Dylan THOMAS
Academic supervisor: R. LEDEE

Company: Space'Tech (student club)

Objective/motivation

The student club Space'Tech, mainly composed of students from the mechanical department of Polytech Orleans, participates every year in an event organized by "Planète Science" and the CNES (Centre National d'Etudes Spatiales) which consists of embedding a few "experiences" inside a rocket, such as the acquisition of the acceleration, the measure of the reached altitude, etc. This year, they needed help from the electronics department in order to design the electronic part which will be embedded in the rocket. They desire to integrate some functions inside their rocket that would allow them to trace the trajectory of the rocket, be able to localize the rocket after the landing, and trigger the parachute slightly before the apogee.

Results

The embedded system can detect the acceleration, the orientation and the reached altitude by the rocket with different sensors (accelerometer, gyroscope, magnetometer and altimeter). The measured data is sent with LoRa transceiver, allowing a range of ~10 kilometers. This communication protocol is also able to provide the localization of the rocket. Regarding the triggering of the parachute, there is now a redundancy between the different triggering conditions in order to minimize the risks of crash. It will depend on the acceleration, the orientation, error during program execution and a timer.

Keywords: embedded system, Cortex-M3, rocket, Inertial Measurement Unit (IMU)

Board designed by Drotek using the LoRaWAN tranceiver RN2483

ARM mbed LPC1768 Board

First prototype of rocket built by Space'Tech

Contact: dylan.thomas@etu.univ-orleans.fr

Eye tracking in the service of medical imaging

Electrical engineering

Ikram SALIHI
Academic supervisor: A. CHETOUANI
Industrial supervisor: A. CHETOUANI

Institution: Regional Hospital of Orléans

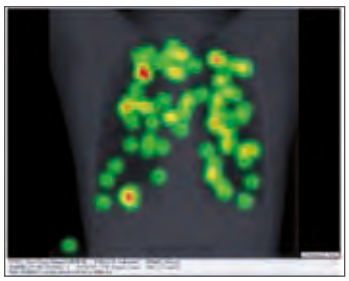
Objective/motivation

Eyesight is the sense that is the most used in the practice of medicine. For radiologists or surgeons, for example, their work is based on their observations. Thus, the use of eye-trackers can be useful so as to know their visual perception in their work environment. The eye tracker is a device that consists in measuring the ocular movement of an individual in a passive way. These movements being unconscious, they reflect the cognitive processes engaged in order to identify the interest of the subject. The diagnosis is usually identified by the rheumatologist, so it can be interesting to know exactly how this diagnosis is done in order to automate the procedure and simulate the specialist's behaviour to limit the risks of misdiagnosis. The project is carried out in collaboration with the hospital of Orléans.

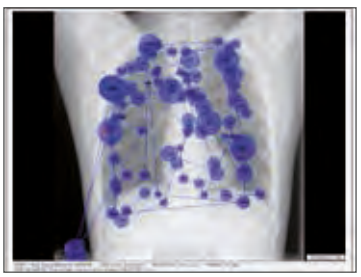
Results

Many studies have been done concerning medical imaging using eye trackers. The objective is to analyze the data which are radiographies with the visual perception of the observer represented as a gaze plot or a heat map. The participant starts the recording during a session, when the radiography has to be analysed. The eye tracker is mounted below the screen of the computer and the respondent is seated in front of it. Once the database is done, the analysis consists of comparing the eye tracking data and eventually the content of the images so as to extract a pattern of the diagnosis according to the state of the patient.

Keywords: eye tracking, medical, radiography, osteoporosis



Heat map on a chest radiography



Gaze plot on a chest radiography

Tobii eye tracker

Contact: ikram.salihi@etu.univ-orleans.fr

Fridge usage detection system for home care services: proof of concept

Smart buildings

Damien DOUX
Academic supervisors: P. RAVIER, R. WEBER
Industrial supervisor: M. ALVES

Company/Institution: undisclosed

Selected participant
11th Annual Final Year Projects Forum

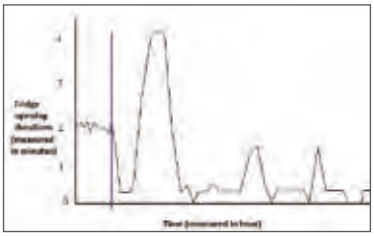
Objective/motivation

This 5th-year industrial project is a request from a start-up, a brand new company in Orléans, and it also represents the preparation of the internship that will follow. The aim of the project is to detect, store and transmit all the data about the uses of a fridge: hours and frequency of opening, duration, temperature inside the fridge, etc. The data will be used by the company for other purposes. This project is not a tracking system but a way to detect people and how they use the fridge. The raw information will be visualized on a smartphone or on a web page.

Results

The system was developed in three parts: the first part was all the sensors (thermometer, photo-resistor, door contact, date and time) coupled with an Arduino Nano and the Bluetooth Module allowing communication with the server. The Raspberry-based server is the second part of the system. A web page was developed to visualize the data from the server using the Internet. The system acquires the uses of the fridge (opening and closing) with all the data needed: temperature, humidity, date and time. The transmission to the server also works through Bluetooth communication as the visualization is achieved through a web page. The part of data interpretation is not implemented yet. It will be the subject of the following internship.

Keywords: IoT, connected fridge, Bluetooth



Contact: doux.damien@outlook.com

HandiBD

Electrical engineering

Adrien MALLET
Academic supervisor: F. DAUBIGNARD
Industrial supervisor: F. DAUBIGNARD

Company: Algona

Fourth Place
11th Annual Final Year Projects Forum

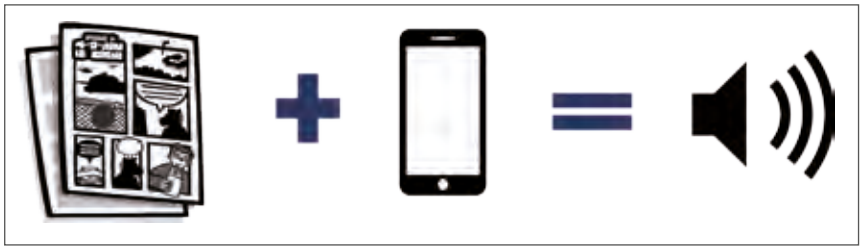
Objective/motivation

HandiComics, or in French "HandiBD", is a project resulting from a simple idea: helping disabled persons, especially children, to read comics. In fact, about 15% of children in sixth grade cannot read or write well. 1% of children and adolescents do not know how to read at all. This is the first handicap in France. So the goal is to use a physical comic and a smartphone, create an app to scan its thumbnails, retrieve the speech balloons and finally extract the text to transform it into sound. The objective of this project is simple: first to create a reactive app, with less than 3 seconds between the click and the restitution of the sound. Then, HandiComics has to be compatible with several comics, and finally have a realistic voice, with the right intonation.

Results

The app is divided into 5 parts. The first consists in taking a photo, and the second is a part of image processing: detect the speech balloon, crop the image around the speech balloon and erase all the colors except black (for the text). Then, put this image with the text in a process to extract the text into an editable text format. This text will then go through a correction phase, and, finally, the corrected text will be sent to a voice synthesizer. The most difficult part of the project is the recognition of the text. In fact, the text of comics is handwritten, so it's more difficult to recognize the letters. So the solution is to use some tools to create our own font for the recognition, and then create a database of several comics' fonts.

Keywords: comics, voice synthesizer, smartphone app, Comics Reader



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Implementation of an industrial vision demonstrator

Electrical engineering

Mélanie CHABIN
Academic supervisor: S. TREUILLET
Industrial supervisor: S. GASNIER

Company: CRESITT Industrie

Objective/motivation

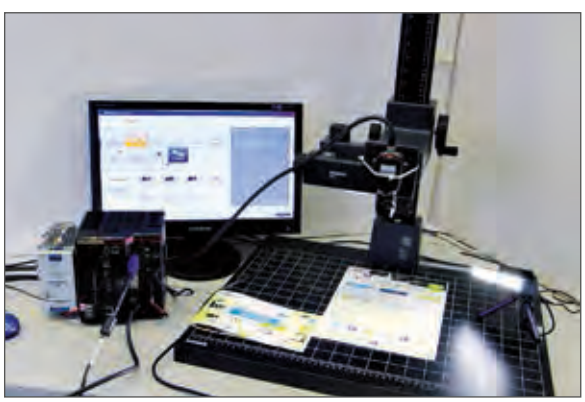
The aim of this project is to develop an industrial vision demonstrator. This project is associated with CRESITT Industrie, an association created in 1996 and located in Olivet. Their objective is to help companies and laboratories of the Loire Valley region in their electronics development. Thus, this project was created in order to introduce industrial vision systems to regional companies. In this project, CRESITT's aim is to help control operators in their work by the implementation of a visual control system. This system will also improve traceability, repeatability, and reproducibility in quality controls. Moreover, visual controls can cause the employees pain in their back, neck or eyes. This is why the ergonomist company "Ergo Motri Santé", located in Orléans, is also participating in this project.

Results

To launch this project, two seminars will be organized at CRESITT. One will take place in March 2017, and another one in April 2017. The objective of the first seminar is to present ergonomic methods applied to industrial jobs. The second will present different types of vision systems and demonstrate what a vision system can do. The demonstrator should work for fixed and moving objects on a conveyor belt in order to cover most of the industrial application. To achieve this, a lighting system, a 2MPixel color camera, a specific controller and a detector cell were bought and used during this project. The system should detect the presence or absence of objects, stains, defects and edges. It will also be able to count objects, and recognize characters and barcodes.

Yogurts' expiration date checking system

Keywords: Industrial vision, demonstrator, automated visual control, quality control, Image processing



CRESITT's demonstrator

Default detection using a backlight (1)

Default detection using a backlight (2)

Contact: melanie.chabin@etu.univ-orleans.fr

Inkjet printing and PVD processes set up for thermal insulation layer deposition

Materials

Cyril VILLIEU
Academic supervisors: A. STOLZ, A. CAILLARD

Institution: GREMI Laboratory

Objective/motivation

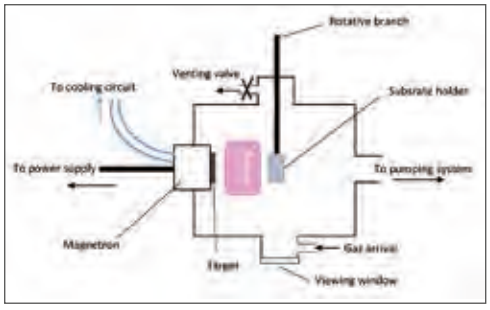
I am working in partnership with the GREMI laboratory. It commercializes products and systems in the following markets: defense & security, laser programs, scientific, industrial, and space instrumentations. I am in charge of developing processes to deposit a thermally insulating layer which is part of an optoelectronic component fabrication. I will be investigating in two ways: first, I will try to obtain it with a drop-on-demand inkjet printer, and then I will use a magnetron plasma reactor. The interest in using printing methods is the price, which is cheaper. PVD is a well-known technique but it is more expensive.

Results

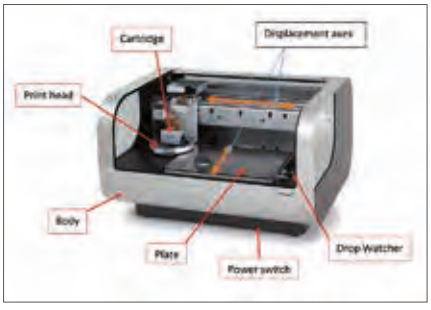
For now we have managed to deposit by PVD magnetron around 2µm thick layers on silicon and on glass substrates. Concerning the inkjet part, we developed the process to have reproducible droplets and a deposited pattern on our substrates. It is a quite promising advancement considering that the ink had never been used. The layers deposited by PVD could be analyzed by different means: we used scanning electron microscopy to get information on the thickness, particles accelerator called Pelletron to determine its composition and, finally, ellipsometry to know the optical index of the layers. These results were important to know if this process is suitable for the application.

Keywords: inkjet, magnetron, deposition, process, insulation layer

Aim of the project: thanks to the insulating layer, radiation will not diffuse to the substrate



Magnetron reactor



Inkjet printer

Contact: cyril.villieu@etu.univ-orleans.fr

Lighting for vision in the craft sector

Materials


J. BERLIOZ-LATOUR


S. LAMY


J-L. TROLLAT

Jade BERLIOZ-LATOUR / Sophie LAMY / Jean-Loup TROLLAT
Academic supervisor: S. RAGER
Industrial supervisor: S. RAGER

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

Institution: Polytech Orléans

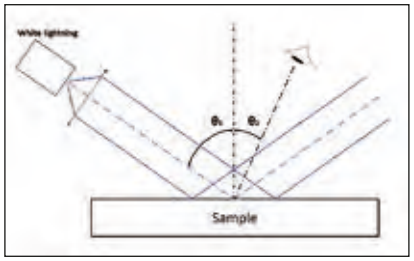
Objective/motivation

The project consists of building different optical benches to detect defects on different surfaces: a wall, a sheet of metal and a mobile phone screen. Nowadays, these types of configurations are used a lot in industries. But the aim of this project is to adapt the bench on consumable resources for daily life and to adjust it for the craft sector. The best configurations should be found by changing the lighting and the position of this one, for each surface, to make some defects more visible. Cracks, holes and excess material have to be detected. It is important to study the influence of the shape of the defect and also the colour of the surface. First, the detection will be done using conventional visual checks. Then, we will take a picture with a camera. Finally, a more specific detection with a laser will be done by analysis of local reflections with a camera.

Results

We finally found the best configurations for each surface and each defect. We made an android application, useful for craftsmen, to explain the best configuration for a visual check. Users can select the type of material, its colour and the defect they want to detect. Then, we explain what are the best angle of lighting and observation to have a good visibility of the defect. We have also created an image processing program for a quicker and enhanced analysis when a laser lights the surface. The reflection of the sample is visible on a screen and with a camera and we take pictures of it. This treatment highlights the differences of lighting on the screen when the laser lights on a defect. Thanks to our image processing, we can see these differences easily and notice any microscopic defect on the sample.

Keywords: optical bench, defects, detection, vision, lighting, craft sector



Schematic about tests of configurations for visual and camera check

Screenshot of the android application results

Screenshot of the android application home page

Contact: jade.berlioz-latour@etu.univ-orleans.fr ; sophie.lamy@etu.univ-orleans.fr ; jean-loup.trollat@etu.univ-orleans.fr

Lighting project on chromakey green screen

Electrical engineering

Marie-Hélène ROSSO
Academic supervisor: C. CACHONCINLLE
Industrial supervisor: F. BELOUET

Institution: CREAM (audiovisual department of the University of Orléans)

Objective/motivation

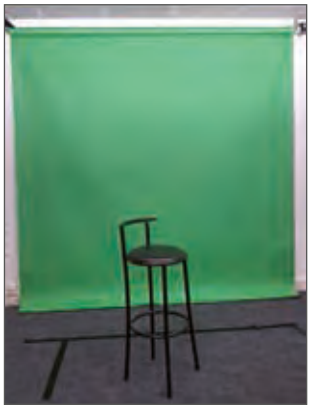
The project consists of finding the best position and orientation of the luminaires to illuminate a green screen uniformly. This green screen is used to create chromakeys. This technique is mainly used to present the television weather forecast, or to create sets and special effects in movies. This project is a request from the audiovisual department of the University of Orléans, the CRÉAM. The main difficulties in obtaining a good chromakey are to illuminate the screen with the adequate intensity and uniformity. If the luminaires are not in the right positions, shadows could be created, and if there is too much light, the screen will react like a mirror and the character will become green. Then it will be impossible to cut him out of the screen in order to create chromakey.

Results

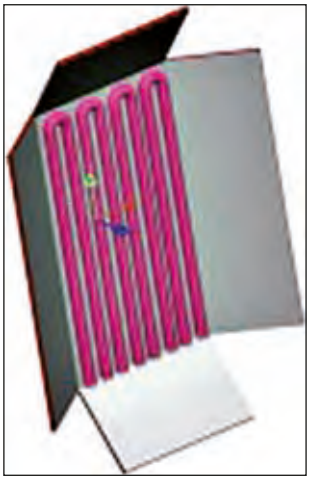
The first step of the project was the bibliography. I then had to determine the uniformity performance to attain. In order to respect the norms and to match with the required performance specification, it has been decided to light the green screen with 100 lux at minimum and with a uniformity at least 70%. To illuminate the green screen, I used two fluorescent projectors of 220W, 1200 lumens and with a colour temperature of 5000°K each.

Keywords: studio lighting, video montage, chromakey

Dialux simulation



Picture of the green screen



Creation of a fluorescent projector

Contact: marie-helene.rosso@etu.univ-orleans.fr

Object detection for self-driving car with Deep Learning

Electrical engineering, Image processing

Z. GUO

X. HUANG

Zhichong GUO / Xiaodi HUANG
Academic supervisor: A. CHETOUANI
Industrial supervisor: A. CHETOUANI

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

Institution: Polytech Orléans

Objective/motivation

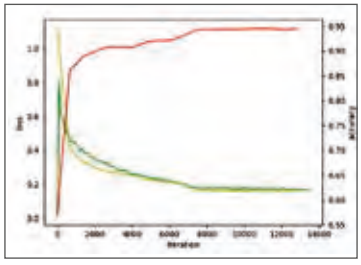
This project aims at teaching a self-driving car to recognize objects such as vehicles, pedestrians, and traffic lights by using a Deep Learning algorithm. Caffe, a well-developed Deep Learning frame on Linux, has been used to set up a supervised Deep Learning system with the help of a database from a car recorder. The goal is to extract the objects with the aid of information from the coordinates and labels and then send them to Caffe to train the model. The project is divided into Object Detection and Object Classification. Convolutional Neural Network helps in both two parts above to locate objects in an unknown image and predict to which class the object probably belongs.

Results

A Convolutional Neural Network has been set up to realize Object Classification, which contains 2 convolution layers and 3 fully-connected layers. The highest accuracy of Object Classification is about 0.91, and error rate of prediction for 4 classes is only 9.11%. To do the Object Detection and Object Classification at the same time, Faster R-CNN, which adds a RPN network to predict object bounding box, was applied. As the database is not balanced, the accuracy for 4 classes is 0.21, which is actually not acceptable. Then the prediction error rate for only vehicles could reach 45%, which is also not acceptable but is enough to predict vehicles in an unknown image. Improvements are expected in further research and development.

Keywords: Deep Learning, data mining, CNN, object recognition

Object detection of vehicles



Learning accuracy (red), train loss (green), test loss (yellow) of classification

Architecture of Convolutional Neural Network of project

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Optical diagnostics of low pressure reactive plasmas for the deposition of conductive polymers for microelectronic applications

Electrical engineering

H. MEI

J. TESSIER

Hao MEI / Jérôme TESSIER
Academic supervisor: E. KOVACEVIC
Industrial supervisor: E. KOVACEVIC

Company/Institution: undisclosed

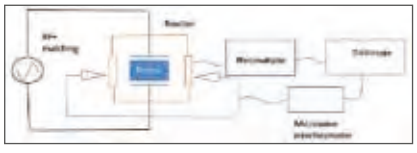
Objective/motivation

Polyaniline belongs to the family of conductive polymers. Its synthesis by low pressure reactive plasmas as ultra-thin films is currently being developed in the GREMI laboratory for different applications such as biosensing purposes (where it has to be deposited on nanocarbons). The behavior of the plasmas used for the synthesis of polyaniline remains unknown, and the formation of "killer" nanoparticles is a very problematic aspect because of thin film contamination. The aim of this project is to carry out measurements of the light emission during polyaniline film deposition by plasma. These measurements will make it possible to better understand the behavior of the plasma.

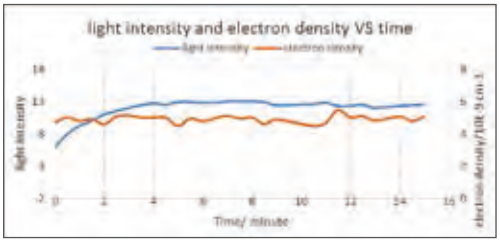
Results

After studying the optical characteristics of the aniline pulsed plasma with a photomultiplier, we can see that the intensity of the plasma increases in the first five minutes and then stabilizes. Furthermore, a light intensity peak is observed at each pulse in the first minute but then disappears. We believe that the disappearance of this peak is due to a modification of plasma chemistry. The electron density in the plasma was then measured with a microwave interferometer, in order to know if it changed over time and if it was responsible for the disappearance of the peak. It appeared that the electron density remained constant over time.

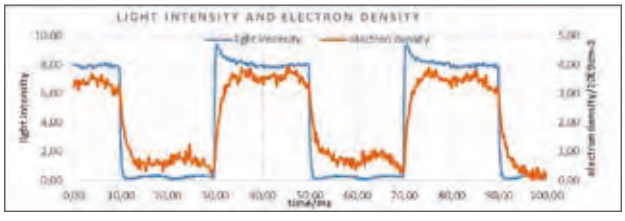
Keywords: polyaniline plasma, optical diagnostic



Experimental setup to measure the light intensity of aniline plasma and the electron density



The evolution of light intensity and electron density of aniline plasma



A typical curve of electron density and light intensity of aniline plasma at 30s. The gas pressure is 0.18 mbar and the pulse frequency is 25 Hz.

Contact: hao.mei@etu.unv-orleans.fr ; jerome.tessier@etu.univ-orleans.fr

Pedestrian detection

Electrical engineering

Damien DREAN
Academic supervisor: S. TREUILLET
Industrial supervisor: C. BERTRAND

EVELIA

Company: Evelia

Objective/motivation

The project is an introduction for the following internship subject entitled Pedestrian Detection. This project is about researching information for the conception of a system able to control intersection traffic lights to ensure that pedestrians are able to cross the road with more security. The system has to detect pedestrians and assimilate bicycles and skateboarders. The key point of the design is to make the product reliable enough to detect people despite really bad weather or light conditions. The device must be placed in a way that allows it to be adapted to any type of intersection via software configuration. The product will be made by a company called Evelia to replace the device sold by one of its subsidiaries, AGD, which is currently selling a system made by an English company.

Results

The first report is done and lists all technologies for the pedestrian detection. It also compares all technologies by showing their strengths and weaknesses. It contains data including the range of the detection, the height where the device has to be put and all other relevant characteristics for any pedestrian detection system. The constraint study is also done and first presents a list of all the features for the final system and all constraints that could apply to the system including weather, light exposure or even pedestrian density or upkeep. Then, it exposes the impact of all constraints to each feature for all technologies in order to compare how they can react in real conditions. Finally, I have also completed the analysis of detection algorithms to compare them and expose their strengths and weaknesses in order to choose the most reliable.

Intersection

AGD 640

Traffic signal

Keywords: pedestrian detection

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Plasma deep etching of titanium and titanium oxide for biomedical applications

Materials

Yannick MERIC
Academic supervisor: T. TILLOCHER
Industrial supervisor: B. BOUTAUD

Institution/Company: GREMI Lab, MISTIC SAS

Fith Place
11th Annual Final Year Projects Forum

Objective/motivation

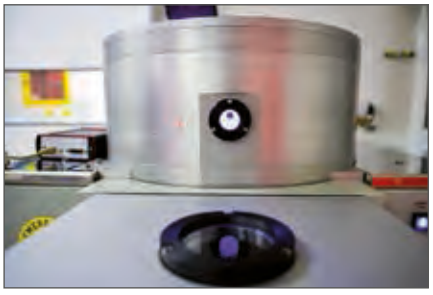
Titanium (Ti) is a material widely used for medical applications. Its native oxide (TiO2), which is inert, makes this metal interesting for bio-implants and prosthesis applications. Also, in vivo pacemakers comprise a titanium housing integrating functional structures. In this context, the micro-structuration of such a material has become a challenge for miniaturization. If some methods already exist to etch titanium, such as wet etching, Inductively Coupled Plasma (ICP) offers new possibilities. Deep etching can be then controlled in terms of etch rate and profile. Multiple parameters have to be considered for ICP titanium and titanium oxide etching: gas chemistry, input power, working pressure and substrate temperature. The objective of this project was to optimize the existing plasma etching process to meet client needs.

Results

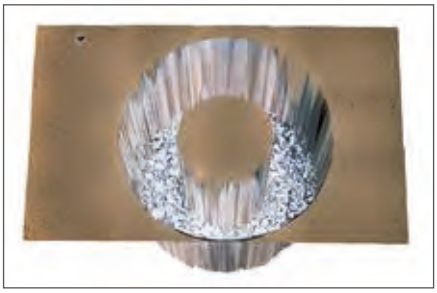
The plasma parameters have been investigated and optimized in order to increase the etch rate on single chips. After sample processing, characterization is achieved with optical numerical microscopy, mechanical profilometry and electron microscopy. Depth measurements have been achieved for each sample, allowing the control of the etch rate for a given process. Experimental results obtained in the GREMI laboratory have demonstrated that 250µm depth titanium structures can be achieved. Finally, the processes developed on chips have been transferred to full titanium wafer etching, which is more representative of the future production of titanium micro-structures for pacemakers.

Keywords: plasma physics, titanium deep etching, ICP

Scanning electron microscope



Corial 200IL plasma etching tool



Real time 3D modelling

Patterned titanium wafer

Contact: yannick.meric@etu.univ-orleans.fr

Plasma magnetron sputtering process optimization

Electrical engineering

Alexandre VAROQUIER
Academic supervisor: L. EL HADI BOUFENDI
Industrial supervisor: G. CHAUVEAU

Company: CILAS

Objective/motivation

CILAS is a well-known company working on high added value components for several domains such as aviation, space, metrology and defense. A way of improvement has been identified on a production coating machine. Indeed, during the process, some parasitic discharges can occur close to the cathode. These discharges can damage the components involved in the process. This also means that there could be a perturbation in the deposition process and a reduction of target lifetime. As the components produced require a very high precision/quality, the recording of parasitic plasmas could be an interesting element in order to optimize arc management parameters.

Results

The project was based on the self-bias voltage information. Indeed, whatever happens in the reactor, if there is any change, the self-bias voltage will change. By observing this change, it will be possible to observe undesirable discharges. Studies of the different solutions to observe and record the self-bias voltage have been done. Many applications can be developed to match this requirement but only three of them have been studied: the Arduino Uno, the Raspberry Pi and a Picoscope. A mean sampling frequency will be used to compare solutions. Arduino Uno can reach a mean sampling frequency of 4.4kHz for the acquisition and record of the signal. This was not enough so the Raspberry solution has been developed and the mean sampling frequency goes up to 32kHz. About the Picoscope, the theoretical speed is about a few MHz.

Keywords: parasitic discharges, analysis, magnetron sputtering, optimization

Arduino Uno

Picoscope

Raspberry Pi 3

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Study and qualification of electrochemical and IoT sensors

Electrical engineering

J-M. SOUCHAY

Y. YANG

Jean-Marc SOUCHAY / Yadi YANG
Academic supervisor: R. CANALS
Industrial supervisor: E. JOIGNEAUX

Company: DSA Technologies

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

Nowadays, water pollution is an important part of our society. Thus, as part of our fifth-year project, we joined together for an R&D project in collaboration with DSA Technologies in order to study and qualify electrochemical sensors which prevent and detect water pollution. Indeed, this kind of monitoring solution regarding water pollution already exists but only in laboratories which measure the concentration of micro pollutants in water samples. This solution is very expensive, uses too much energy and does not allow a representative evolution of the concentration of micro pollutants according to time. Thus, DSA technologies decided to make a low-energy and low-cost electrochemical sensor which continuously measures in situ the concentration of micro pollutants in the water and communicates the sensor data at a long distance. As part of our project, our missions are to study and to qualify the electrochemical sensor developed by DSA Technologies and to get the sensor to provide data to a monitoring device at a long distance thanks to a radio frequency communication protocol.

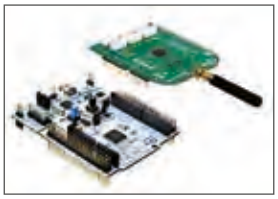
Architecture of the expected system

Results

Thanks to RF Development Tools Low-power wireless Nucleo pack with Nucleo-L073RZ, a LoRa expansion board and a LoRa Gateway, the developed system is able to acquire sensor data at regular time intervals and to send LoRa messages including sensor data to the gateway. From the LoRa gateway, we can display the relayed messages in order to monitor the different values. Indeed, as the electrochemical sensor developed by DSA technologies is a mock-up, we simulated the functioning of the final expected system through tests with a temperature sensor. Thus, the developed system allows us to adapt the solution to the electrochemical sensor and to the needs of the customer concerning the frequency of measurement and the frequency of sending LoRa messages. The frequency of sending LoRa messages matches the frequency of retrieving the data. The LoRa radio frequency communication protocol allows retrieving the sensor data at long distances.

Keywords: electrochemical and IoT sensor, in situ and continuous measurement, long distance communication

LoRa Gateway



RF Development Tools low-power wireless Nucleo pack with Nucleo-L073RZ and LoRa expansion board

Contact: jean-marc.souchay@etu.univ-orleans.fr ; yadi.yang@etu.univ-orleans.fr

Surface nanostructuration to evaluate the thermoelectric effect of the materials for a microelectronic field

Materials

X. GAO

L. PEGOT-ESPAGNET

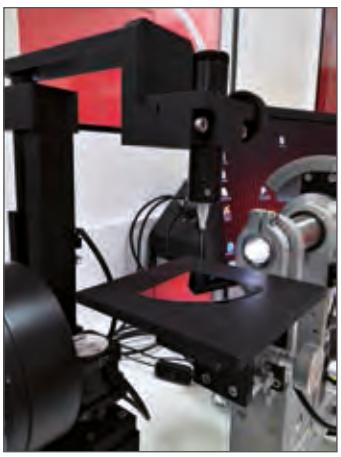
Xin GAO / Léo PEGOT-ESPAGNET
Academic supervisors: C. LEBORGNE, A. STOLZ

Institution: GREMI Laboratory

Third Place and Innovation Award
11th Annual Final Year Projects Forum

Objective/motivation

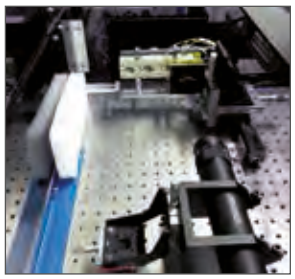
For economic and technical matters, the energy harvest in micro electronics is critical. Today, the focus is set on recycling the energy from the thermal losses of devices, which is possible through the Seebeck effect (conversion of thermal energy into electricity). Participating in the Tours 2015 project, the GREMI laboratory developed a device able to measure the thermoelectric effect of thin films. Some materials widely used in microelectronics, like silicon and titanium, have thermoelectric properties that can be improved by nanostructuration. Previous studies showed that laser nanostructuration could achieve this improvement at a cost of a long treatment time. Therefore, plasma nanostructuration is the next step in the experiments to enhance the thermoelectric characteristics of the materials. The optimization of the plasma treatment of the materials has been aimed at during this project.



Contact angle measurement

Results

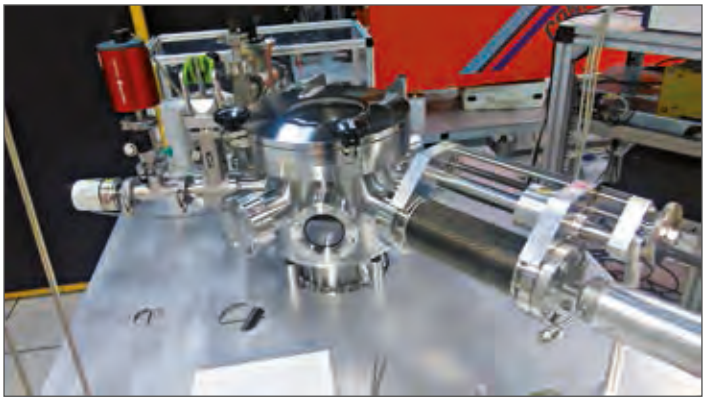
Several groups of experiments were conducted based on the control variable method which helps analyze the influence of plasma parameters. The Si samples were treated by Ar plasma with flow of 10sccm whereas the process time, RF power and distance between electrodes were the parameters to be studied. After surface modification, the contact angles of every sample were measured to define the surface characteristic. By comparing to an untreated reference, the impact of every parameter can be defined. Each group of experiments covers the impact of one specific parameter. Crossing the results of those groups will lead to an optimization of the process and refinement of the results.



ZT meter; thermoelectric properties measurement

Keywords: thermoelectricity, nanostructuration, plasma, microelectronic

Plasma



Plasma reactor

Contact: xin.gao@etu.univ-orleans.fr ; leo.pegot-espagnet@etu.univ-orleans.fr

Texture analysis for the diagnosis of osteoporosis on bone radiographs

Electrical engineering

Guanglie OUYANG
Academic supervisor: R. JENNANE
Industrial supervisor: E. LESPESSAILLES

Company: IPROS

Objective/motivation

Osteoporosis is considered as an incidence of public health, increasing with the aging population. The diagnosis of osteoporosis is based on measurement of bone density as well as qualitative factors, particularly trabecular bone microarchitecture. To assist in the diagnosis of osteoporosis, Mr. Jennane held a challenge to call researchers who would like to develop an algorithm for texture analysis to identify osteoporotic cases from healthy controls on 2D bone radiograph images. The purpose of my industrial project is to develop a website for the participants of this challenge, and to classify the osteoporotic population and the normal population.

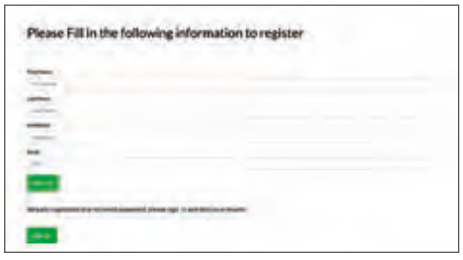
Results

The developed website proposes a login page, connection to the database, upload of the obtained results, scores of the obtained results, and email confirmation. The ROC curve was implemented to get the optimal variables among all the parameters obtained by the optimized algorithm for the identification of the osteoporotic population. Logistic regression was proposed to classify the osteoporosis population and normal population with the results of the ROC curve, and the two populations could be classified by the decision boundary function.

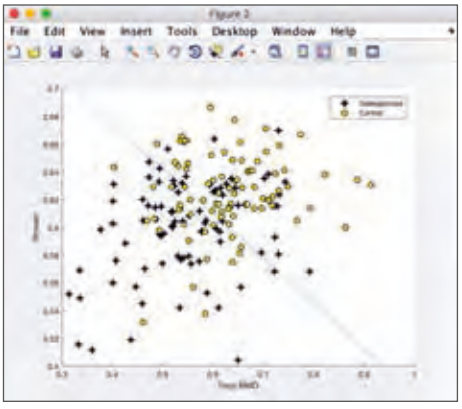
Keywords: osteoporosis, website development, logistic regression classification

RESULT OF YOUR ALGORITHEME					
TP	TN	FP	FN	SN	SP
9	12	17	20	0.310344827586	0.413793103448

Test of result



Login page



Classification

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The localization in augmented reality of Project Tango

Electrical engineering


S. CHEN


C. YUE

Shaolong CHEN / Chenyu YUE
Academic supervisor: R. HARBA
Industrial supervisor: T. CHICHE

Company: Schneider Electric

Objective/motivation

Our project is based on the application Vijeo360 from Schneider Electric. The Vijeo360 is an augmented reality application of Project Tango which can render real-time information for technical engineer and guide the professional operation. In our project, we use the technology of Project Tango to develop an application and render the information of a specific PC model in augmented reality. The main objective of our project is to test and compare different methods of poses estimation and algorithms of object detection which is to find the best way to optimize the accuracy of localization for rendering the information of POIs.

Results

An application is demonstrated in device Tango. The application can render the information of POIs of a PC 3D model in augmented reality and save the information with an Area Description File. The user interface of the application can do the fine tuning in a 6 degree of freedom of the POI's poses. A Readme guidance has been written for the client and the source code in C# is has been delivered. A comparison table which includes the test result and the analysis of different methods of poses estimation and algorithms of object detection is concluded at the end of our project.

Keywords: augmented reality, Project Tango, poses estimation, point of interest


3D PC model of interest

Google Tango Device of Project Tango

Augmented reality application of Project Tango

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Usage of a pulsed Nd:YAG laser

Materials

J. GIROUX

C. PASQUET

Jérémie GIROUX / Charlie PASQUET
Academic supervisor: E. MILLON
Industrial supervisor: E. MILLON

Institution: GREMI Laboratory

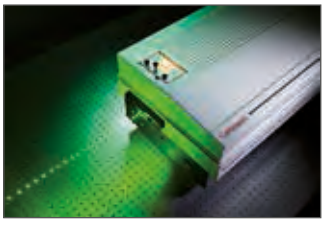
Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

Our project takes place in the GREMI research laboratory. The aim is to use a Nd :Yag laser, which is a pulsed laser, to know how it works and find how we can modulate its parameters. This laser allows us to send a huge amount of power for each pulse, with a maximal at 300MW/pulse. At the end of the project we have to give a complete user guide and also a protocol of usage. The device will be used in the laboratory for an application of pulsed laser deposition that consists of the deposition of a thin film that will bring new characteristic to a specific material, like a better strength or conductivity.

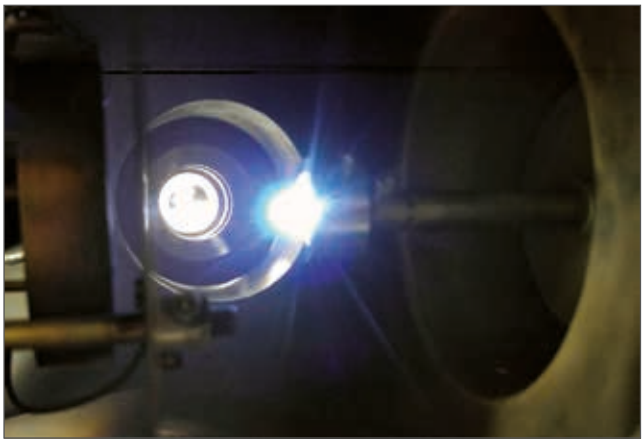
Results

Our tasks were separated into two different categories: analysis of the laser performances and effect of this laser on different materials varying different parameters of the laser. Before starting, we realized a first ablation process on a material called ZnO, zinc oxide. The aim was to proceed to a PLD, Pulsed Laser Deposition, which consists in depositing atoms obtained from the ablation of another sample. This allowed us to understand how the process works. We determined the different characteristics of the laser. As it is a pulsed signal, we determined the duration of each pulse and the time between two pulses. We also analysed the profile of the beam, which consists of putting a special paper in its way. By reacting under the high energy (120 mJ) of the laser, it is possible to observe the shape of this beam. The second step consisted of using this beam on different materials to observe its effect on them.

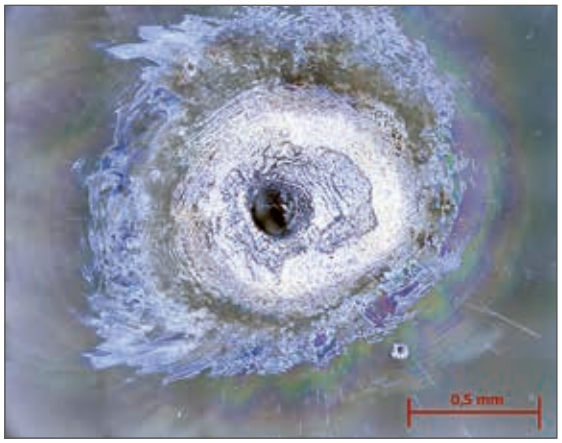


Our laser (from continuum)

Keywords: laser, ablation, deposition, ultraviolet



Plume plasma in the reactor2



Result of an impact on silicium

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WiseBox: a wireless, elegant and multi-protocol solution for open source domotics

Electrical engineering


R. LIEGEOIS


J-M. RIVET-COLLEAU

Romain LIEGEOIS / Jean-Michel RIVET-COLLEAU
Academic supervisor: G. LAMARQUE

Company: Nodon

First Place, Innovation Award and High Schoolers' Choice Award
11th Annual Final Year Projects Forum

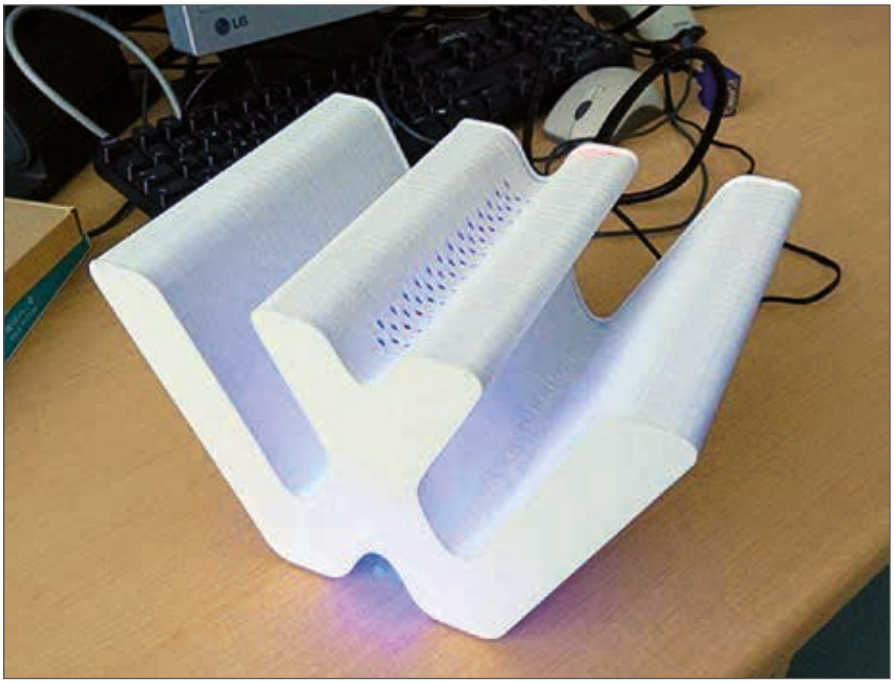
Objective/motivation

Nowadays, domotics is complex and expensive, with a wide range of different communication protocols used between connected devices. Some of them are proprietary, and most of the boxes used to control these devices are not aesthetic. So we thought of a solution that would be open source, multi-protocol and scalable to any connected device at a lower price. We would then be able to control most of the common radio frequency used for communication like 868MHz (EnOcean, Z-Wave), 433MHz (Somfy, Blyss), BLE and WiFi. We chose to work in start-up state of mind, as if the product were to be sold at the end of the project. NodOn is the company that has accepted to work with us and lend us a few connected devices to work on.

Results

Our goal is to make a product that could be sold to the general public, so we focused on realizing a fully operational prototype. We used an open source domotics server to gather the data and control the connected devices. A Raspberry Pi 3 is used to host the server as well as the antennas to communicate with the various protocols. The whole thing is put inside an original and elegant box that we designed ourselves, along with a user manual and a few Nodon devices to get started. The box can control both EnOcean and Z-wave devices, but also BLE and a few 433MHz protocols thanks to an antenna combined with an Arduino mega to host the 433MHz protocols library RFLink.

Keywords: domotics, multi-protocols, IoT, connected devices


The WiseBox

Contact: romain.liegeois@etu.univ-orleans.fr ; jean-michel.rivet-colleau@etu.univ-orleans.fr

Innovations in design and materials

Analysis of materials by Raman spectrometry

Materials

Marie DIRAISON
Academic supervisor: M. AMMAR

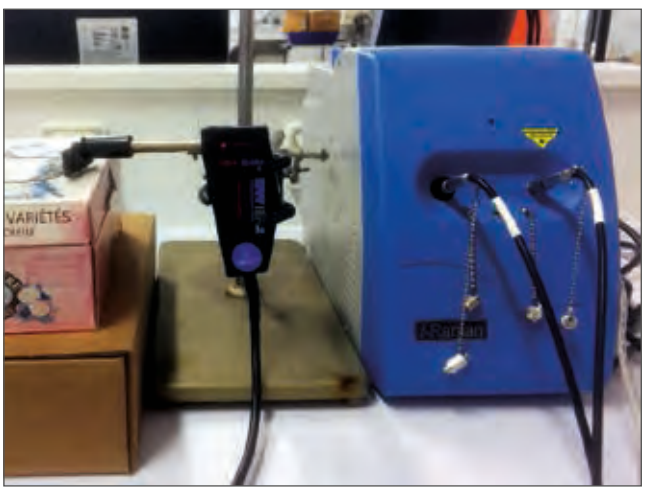
Company/Institution: undisclosed

Objective/motivation

Raman spectrometry is a non-destructive method of material analysis. It can be useful in many cases, in the laboratory or in the field (analysis of soils, paints, etc.). A monochromatic light is sent to the material to be analyzed. Photons can be reflected, absorbed or scattered. Among the photons scattered, some will have their frequency changed. Their analysis will allow us to deduce information from the sample. The aim of this project is to get a grip on a Raman spectrometer recently acquired by the school. Experiments will first be undertaken on known samples to understand how the spectrometer and its software operate. We can then choose the most interesting material to set up a new procedure serving as subject of PW for future students of the Materials department at Polytech Orléans.

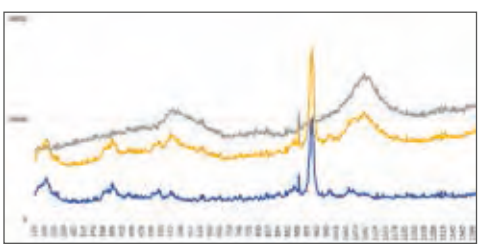
Results

The first step was to install the software attached to the spectrometer on the computers in the experiments room, and to understand its different functionalities. In fact, the spectrometer allows us to obtain a spectrum (see images), and its analysis allows us to know a material better. We have first checked the good calibration of the material by analyzing silicon, which has a simple and well-known spectrum. Then, it was observed that different parameters influence the quality of the results. Therefore, the installation had to be improved, in particular to keep the sample close to the laser without touching them during the acquisition, but also to acquire it in the dark, because the ambient light is also captured and distorts the results. Then tests were run to find out the link between the intensity of the spectrum and the power sent by the laser or the duration of acquisition.

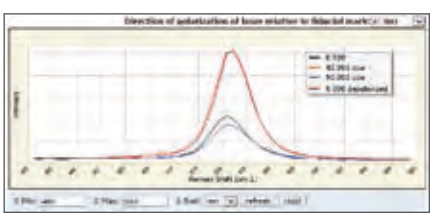


Analysis of a sample by Raman spectrometry

Keywords: materials, spectrometry, Raman effect, non-destructive test



Comparison of glass (grey and yellow) and crystal (blue and yellow)



Theoretical spectrum of silicon (source: http://rruff.info/)

Contact: marie.diraison@etu.univ-orleans.fr

Bench conception of a hybrid UAV and a components' sourcing

Mechanical engineering

Z. LING

M. POUZOLS

Zijian LING / Matthieu POUZOLS
Academic supervisors: C. BOURILLON, G. COLIN, J. FANTINI
Industrial supervisor: A. VIDALING

Company: Skydrone

Objective/motivation

On the market, most UAV are powered by the electrical energy stored into a battery. However, there are significant disadvantages with this current system. The cons are that this kind of UAV is not able to carry a heavy weight of equipment and to operate for more than 20 minutes due to the energy density of batteries. Our partner Skydrone is a company which provides aerial video services. They want to extend their business by creating a new generation of UAV. They intend, therefore, to create a hybrid UAV which will be able to improve the carrying capacity and its autonomy. The purpose of our project is to help them approve the hybrid concept system by a series of tests and give a list of the optimal manufactured components available on the market.

Results

Our first task was to create and buy the necessary materiel (fixation support, fuel, etc..) to start the Internal Combustion Engine (ICE) safely and correctly including a rope system to control the throttle. For that, we made several dimensional measures for design and these parts were manufactured by the university workshop. We established several test protocols which allow us to know the characteristics of our hybrid system and its behavior. At the same time, we acquired the necessary information for each component from suppliers, especially for the Power Management Unit component (Amp Rectification, Regulation Unit, Integrated Starter Controls) which was designed for the project. Finally, after doing the tests, with the characteristics and the specifications, we did the components' sourcing and gave a feedback about the hybrid system behavior.

Keywords: hybrid drone

ICE and the brushless generator

Bench test

Power management unit

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Colorimetric analysis to help with the identification of drilled rock powders on Mars: the CaliPhoto method

Electrical engineering, Mechanical engineering

A. JALLAL

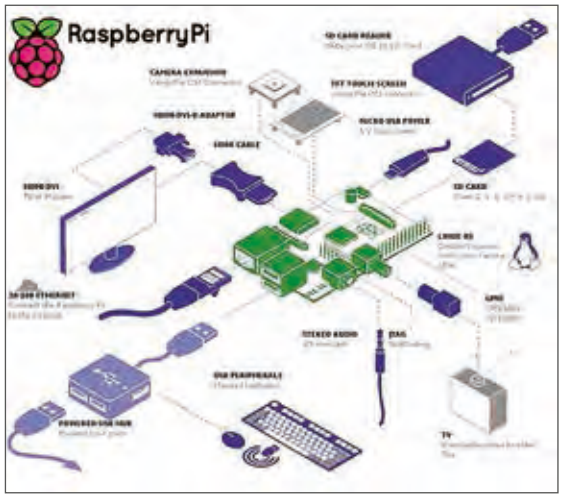
Abdessamad JALLAL / Mingxu XING
Academic supervisor: A. FONTE
Industrial supervisors: F. FOUCHER, G. GUIMBRETIERE

M. XING

Institution: CNRS (French National Center for Scientific Research)

Objective/motivation

The objective of our program is to understand the habitability of the environment and search for past traces of life in Martian rocks. We use the color of powder to obtain information about drilled rocks or even identify it to achieve these ends. However, because of the difference of light, we may get different colors of images for the same powder. Therefore, we put an aiming below the powder to correct the color of the picture, this is called the CaliPhoto method. The aim of the project for us is to make a portable camera with its support, which can take the raw image with wi-fi connection.

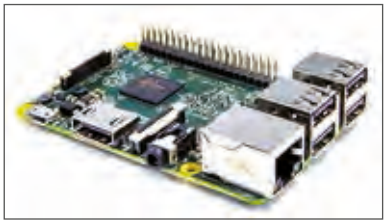


Raspberry pi structure

Results

Raspberry Pi is a single board computer which has been chosen to run the CCD camera. First, we had to find the driver for our CCD camera which can be run in Raspbian system, and build an application or the driver. Once the application was built, we decided to add a screen or terminal window so we may run the application to take pictures and study them. The application has different options to either take a picture or a video, to choose where to save the picture and to name the picture. The support, on the other hand, has been determined to be a tripod and will be designed specially to support planar and non-planar surface. The field instrumentation must be compact, robust and inexpensive. A prototype is being designed using CAD software.

Keywords: CCD, virtual shutter, portable support



Raspberry pi

CCD camera

Camera support

Contact: abdessamad.jallal@etu.univ-orleans.fr ; mingxu.xing@etu.univ-orleans.fr

Deep drawing simulation

Mechanical engineering

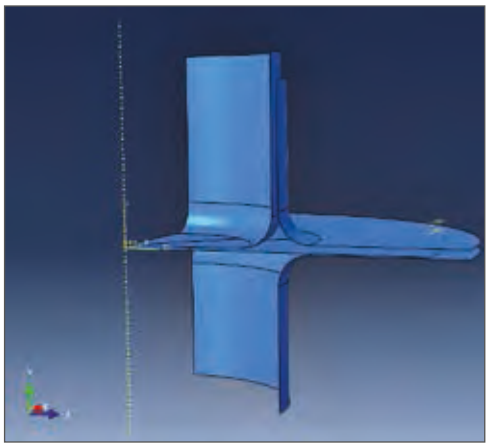
Benjamin PHILIPPE
Academic supervisor: J-L. DANIEL

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

Institution: Polytech Orléans

Objective/motivation

For the coming final-year students in ICM, a deep drawing machine will be created. Deep drawing is a metal forming process in which a sheet of metal is forced into a die cavity by a punch. Abaqus software is used to realize finite elements analysis on different models. Abaqus/Explicit mode is used to simulate nonlinear behavior and automotive crashworthiness, for instance. The aim of this project is to simulate several stamping tests with different punch shapes in order to determine the forces needed in designing the motor of the machine. Moreover, the tool Abaqus allows us to know stresses and strains on each element of the sheet of metal and we can conclude if the sheet of metal will crack or not thanks to its material properties.

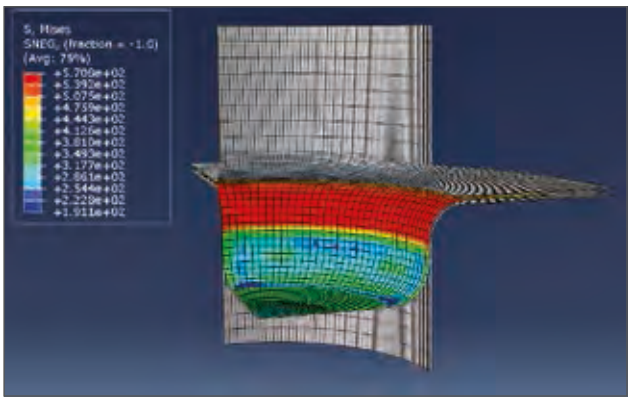


Modelling of the deep drawing process on Abaqus

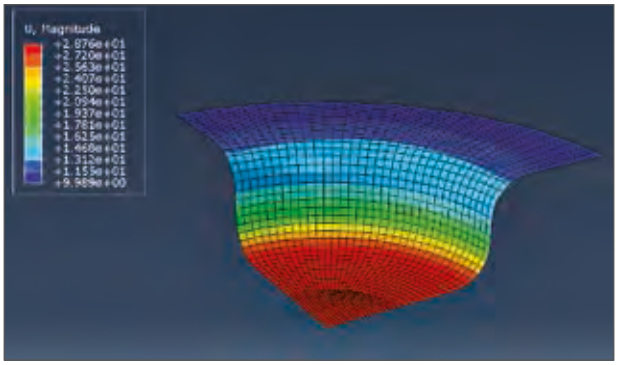
Results

Several models have been made with cylindrical, hemispherical and cross-shaped punches. In this project, the main experiment was to study the pressure applied on the blank holder and the distance between the blank holder and the die in order to obtain a good final product. Indeed, the sheet of metal must be compressed but can move in order to avoid cracks and create the product. To reduce the time of calculation, it is necessary to work on a quarter of each part. 3D models have been designed. The sheet of metal is represented in shell elements and others parts are represented by rigid elements.

Keywords: deep drawing, Abaqus/Explicit, finite elements, Marciniak, shell elements



Stress distribution in the sheet of steel



Displacement distribution in the sheet of steel

Contact: benjamin.philippe1@etu.univ-orleans.fr

Design of a metal and dry fabric stamping device

Mechanical engineering


C. BRIENT


I. SAIDI

Cyril BRIENT / Imed SAIDI
Academic supervisor: S. ALLAOUI
Industrial supervisor: S. ALLAOUI

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

Institution: Polytech Orléans

Objective/motivation

In 2017, Polytech will add new practical courses to the ICM curriculum in order to fit the new French academic program. One of those practical courses will concern finite element analysis on stamped composite parts. Therefore, our purpose here is to design a stamping machine that can preform fabric. The stamping is a preforming process of a sheet, which deforms it into a die with the help of a punch. From any type of sheet (metal, plastic, or composite), it is possible to obtain different shapes with any kind of complexity. This process is commonly used in the vehicles industry to form several parts.

Results

The final solution is a stamping device which fits on the two tension-compression machines of Polytech. This solution was the best in terms of cost and design time compared to build a stand-alone press. Through finite element analysis, the device is able to form an aluminum sheet or a dry fabric with different geometries, such as a hemi-sphere, a square box or a cylindrical shape. The deliverable of this 2-month long project is the technical drawings of each part of the stamping device, which allows Polytech to manufacture it. The students of Polytech will be able to learn about the stamping process through practical courses beginning in September 2017.

Keywords: dry fabric, metal, preforming, stamping machine

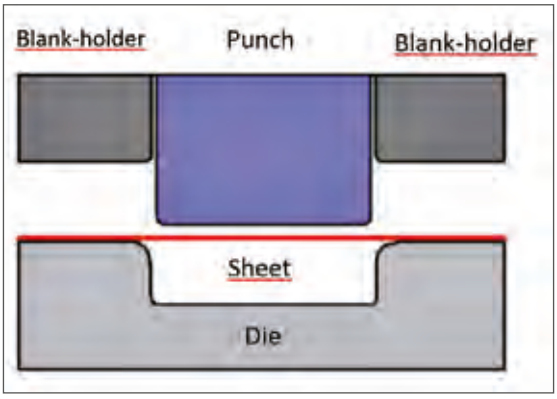


Fig. 1 The metal sheet (or dry fabric) is set in position between the blank holder and the die.


Fig. 2 The punch stamps the sheet. High stress is applied in the case of a metal sheet.

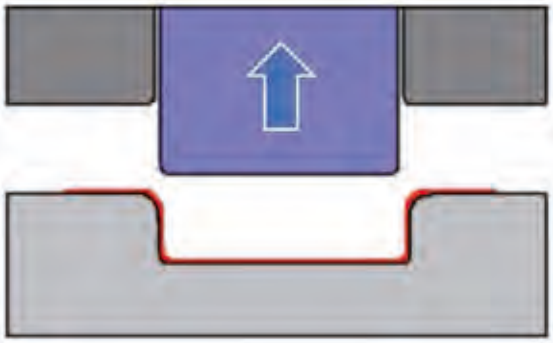


Fig. 3 The punch and the die return to their initial positions. The preform can now be removed.

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Designing of a window lifting mechanism without frame using Matlab/Simulink and 3D Experience

Electrical engineering, Mechanical engineering

Valentin BOE / Lakshman MANOHARAN
Academic supervisor: J. FANTINI
Industrial supervisor: S. LAC


V. BOE


L. MANOHARAN

Company: Inteva Products

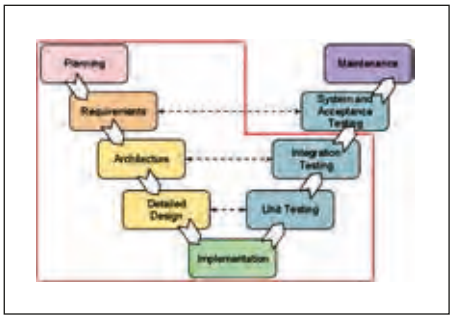
Objective/motivation
Design of a window lifting mechanism

Results
Confidential

Keywords: automatic control; Matlab/Simulink; 3D Experience; electro-mechanic


Example of car with windowsframe


Example of car without windowsframe



V-shape project

Contact: valentin.boe@etu.univ-orleans.fr ; lakshman.manoharan@etu.univ-orleans.fr

Eboost prototype of the hybrid vehicle

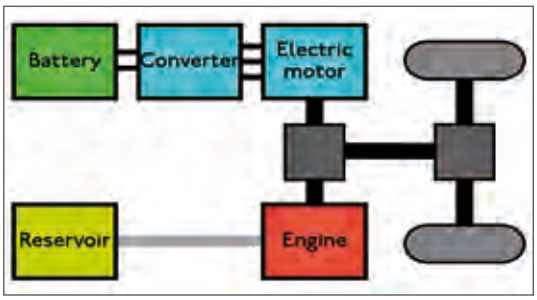
Mechanical engineering

Yann GITTON / Vikrant KALKAL
Academic supervisor: E. COURTIAL
Industrial supervisor: E. DUARTE

Company: John Deere

Objective/motivation

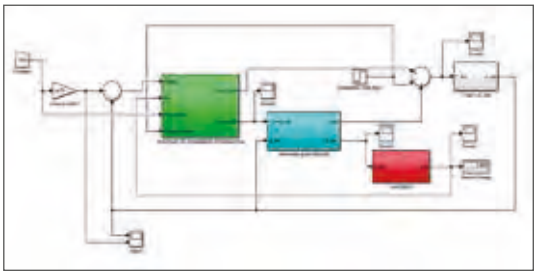
To develop a model of an electrical system composed of an electrical engine and batteries on Matlab/ Simulink to hybridize John Deere tractors. The purpose of this electrical hybridization is to provide an electrical boost to the existing ICE (Internal Combustion Engine) of John Deere tractors, so that the speed drop due to load impact at low speed can be avoided. A competitive study (Benchmarking) had to be done to avoid copying of the existing technology. The characteristics were chosen from the collected data. The model aims to decrease the "recovery time" of the ICE. The simulations will be done at John Deere using their tractor ICE model and our electrical model. According to the results obtained upon completion of the simulations a feasibility study of the technology modeled will be done.



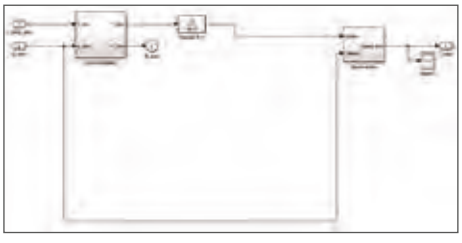
Parallel hybridization

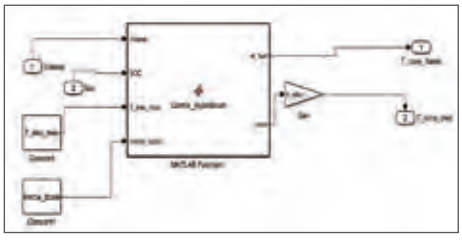
Results

The benchmarking part has been approved by the supervisors; this will lead to the next part. In this part, a suitable brushless DC motor is chosen along with the battery as per the requirements of the model. A prototype model of the electric part of the engine is made on the software Simulink. This model is speed controlled. The characteristics of this model are derived from the data mapping done earlier. Following that, some simulations were done. The simulation was completed successfully with some warnings from the system for specific parts like batteries. The curves which are obtained show that the model developed fulfills the requirements to some extent although the model still requires some changes for better optimization. The response of the I.C. engine at lower rpm is expected to improve with the boost provided by the electric engine.


Simulink model of the hybrid vehicle

Keywords: hybrid vehicle, electrical boost, Matlab, simulation, speed control


Simulink model of the electric engine


Hybrid system control

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FE simulation of fracture of porcine rib under high velocity impact

Mechanical engineering

Slim DJEBIEN
Academic supervisor: R. HAMBLI

Institution: PRISME Laboratory

Second Place
11th Annual Final Year Projects Forum

Objective/motivation

The project deals with thoracic trauma under a high velocity impact which can lead to the fracture of the rib and is the second leading cause of death in an accident. It was initiated by non-lethal weapons companies to understand the behavior of the projectile under these conditions. The modelling of the bone rib fracture in a variety of contexts: (transport accidents, work accidents (shard projections), physical activity, natural or industrial disaster (blast and impact)) is a major issue for the protection of a person and the design of protection systems. It is becoming difficult for laboratories to carry out experimental tests on human and animal bones because of legislation which is becoming stricter. The goal of this project is to develop a digital simulation with Abaqus/Explicit allowing us to predict the fracture of the thoracic ribs especially under the pressure of high velocity impact.

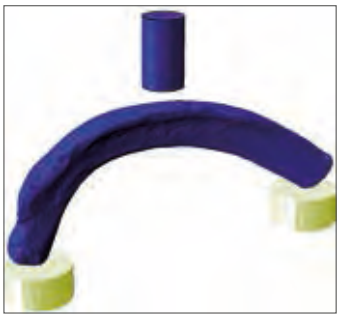
Scan of the porcine rib

Results

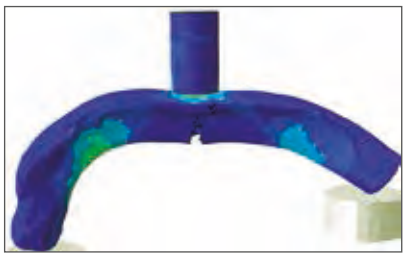
I had to find a fracture law, which is a mathematical law describing the behavior of the rib under severe conditions. In order to achieve that, I used a Drucker-Prager criterion to simulate the quasi-brittle behavior like ceramics and concretes knowing that those materials have the same mode of rupture as the rib. After the computations, I found the same fracture structure of experimental testing and we can define a critical velocity of the projectiles, especially rubber ones like Flashballs. Knowing the energy before the rupture, we can design protection systems for the thorax.

Mesh of the rib

Keywords: rib, impact, fracture, biomechanical, finite element



Modelling of the rib impact



Crack propagation

Fracture of the rib

Contact: slim.djebien@etu.univ-orleans.fr

Finite element modeling of a rib fracture protector

Mechanical engineering

Kevin GARNON
Academic supervisor: R. HAMBLI

Institution: PRISME Laboratory

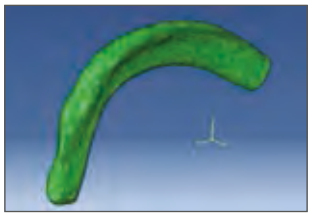
Objective/motivation

The aim of the project is to study the influence of a chest protector in order to prevent thorax against a rib fracture. Prevention of thorax bones failure is essential and can save many lives. For example, a rib failure can pierce the thorax cavity, creating a hole in the lung or, worse, in an artery. In several accidents, rib failures have, sadly, caused death. This can be avoided by a better understanding of the protections. Consequently, creating a model can help industrialists to design new products which can protect people from injuries. This study concerns many applications such as sport (biking protection, horse riding, hockey, etc.), transport (seat belt in automotive) and medical devices.

Results

A rib scanner data was converted into an Abaqus mesh. Then an Abaqus model following the Hopkinson bar test was created. It consists of two long bars which can hold the rib and one impactor which hits the rib. Because a Hopkinson bar test was run on a real rib, its result was used to adapt the model created. At this point, the simulation of the failure has to be implemented to the simulation. Adding damage is the hardest part of the project because it is essential to stay realistic. After that, a protective layer was placed over the rib and the influence of this layer was studied (by changing the material and the width). The curve of the width versus the energy absorbed was plotted for different materials to illustrate the influence of the layer.

Keywords: bone, failure, protection, biomechanical, modeling



Finite element rib model on Abaqus

Rib failure

Model with a protective layer

Chest protector

Contact: kevin.garnon@etu.univ-orleans.fr

Fragrance bottles conditioning

Mechanical engineering


M. AROUBATE


O. CENS


M. VERGNAULT

Mohamed AROUBATE / Olivier CENS / Maxime VERGNAULT
Academic supervisors: A. FONTE, B. LE ROUX
Industrial supervisor: M. LETERTRE

Company: Le Tellier Emballages

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

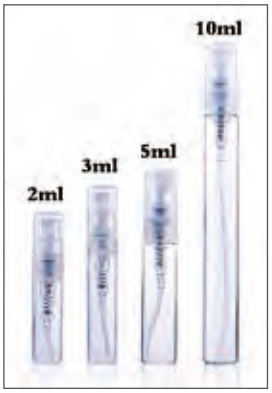
Recently, Le Tellier Emballages (LTE), a packing company in the north of Orléans, bought at an auction a bottle-conditioning production line which is, for the time being, out of order. LTE also won a contract with another company which wants 360,000 bottles per month. Therefore, LTE needs to repair and improve the bottle-conditioning production line in order to be able to produce the 360,000 bottles per month (3,000 bottles per hour). In order to respect the project's requirements, we split our working time into several activities. One of the main objectives of this project was to choose an industrial robot, which would be added in the production line. We also had to program this robot and integrate it into the production line. Another objective of the project was to design the filling and capping system to reach the bottle production flow.

Results

At the beginning, we started the project by defining mathematically the bottle production flow to understand how we could improve it. After that, we concluded that to reach the goal of 3,000 bottles per hour we must pack the bottles two by two and also integrate an industrial robot into the production unit. The robot we have chosen is a robot SCARA because this kind of robot can carry out our actions relatively quickly and can be well integrated in our production unit. We also worked on the capping system and the filling system. We researched the best solutions for our production unit. We also designed all of the automatic parts of the system by using Grafcet and Gemma tools. The energy of the system will come through the pneumatic way, so we also designed the pneumatic circuit of the system.

Keywords: fragrance, conditioning, production unit, industrial robot


Existing production machine



Fragrance bottles

SCARA robot

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maxime.vergnault@etu.univ-orleans.fr

Implementation of a multiphysics model in a finite element code: case study of the gas/solid ceramic membrane exchanges

Numerical modeling

Cédric DAVID
Academic supervisors: E. BLOND, T. SAYET

Institution: PRISME Laboratory

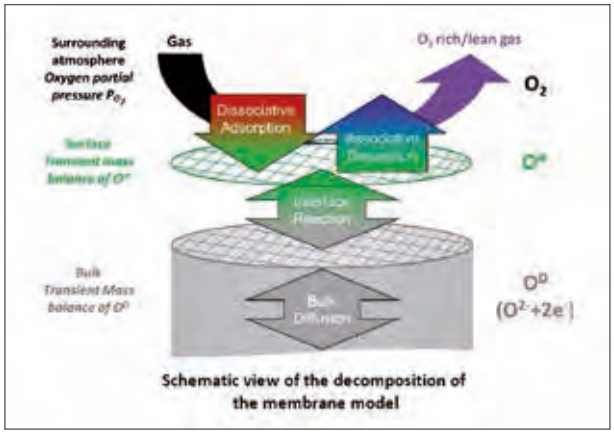
Objective/motivation

A new method to separate oxygen from air at high temperature instead of cryogenic distillation is in a developing stage because of the reductions of the energetic costs it could create. It will use mixed ionic and electronic conductors (MIECs) to collect the oxygen. The aim of this project is to create a numerical model that can reproduce the oxygen fluxes through the surface of a ceramic membrane under certain conditions. The theoretical model has already been written and tests were made with the COMSOL software. As this model needs to be improved, we propose to implement the new model in the Abaqus software.

Results

For this project, only the surface exchange part will be studied. The model has been implemented in a subroutine user using the Fortran language by Abaqus during the finite element procedure. That way, the user will be able to modify the parameters in the Fortran file. Finally, tests were made to compare the finite elements model to real tests made by the SPCTS laboratory to validate the model.

Keywords: multiphysics, abaqus



Schematic view of the decomposition of the membrane model

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Man-machine Interface: Biaxial Traction Machine

Electrical engineering

E. DELAVEST

S. HANTI

Emmanuel DELAVEST / Samia HANTI
Academic supervisor: J. GILLIBERT
Industrial supervisor: J. GILLIBERT

Institution: PRISME Laboratory

Selected participant
11th Annual Final Year Projects Forum

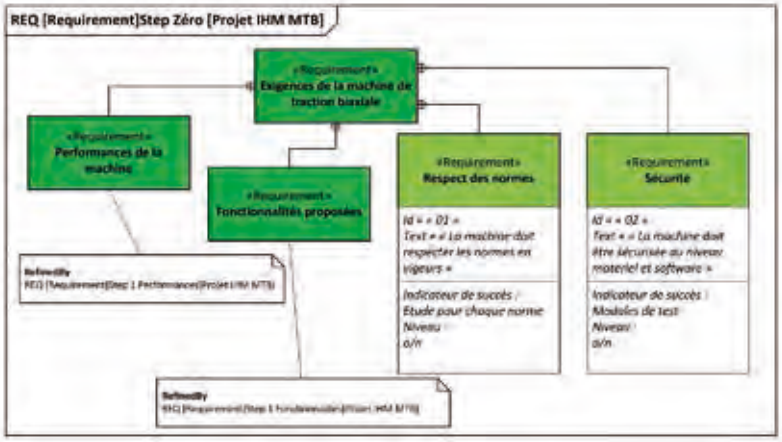
Objective/motivation

The PRISME Laboratory has launched a research program on woven materials in order to build a knowledge model and improve the composite materials production process. Researchers perform tests on a biaxial traction machine in PRISME facilities at the Vinci site of Polytech Orléans. This woven materials test machine is not fully operational. The hardware part is functional but the software part is not finished. Some functionalities need to be repaired or implemented but our main task is to design an automatic function of PID regulator coefficient calculation. The machine has to be stable, precise and fast enough in order to allow all needed tests. Our goal is to deliver a functional and tested man-machine interface designed on Labview software by March 20, 2017

Results

After repairing the acquisition functionality, we were able to perform our first test of the machine performance. We find out that the sampling frequency was 5Hz while we wanted 1000Hz. One student was looking for the cause of this problem while the other was creating a Matlab program to calculate the PID regulator coefficient.The sampling frequency problem was solved within the second test but the Matlab function was not working on the data acquired so we had to search another solution of regulation. Finally, the response time initially desired was not reached and we had to make a compromise between speed and precision.

Keywords: biaxial traction machine, man-machine interface, woven materials, composites materials, performance increasing



Global requirement

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Modelling and designing a telemedicine armchair arm

Mechanical engineering


A. ABOIKONI


I. BOUAYOUN

Albert ABOIKONI / Imane BOUAYOUN
Academic supervisor: E. COURTIAL
Industrial supervisor: M. REBIAI

Company: StreamVision

Objective/motivation

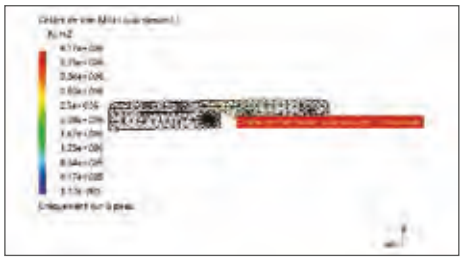
Participating in the development of an innovative product is a privilege when it concerns a product that provides a health check in 7 minutes to populations located in a medical desert, improves the patient's well-being and is simple to use. The objective of the project is to design an armrest of the chair respecting several constraints: mechanical (the arm must resist bending), ergonomic (the design of the armrest must adapt to the morphology of the arm), electronic (the sensors must be accessible for maintenance) and practical (studying the electrode fixation system to avoid injuries, so the armrests must be removable). It must be removed when the wheelchair passes through a narrow space. Choosing a material of the arm can meet both the mechanical constraints and the constraints related to the medical environment. The material must be washable and withstand disinfectants (hydro-alcoholic solution) used in a medical environment.

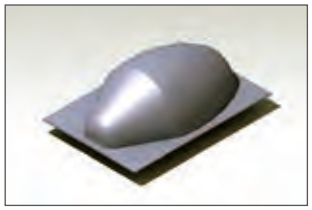
Results

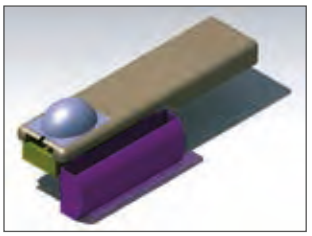
We spent the first part of the study developing the requirement of Mr. Rebiai, the industrial supervisor, and making sure that we truly understood the stakes of the project. Thus, we took a look at the materials of the main parts of the new armchair arm, the covering of the armrest and its framework. A covering with leatherette was validated with the industrial supervisor for its compatibility with the medical environment. Because the armrest should be able to detect the heart activity of the patient ergonomically, a new model of electrode has been designed to suit the hand of the patient. Through discussion and reflection, we managed to design different models of the armrest, which were compared in order to pick the final armrest model dimensions and configurations. As a conclusion of the previous studies, we still have to make a resistance analysis to validate our model.

Keywords: design, modelling, medical environment, sensor, electrode


The subject of the study


Mechanical study of the armrest


Model of the electrode


Armrest model selected

Contact: albert.aboikoni@etu.univ-orleans.fr ; imane.bouayoun@etu.univ-orleans.fr

Numerical modelling of metallurgy furnace for process optimization

Numerical modelling

Meryeme BENIDER
Academic supervisors: E. BLOND, A. GASSER
Industrial supervisor: D. BARBIER

Company: Vallourec Research Center

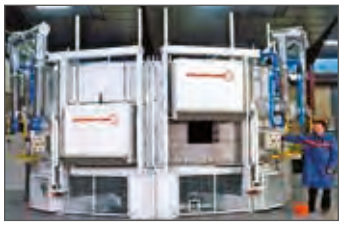
Objective/motivation

This project is to study thermal shocks on refractory materials of a metallurgy furnace, more precisely to define the thermomechanical behavior of a hearth rotary furnace. Actually, the hearth rotary furnace is used in Vallourec Research Center France as the equipment in which the heat treatment of steel tubes is undertaken, so it is important to define which elements to take into consideration in order to simulate thermal shocks in those metallurgy furnaces. Furthermore, the rotary hearth constituting the furnace of VRCF is composed of several materials separated from one another by some layers of joints. Finally, modeling the thermomechanical behavior of this furnace during its operation was the key to achieving the objective of this project.

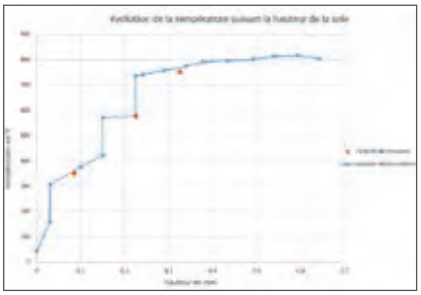
Results

In order to accomplish a numerical analysis of the thermomechanical behavior of this furnace, I have created its numerical model in the Abaqus software. After defining the characteristics of materials constituting the furnace, which were available in the plans given by my industrial tutor, I have introduced the interactions between the layers constituting the rotary hearth of the furnace and the the thermal loadings as they were defined. Moreover, I have analyzed each part of the operation of the furnace separately so that I could validate by simulation the time-temperature profile given in the plan of each part. Finally, I have, as a result, a thermal field that coincides rather well with the field measured by the thermocouples, and then was able to define the important elements to take into consideration in the numerical analysis.

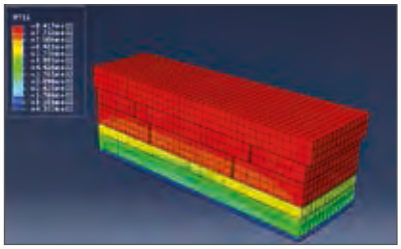
Keywords: furnace, metallurgy, refractory materials, thermo mechanical analysis



Hearth rotary furnace



Temperature through the height of the model



Temperature field in the model in degrees Celsius

Contact: meryeme.benider@etu.univ-orleans.fr

Standard electric energy source integrated in a medical station under variable Saharan and tropical climates

Electrical engineering


F. GATWAZA

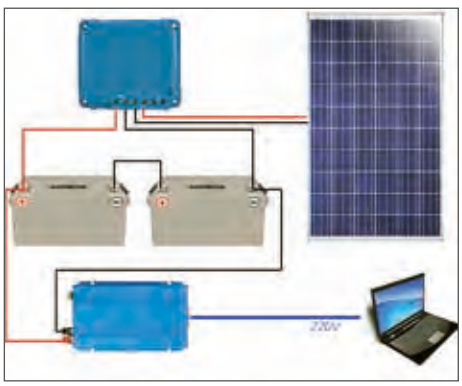

A. SAGE

Fabrice GATWAZA / Antony SAGE
Academic supervisors: B. BONHEUR, A. GASSER
Industrial supervisors: P. EVRARD, F. JOLLY

Institution: ECMSSA

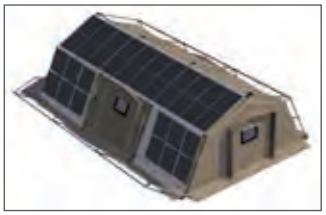
Objective/motivation

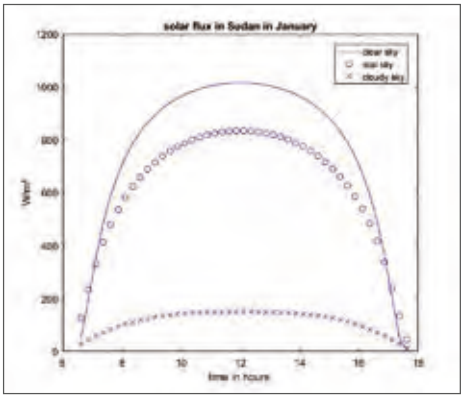
This project was ordered by the company ECMSSA (Etablissement Central des Matériels du Service de Santé des Armées). The aim is to improve the method of healing injured soldiers on the battlefield. One way this company can possibly achieve this is to have electricity-generating devices. These device need to be easy to set up, require little maintenance, generate little or no noise and must be able to operate in several different climate conditions. After taking into account all of these constraints, engineers at ECMSSA thought it would be better to create a system with solar panels as a source of energy. The possibility of using flexible photovoltaic panels that can be integrated into tents turned out to be the easiest way of tackling all those problems. This kind of device is easy to set up and doesn't make any noise. Conclusively, it meets all the constraints raised earlier and would improve the treatment of injured soldiers.


Schematic of the electric network

Results

We researched the topic to have what is required to start the project, wrote the technical specifications, using the "SysML" systems modeling language after thorough discussions with project supervisors, and organized our plan of action. At the end of the project, we had to deliver a spreadsheet to calculate the optimum surface needed to make an electrically autonomous tent with a very low weight. The spreadsheet takes into consideration all of the specifications that we had previously written and allows us to decide which surfaces and sides to put the solar panels on. To create the spreadsheet, we took into consideration parameters such as the tent's geographic position and, consequently, the sun radiation's flux, the weather, and the inclination and performance of the panels. Having calculated the radiation's flux at a point on earth, we calculated the flux that can be collected by a panel according to its orientation and inclination, which allows us to decide on the best orientation of the panels and consequently the optimum surfaces to make the tent electrically autonomous. The energy needed is calculated according to the power and time of use of all the devices but also takes into consideration the time when it isn't possible to produce energy due to weather conditions. To sum up, you enter all the aforementioned parameters, and the spreadsheet gives you the surface of panels you need.


Schematic of a tent covered by solar panels



Example of process of solar flux in Sahel-Saharan strip in January in different weather conditions

Keywords: electric network, solar panel

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The development of a protocol for generation of calibrated defects during shaping

Mechanical engineering

Lénaïg COLLIOT
Academic supervisor: S. ALLAOUI

Institution: PRISME Laboratory

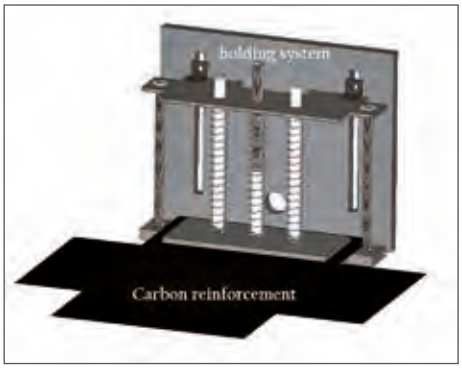
Objective/motivation

Composites are used more and more in industry. For example, in the auto or aerospace sector. They can even be used to manufacture technical and complex parts. In order to give them a precise shape, many shaping processes exist such as the RTM (Resin Transfer Molding) process. However, the complexity of some composite parts leads to the formation of some defects at the scale of the reinforcement's yarn, for example, "buckles mesoscopic defects" or "weave pattern heterogeneity". But these flaws are still not studied. This is why university lecturers and researchers have created a special test bench to produce these specific defects. My project consists of developing a protocol and conditions to generate these calibrated defects.

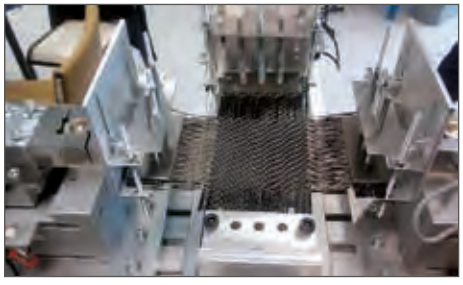
Results

I first ran some preliminary tests on two types of reinforcements: taffeta and interlock. During these tests, I tried to generate the mesoscopic defects and determine the conditions to make these flaws. I found three parameters: the fixation of the sample, the stress applied on the sample and the conditions of solicitation (number of yarns we pull on, the number of embedded yarns). Thanks to these observations, I was able to imagine and design a new holding system to maintain the different reinforcements on the test bench. Now I can run the test on the machine applying the best conditions to create these specific defects.

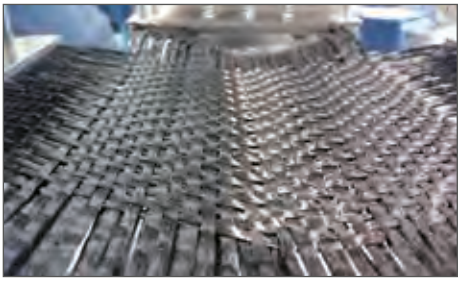
Keywords: composites, fabric reinforcement, preform quality, mesoscopic defects, yarns



Design on CREO of the holding system



Holding system on the machine



Buckles mesoscopic defects on carbon reinforcement

Schematic of carbon reinforcement

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Thermal and electrical modelling of a cell that measures high temperature electric conductivity

Electrical engineering

Jialiang GUO
Academic supervisor: L. DEL CAMPO, M. MALKI

Institution: CEMHTI Laboratory

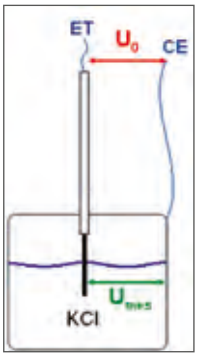
Objective/motivation

A CEMHTI research team has developed an experimental device for measuring the electrical conductivity of materials melting at high temperatures. CEMHTI is in great demand from industrialists to carry out measurements in the molten state in order to feed corresponding process optimization codes. The aim of this project is to perform an electrical modeling of the measurement cell (using Patran-Nastran / Comsol) to find the operating conditions giving the most accurate electrical conductivity results. Electrical conductivity measurements in molten and highly viscous glass raises serious experimental difficulties, due to the corrosive nature of the melt and the impossibility of using a simple measurement cell structure involving well determined current paths. The geometric cell constant is researched as an important parameter.

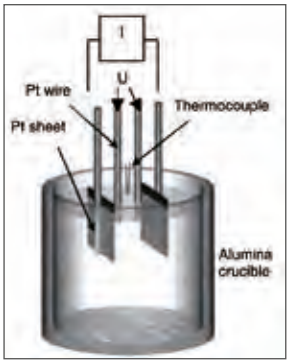
Results

First of all, we studied the solid state glass using the ''2-electrodes'' method with the software COMSOL. The geometric cell constant was calculated by integrating the current density of certain surfaces and using Ohm's law. In this method, the influences of immersion depth of the electrode in the center and the concentration of solution are tested. Next a model of the sample glass disk was studied to obtain the best conditions of testing. Therefore, different thicknesses, conductivity and diameter of the sample were studied. The same model was also studied by software Patran to compare the results. After that, we investigated the molten state glass using the ''4-electrodes'' method. The ''4-electrodes'' method was adapted to perform impedance measurements over a wide range of temperatures and frequency ranges. In this method, the influences of Immersion depth of the electrodes and the type of crucible are tested.

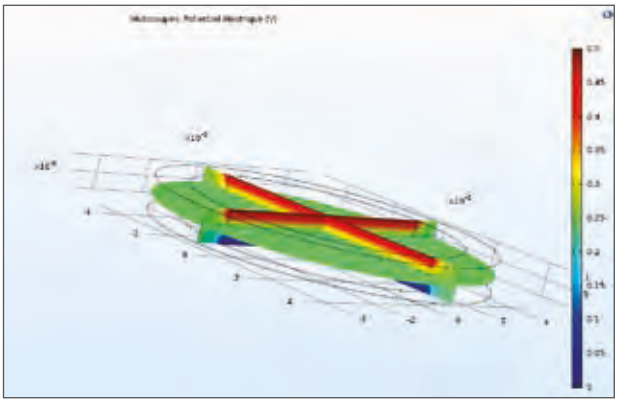
Keywords: glass, electrical conductivity, geometric cell constant, COMSOL



''2-electrodes'' method



''4-electrodes'' method



Disk model

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Thermomechanical simulation of refractory masonry

Numerical modeling

Rémi MAHOUAS
Academic supervisor: A. GASSER

Institution: PRISME Laboratory

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

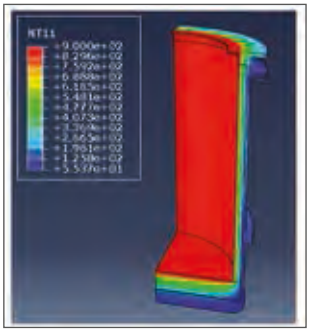
This project addresses need to develop a digital tool which reproduces the thermomechanical behavior of the refractory lining in steel production, more precisely in steel ladles. Indeed, a refractory lining is used in a steel ladle to protect the ladle's structure from the high heat (1650 degrees Celsius) released by the molten metal contained in the ladle, during the refining process of the metal. The masonry constituting the refractory lining is composed of numerous bricks separated from one another by joints. The required digital tool allows the computed field of stresses, displacements and strains to be visualized in the software "Abaqus".

Results

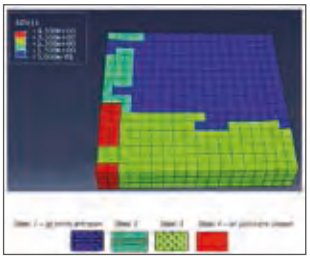
In order to develop the numerical tool, we had to find an equivalent material which has the same behavior as the assembly of bricks and joints. This equivalent material (with elastic orthotropic behavior), found by a homogenization method, required the value of nine mechanical parameters: three Young's modulus, three shear modulus and three Poisson's ratios. These nine values were quantified by nine mechanical tests such as tension tests or shear tests. Then, we improved a subroutine that already exists in "Abaqus" to reproduce the thermomechanical behavior of the refractory masonry used in steel ladles. Thanks to this digital program, we obtained the progressive closure of the joints caused by the thermal expansion of the bricks and the mechanical stresses applied to the lining's structure.

Keywords: masonry, refractory, bricks, joints, steel ladle

Refractory lining in a steel ladle



Temperatures during the refining process



Closure of the joints during a biaxial compression of a simplified 3D model

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Topology optimization

Mechanical engineering

Yasser EL YAAKABI
Academic supervisor: R.HAMBLI

Company/Institution: undisclosed

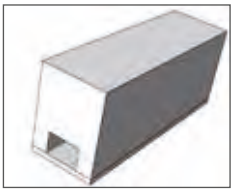
Objective/motivation

The major industries have had growing interest for additive manufacturing (AM) in the last 10 years. Its fast uptake is due to different innovative factors such as no shape limits in manufacturing process, full customization of the product and limited waste material. It gives the ability to print complex shapes allowing the focus of the design of the products on their function and not on the constrictions of conventional manufacturing processes. In order to have that best shape possible that gives the best compromise between weight and mechanical functions, AM relies on the use of a digital method called 'Topology optimization'. This technique consists of suppressing, for a given set of loads, boundary conditions and constraints, material layouts where there is no need for it. The most common programs that help do that are DesignSpace, Tosca, Within Labs and Inspire. The aim of this project will be to apprehend the use of the program 'Tosca' for topology optimization

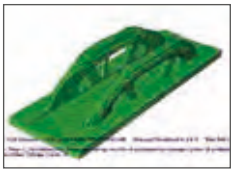
Results

The topology optimization starts with the implementation of a 3D model representing the maximum bulk or the implementation of an existing model into which we will apply forces and boundary conditions. Afterward, the program will calculate the constraints applied to the model and represent the most important areas (red areas) and others with no uses (blue areas) in different colors. The programs will then proceed to suppress the unwanted areas (blue) and will release a final structure that meets the mechanical and design constraints. In the project, I was able to use this technique for 17 3D models such as a control arm used in the automotive industry, a mechanical gear, a rim, a bridge, a frame for a quadcopter, an opening system for doors, a chair for overweight persons, a valve for high pressures, a rod, a brake pedal, an industrial hook, etc. I also studied the influence of some parameters on the given results such as the size of the mesh as this choice might influence the result.

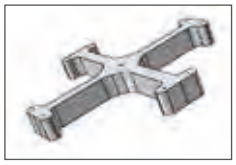
Keywords: topology, optimization, TOSCA



Initial structure of the bridge



Optimized structure of the bridge



Initial structure of the quadcopter

Optimized structure of the quadcopter

Initial structure of the door opening system

Optimized structure of the door opening system

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Trajectory planning on mobile robot WIFIBOT

Robotics

G. BROUILLON

Y. ZHOU

Guillaume BROUILLON / Yang ZHOU
Academic supervisor: A. FONTE

Institution: PRISME Laboratory

Objective/motivation

The objective of our program is basically to control a mobile WIFIBOT-type robot which is equipped with a laser rangefinder, an inertial center, a GPS, an HR camera, and odometry in an unknown environment. We need to code in language C through a middleware called ROS ((Robot Operating System). Considering this aim, we can conclude that the programme that needs to be made through ROS consists of autonomous navigation, avoiding obstacles, cartography and visual recognition.

Results

After a basic recognition of the operating system Ubuntu 14.04, as well as the tutorials of ROS at the very beginning, we learned how the ROS works and how to use it. Thanks to this, we were able to activate all of the sensors on the robot and collect all of the information provided by the sensors. Using those data, we succeeded in writing a programme which allowed the robot to run automatically and avoid obstacles. Also, to control the WIFIBOT remotely from any laptop, we are using a software called NoMachine which can transfer the screen of the robot's operating system to the laptop which connects the same Wi-Fi with the robot.

The wifibot

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Production Management

5S project management

Production engineering

Ass Malick NZE BA
Academic supervisor: H. LAILHEUGUE
Industrial supervisor: T. ADAM

Company: CIRETEC (ELVIA)

Objective/motivation

In order to improve the quality of the production plant, CIRETEC wants to carry out a 5S project in a lean approach. In fact, a lack of real knowledge of the method and then of the use of the 5S tool allowing its application within the factory have been observed during an audit. Although some work has been done over the last two years, a deployment of the tools to have a common culture about 5S and its application is therefore considered necessary in order to unleash growth and efficiency within the company. This project will enable 5S to be deployed within six months by acting on 50% of the plant's workshops, and then by training 30% of the managers and six team leaders.

Results

A development of a common culture around 5S within the factory, allowing a flexibility of the personnel and a solidity of the knowledge acquired. Sustainability of 5S, enabling its inscription over time. A generalization (deployment) throughout the plant for a better evaluation of the return on investment of this project. Actions to better inform on the 5S tools, which lead the employees to become aware of these benefits in order to prevent risks, will be carried out by means of training. The promotion of the 5S practice by the employees will be pushed by means of an internal audit. A progressive deployment on all the company's workshops will therefore be carried out by a preparatory analysis of the work site, enabling key indicators of evolution.

Keywords: reliability, quality, competitivity

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Build and manage an internal production line conductor training process

Production engineering

Dylan MAROT
Academic supervisor: G. HIVET
Industrial supervisor: A. L'HONORE

Company: Bonduelle Traiteur International

Objective/motivation
My company develops produce and conditions salads. The aim of my project is to create an internal production line conductor training process. The training process must be clear and structured to optimize the conductors of production line training and to accompany the learner throughout their learning. The different objectives are to reduce the training time to reduce the cost of the training, follow up the training but also avoid a decline in performance during the first weeks following the training. There are models, guides, and procedures to facilitate the learning.

Results
Each year, between 15 and 20 persons come to the enterprise to learn the trade of line conductor and to be ready and efficient for the high season. Each year, the training is not organized well enough and there is much loss, waste of time with candidates who quit before the end of the training or financial losses with training which lasts longer than expected. With this project, the results obtained with the internal training are better and the duration of the training is reduced. Moreover, the line performance is optimal from the start of the shift. The conductors can learn at their own pace with different sources like books, guides or references. This project demands the investment of the many skills and services with a consequent budget. My role is to be the chief of project with structuring, the creation of documents and the deployment of the training procedure.

Keywords: management, process, development

Bonduelle Traiteur International

One of the products

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CMM Park Optimization

Production engineering

Alexandre ROBERT
Academic supervisor: M. HAUTEFEUILLE
Industrial supervisors: B. MAXIMILIEN-FRANÇOIS, N. DELAFON

Company: John Deere Power Systems

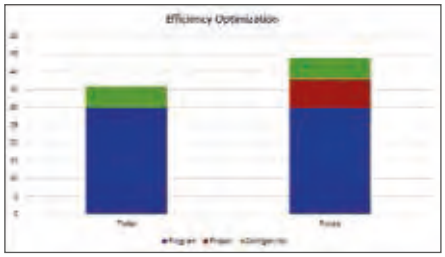
Objective/motivation

John Deere Power System is an engine manufacturer which is present all around the world. They make 3, 4, and 6-cylinder engines which go from 75 to 275hp. The primary goal is customer satisfaction. Quality is one of our most important values, but it is sometimes difficult to make a good product on time. Metrology is a central department which has to check the parts dimensioning for multiple reasons: set up part control, control plan execution, equipment validation project, etc. Today, within the Metrology department, many parameters can be improved. Some of the main challenges are productivity increased by process standardization and identification and tracking of equipment efficiency. In this context, I will lead this project by standardizing a way of working and optimizing the Metrology area in function of multiple parameters: possibilities of performing tasks in concurrent time, machine capacity, number of resources (material and human), etc.

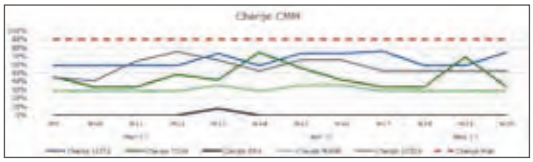
Results

Define the non-production sources applying to the metrology department and set up indicators (yools and calculation method) that allow them to be measured and Improved ; implement a strategy for using all CMMs (Coordinate Measuring Machine) in order to ensure the highest number of measure in a define time frame. Objective: gain 8 hours of control per week with the existing scope in the Weekly Control Program.

Keywords: analysis & simulation, strategy, optimization, management, benchmark, Excel macro



Efficiency Optimization graph



Charge CMM graph

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Continuous improvement in various services and production equipment

Production engineering

Hoang Phi Van LE
Academic supervisor: J-B. VIDAL
Industrial supervisor: J-F. GOT

Company: Les Crudettes

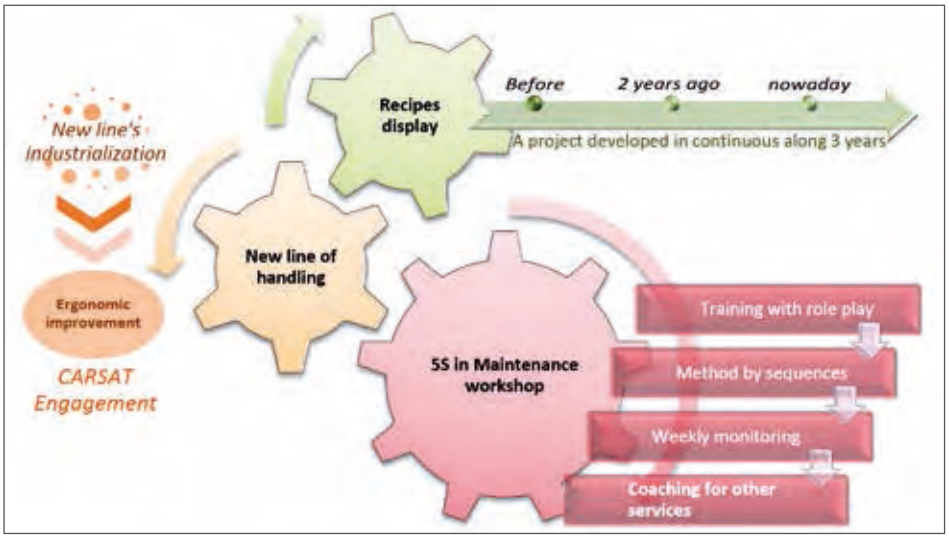
Objective/motivation

Three projects : 5S in Maintenance service (promotor for Lean policy in the prospect of the whole company) ; new line of salad handling (employee's health engages the company's health) ; snacking recipes dynamic display (productivity and reliability engagement). These three projects are based on the aim of improving the three fundamental axes of the company: humanity, environment, efficiency.

Results

These projects are currently ongoing. Still at this moment, the Snacking Recipes Display project is almost done. The PC panel was installed and actually on approval. This equipment, like a job description, helps us to reduce the time of change of recipes, and eliminate errors in ingredients deposition. Finally, the 5S project in the maintenance service is running as scheduled: our planning was respected. The first sequence, "Sorting", is done; we have just run an audit to validate this step. In addition, the best news is that all team members are keeping a positive attitude, although the working rhythm is very hard.

Keywords: humanity, productivity, reliability, quality, ergonomic



Project shematic

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Continuous improvement on grinding center

Production engineering

Adrien BENON
Academic supervisor: P. GRILLOT
Industrial supervisor: D. LEHOUX

Company: Sandvik Coromant

Objective/motivation
The objective of this project is to optimize the time of change-over on a CNC-controlled grinding center to improve our productivity by using the SMED method. The project is composed of 3 main stages: Preparation: to inform project teams, to decide on necessary resources for the changes and to set up the sheet of follow-up setup time ; Observation: to identify all the operations during setup time and to find the operations with no-added values ; Standardization: to set up the actions of improvements.

Results
In a very uncertain economic climate for the company, the operators had difficulty in adhering to the SMED approach. Nevertheless, the setup time, which was 65 minutes at the beginning of the project, was decreased to reach the objective of 15% reduction.

Keywords: production, setup time, SMED, OEE

CNC-controlled grinding center

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Definition and support of the professionalization process in the establishment of a new programming service

Production engineering

Jean-Rémi BERTHONNEAU
Academic supervisor: B. LE ROUX
Industrial supervisor: J-M. LATHUILE

Company/Institution: undisclosed

Objective/motivation
The project is included in the framework of a national program of the company consisting in retrieving the activity still shared by two companies recently founded from a firm scission. The recovery of this new labor entails a reorganization of the structure of the company, especially the programming process of the activity. In the whole national territory, agencies are being created in order to ensure the programming, and planning. The project consists of developing and following the skills of the future team integrated in an agency.

Results
First, it requires setting up a skills base and then performing a skills mapping to be able to define a professionalization program for each employee. The success of the project rests on the ability to motivate people to be prepared and efficient for the transformation by using change management and analysis skills. In addition, we are developing a software module in order to follow the progress of the employees.

Keywords: professionalization, change management, transformation, programming

Project schematic

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Integration of a computerized Maintenance Management System

Production engineering

Romain GRZEGORCZYK
Academic supervisor: S. GROSSELIN
Industrial supervisor: G. POCLET

Company: MSL Circuits

Objective/motivation

MSL Circuits is specialised in electronic sub-contracting sectors for the automotive industry. In order to record all the maintenance operations, the company uses a CMMS software program which was developed by the industrial equipment department in 2003. With the technological advances, the current CMMS can now be described as obsolete and it doesn't allow for improvement of the efficiency of the production lines of the company. A new CMMS incorporating a direct link between the curative and the preventive operations would allow us to optimize the maintenance in order to have a better use of the resources (troubleshooting time, stock and use of spare parts, preventive maintenance...).

Results

I was asked to accompany the implementation of a new CMMS. With this objective in mind, I have to train the users (leaders and maintenance technicians), to transfer all of our data to the new software program, to achieve all of the tree structure according to the type of energy used, and the geographical location in order to facilitate the work of the technicians during the resolution of failures. Later, I will carry out an analysis of spare parts used to optimize the stocks. The goal of the integration of a new CMMS is to improve the maintenance and increase the efficiency of production lines by tackling the recurring causes of breakdowns and eliminate them.

Keywords: software, production, management, automotive industry, CMMS

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Lead Time Optimization

Production engineering

Pierre-Emmanuel BA
Academic supervisor: J-M. AUFRERE
Industrial supervisor: C. VALETTE

Company/Institution: undisclosed

Objective/motivation

As a Lead Time project manager, my role is to implement and coordinate different assignments. I show some of the board members the progress with a dashboard and exchange ideas every Monday. This project is cross-functional and concerns many departments. Supply chain, production, supplier, and HR department. We have two issues: increasing cash flow, which is an important part of the company strategy, and responding to the current challenges of the industry.

Results

The target is to reduce the lead time by 20%. Every week, headquarters sends us the results of the week before. Once I get the results, I analyze the data and fill out the dashboard. I take the Flop 3 of the worst products in terms of lead time and create different teams. I also created a tool on Excel® for team leaders to improve the commitment in terms of quantity. This setting has an impact on the lead time. The last KPI is the weekly number of production orders not on sale.

Keywords: lead time, Lean manufacturing, luxury factory

Project schematic

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Management of critical maintenance work during nuclear power plant outage

Production engineering

Romain POISSON
Academic supervisor: B. BONHEUR
Industrial supervisor: F. DEVAUX

Company: EDF CNPE de St-Laurent-des-Eaux

Objective/motivation

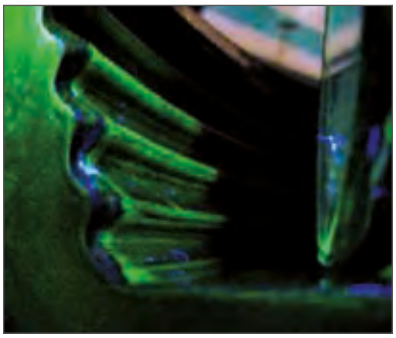
Management of the critical maintenance work on 2017 outage campaign with a preliminary study of potential risk, the real-time support during the activities realization and the feedback from the work maintenance. The preliminary study of potential risk will be done thanks to the feedback from the other nuclear power plant managed by EDF. The real-time support will be done thanks to the different results found during the maintenance work. The feedback will be used to plan the future different operations of maintenance. (1)During the outage 1P32 (from 20 May to 30 July 2017), the St Laurent des Eaux CNPE will carry out a complete survey of the two low pressure bodies of the unit 1 turbine generator. The critical path passes through this activity. That is why this activity could impact the duration of the outage and it is important to secure it.

Picture of the low pressure bodies

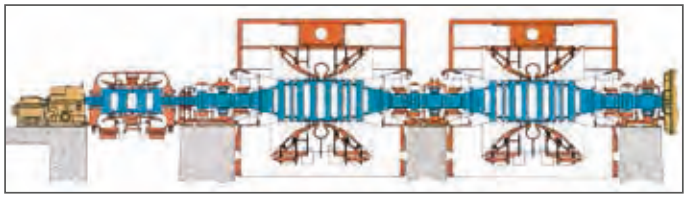
Results

It is currently impossible to present the results, because the outage has not yet been carried out. Therefore the following results are potential results: synthesis documents sum up all potential riskiness and the associated parries of this risk; synthesis documents after the works to sum up the strengths and the weaknesses, to schedule the future maintenance of the system; real-time control of the maintenance work to guide the resources in the best way possible; link with national engineering throughout the work maintenance.

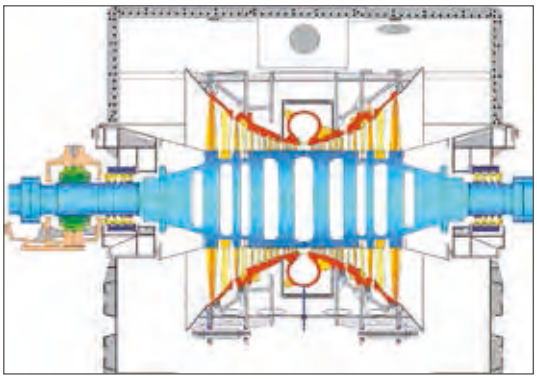
Keywords: steering, maintenance, reliability, riskiness, anticipation



Magnetoscopic examination of fasteners



Cross section of the shaft line



Cross section view of the low pressure bodies

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Management of welding operations on heat exchangers

Production engineering

Donatien RIVIERE
Academic supervisor: G. HIVET
Industrial supervisor: X. TERRIER

Company/Institution: undisclosed

Objective/motivation

The company has developed a new business on the part of customers in the nuclear sector. This includes the realization of two heat exchangers with a potential of six to 10 units which provide a significant workload for the future. These heat exchangers have impressive dimensional characteristics: a diameter of 3 meters, length 15 meters, and weighing approximately 150 tons. The project consists of ensuring a mastery of welding operations in accordance with customer specifications and applicable standards. The realization of the project arose from the creation of welding procedures, and the assurance of the qualified welding procedures of both welders. The implementation of the assembly process requires a regular follow-up and mastery within the production workshop. Refer to the operating procedures by the welders. The objective is to minimize the costs of production and qualification of welding procedures as well as to face human resources in the search for qualified personnel. The company must guarantee the production and the conformity of the product to its customer. It certifies the conception and production of the product according to customer regulations and applicable standards.

Welding

Results

No results for the moment

Keywords: welding, management, process, nuclear

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Modification of the automatic welding post

Production engineering

Maria MOUNAVARALY
Academic supervisor: B. LE ROUX
Industrial supervisor: N. RETIF

Company: Brandt France Orléans

Objective/motivation

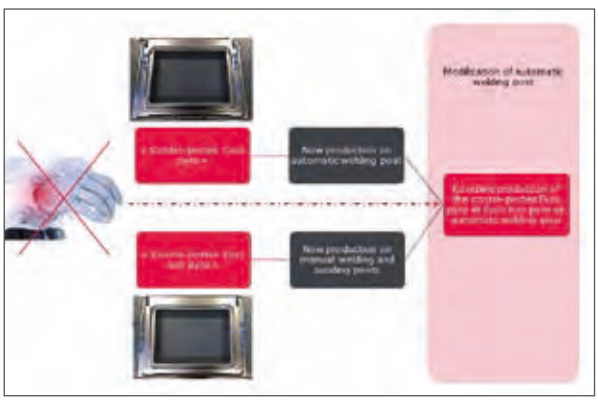
My 5th year project consists of improving the ergonomic conditions of a workstation which produces "contre-portes" and which includes a welding stage and a sanding stage accomplished manually. A manual sanding post represent a risk of TMS for the operator, thus the purpose is to remove this post. At present, we have an automatic welding machine which combines the welding and sanding stage. The objective is to transfer the reference of "contre-portes" which engenders this risk to the automatic post. The main interest for the company is the abolition of the manual sanding post and thus an improvement in ergonomic conditions for the operator and a saving of space. Furthermore, to that are added a gain in capacity of the manual welding machine and also a gain in productivity on the reference of euro inner doors concerned.

Results

The steps to be followed to carry out an industrialization project are studying the current situation of the concerned posts; conception and elaboration of the project; writing the specifications; choosing the supplier; and following the creation and implementation of the solutions. To realize my project I have a budget of 60,000 euros. To date, I have consulted suppliers who have offered a calculation for this subject which meets with our budget. There thus remains to choose a supplier according to internal criteria of the company and to place the order to set up the means.

Automatic sanding and welding station

Keywords: production, methods and industrialization, productivity, ergonomic



Project schematic

Manual welding station

Manual sanding station

Contact: m.maria52@hotmail.com

Operational deployment of a line's multi-product investigation cell

Production engineering

Vincent GAGNEAU
Academic supervisor: C. DUROS
Industrial supervisor: G. MAZOT

Company/Institution: undisclosed

Objective/motivation

The EVE line is currently processing to a reorganization of its production system by passing from mono-product cells to multi-product cells. Thereby, the previous investigation cells, which were linked to their production cells, must be split and merged in a new multi-products investigation cell for the EVE production line. The goal of the project is to establish the process which will lead the new investigation cell and manage the investigation team to reach the objectives of quality, cost, and time while developing team polyvalence.

Results

By developing the polyvalence and focusing the work power of the team on the priorities, we want to reduce the waiting stocks of the merged investigation cells. Thereby, the objective is to reduce by 10% the investigation's immobilization account and reduce the investigation immobilization time to tend towards the internal objectives while maintaining reparation rate for the intern and client product failures.

Keywords: management, stock vision setting

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Optimization of Level 2 preventive maintenance

Production engineering

Sébastien FINOT
Academic supervisor: C. MOREAU-WINSWORTH
Industrial supervisor: T. VAILLANT

Company: Brandt France Orléans

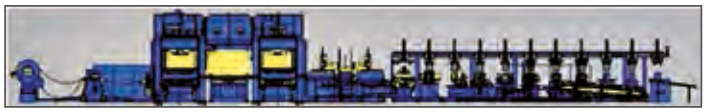
Objective/motivation

Within the component production unit, 70% of the technician's time is spent on machine's failures. This represents 6,600 hours of corrective maintenance and about 185,000 € per year. That is why my fifth-year project is to improve the performance of Level 2 preventive maintenance to reduce the lack of machine availability. This will be done by reviewing all the actions that have been implemented and used so far, separating them into 2 levels: a level 2 that will be carried out by an authorized operator and a level 3 that will be carried out by a maintenance technician, while adding or removing actions depending on the machine's failures already listed.

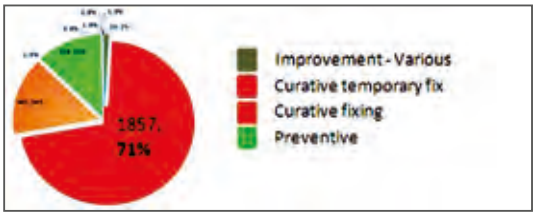
Results

I chose a standard process (ESIMEC) that has undergone the biggest amount of repair work and which is most representative of the machine park (old, sheet metal unwinder, press, welding ...), with the aim of performing the same operations as all machines of the factory. The ultimate goal is to reduce by half the time spent by maintenance technicians on corrective maintenance, by optimizing level 1 preventive maintenance (previous year's project) and level 2 preventive maintenance in order to reduce the cost of corrective maintenance.

Keywords: production, kaizen, preventive maintenance



ESIMEC process



Breakdown of interventions

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Performance indicators on non-compliance of workshop

Production engineering

Clément SICURANI
Academic supervisor: G. HIVET
Industrial supervisor: B. BONNAMOUR

Company: Groupe Lorillard

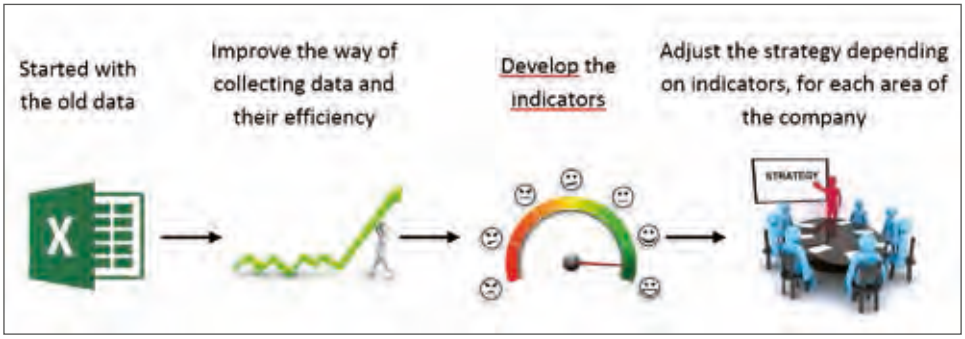
Objective/motivation

In a workshop and in the perfect world, each product would be made on time and at once right at the first time but in the real industrial world, each product may have some delays and could be non-compliant. It's with this goal in mind that a production manager needs to have some performance indicators for his workshop. The manager needs to include this production loss with the aim of adapting his minimum quantity of production in order to meet the objectives set by the company. It's why I have to create a performance indicator on non-compliance. I have analyzed the amendment procedure which identifies a defect and then corrects it by giving a new production order. The non-compliance system will guarantee the quality of the carpentry to the customer. The purpose of the recovery procedure is to remove the defective part(s) and to produce one or more new parts while minimizing the financial losses through the recycling of the accessories and/or the raw material, which is important today for each company.The main objective of this project is to obtain statistical indicators concerning defects due to non-compliance. The validation of this objective will provide an overview of the various areas of improvement, either on machines or on staff. It will allow us to quantify the loss this could entail financially for the company. These indicators allow the company to decide on a strategy to be adopted concerning the quality, production and maintenance sectors.

Results 107

The implementation of this project will allow us to obtain a rate and a recovery cost, according to a fixed time range (days, weeks or months). In addition, improving the existing Excel file now allows the manager and the team leader to preview the machine most commonly responsible for faults, as well as the type and nature of the most common fault. Thanks to graphs which are printed every weekend and presented at a production meeting, this allows the non-conformity data to be monitored on a regular basis, thus linking production, quality, maintenance and financial impact. This will subsequently improve the various defective axes and carry out maintenance actions. So through these unique indicators, we can get a lot of information about the performance and management of our production workshop.

Keywords: quality, monitoring, indicators, production, cost



Project schematic

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Post implementation of the ERP Hélios

Production engineering

Pauline VERMOREL
Academic supervisor: S. LEROUX
Industrial supervisor: D. BOUILLARD

Company: MK AIR Mekamicron

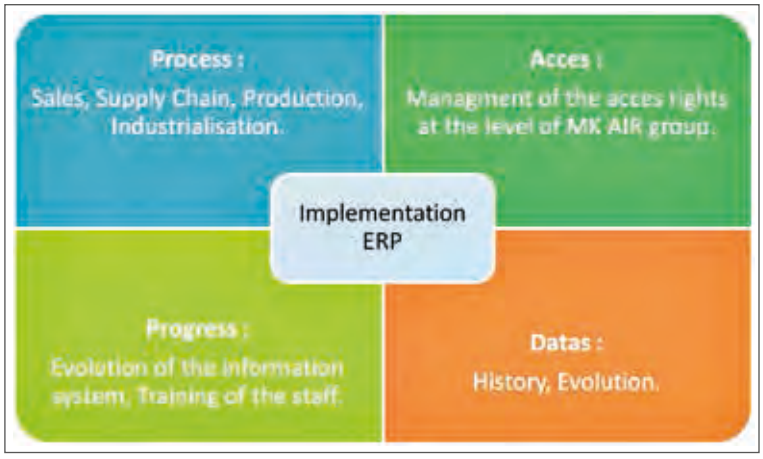
Objective/motivation

The annual production of 150,000 parts made in 1,500 fabrication orders has to be managed by an ERP (Enterprise Resource Planning). It represents the frame of the production in an SMB (Small and Medium size Business) aeronautics company specialized in planes parts in the military and civilian field. The respect of the product quality and of the cycle is the main issue for a company in the production field. The softeware used by the company since 1993 gathers together all the data from the input of purchase orders to the billing. The ERP gathers information from all the departments; it gets more complex because it has to be without bumps for the users. Currently, the process of the Supply Chain and the production is not optimal and this fact produces a devaluation of the OTD (On Time Delivery), which is the indicator of customer service.

Results

This project has to manage the post implementation of an ERP with a correction of the data input, a revision of the existing parameters of the information system, an action plan following the process of problems resolution, an issue of all the process according to the new ERP, a training of all the staff, and the setting up of all the rights and administrations at the level of the group MKAIR.

Keywords: automatization, supply chain, production, MRP2



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Reducing traversal time across a workshop

Production engineering

Marie HERBERT
Academic supervisor: E. COURTIAL
Industrial supervisor: S. LAURENT

Company: Saint-Gobain Sully

Objective/motivation

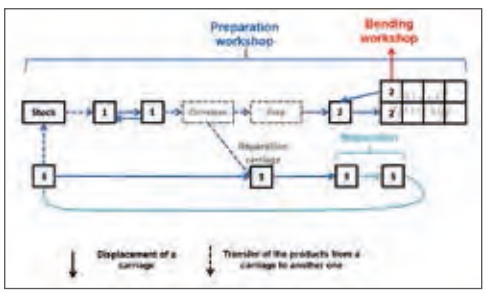
I am currently working as an apprentice engineer for Saint-Gobain Sully where windshields for aerospace, vessels, trains and military vehicles are manufactured. To bend the glass and give it its final shape, we need to place it in a furnace and heat it up to six hundred degrees. At Saint-Gobain Sully we have four furnaces to do this job. This project is about reducing the time needed for a product to go through the workshops. To achieve this goal, we are going to analyze the flow of products and information in the workshops by doing what we call a "Value Stream Map". Thanks to this first analysis, we are going to be able to find new ways of managing the flow, mostly by giving simple rules to follow on a daily basis to the operators.

Results

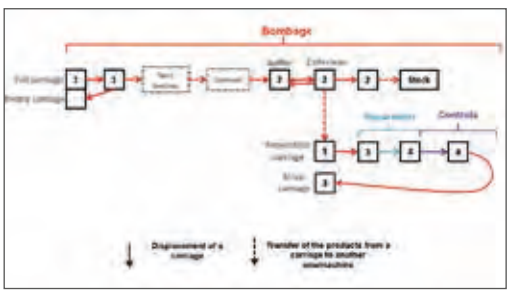
This kind of project has been conducted before in the two next workshops after the one dedicated to bending and it was a great success. Indeed, the project manager was able to reduce the traversal time from three weeks to less than ten days. That is why we can reasonably think that this method will be as effective in the bending workshop. For now, the traversal time is about seven and a half days and we hope to reduce it by three days within four to five months of team work. For my last year at my engineering school, I will be the project manager of this project. I will have to prepare the meetings with my team, the organization of the different steps of the project but I will also have to decide what task each person will have to do.

Keywords: value stream map, visual management, flow, stocks

A350: front windshields of an Airbus A350 manufactured in Saint-Gobain Sully



Preparation workshop: first workshop of the project, movements of the carriages in the preparation area



Bending workshop: second workshop of the project, movements of the carriages in the bending area

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Reduction of cycles for Safran helicopter engine product

Production engineering

Maxime GRONDIN
Academic supervisor: S. ALLAOUI
Industrial supervisor: P. POITOU

Company: Zodiac Hydraulics

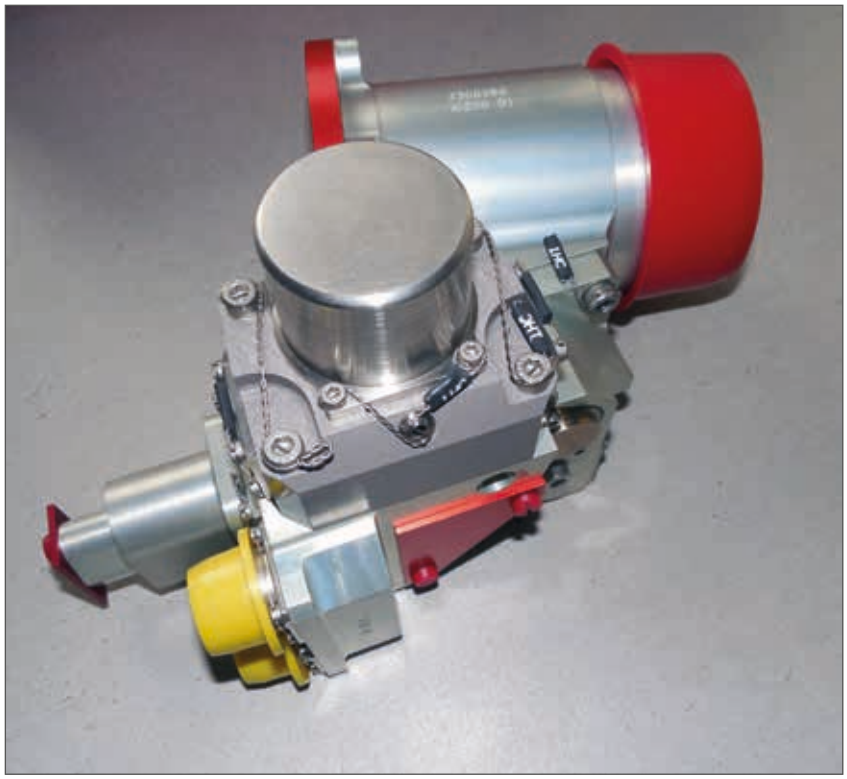
Objective/motivation

Zodiac Hydraulics designs, manufactures and supports equipment and sub-systems for hydraulics and fuel servo control systems. Our customer, Safran Helicopter Engines, the world leader in helicopter turbine engines, asked ZHC to work on the reduction of cycle to provide their equipment quicker than the actual lead time. The goal of this project is to allow ZHC to absorb the change request of the helicopter market and be more responsive to customer demand.

Results

Currently, the project has just started and the first step was to define a project team, to choose the equipment and to analyze the cycle. The expected result is to reduce the cycle for servo control, valve and manocontact. The target for June 2017 is to reduce the procurement cycle for all purchased or manufactured parts to 80 days maximum.

Keywords: Procurement Helicopter Engine Cycle lead time



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Reparability analysis of a sensitive product integrating the obsolescence processing of the low noise amplifier function

Production engineering

Mustapha DAKDAKI
Academic supervisor: B. LE ROUX
Industrial supervisor: A. GARIN

THALES

Company: Thales Air Systems

Objective/motivation

The aim of this project is to find a substitution component that will replace the obsolete low noise amplifier used within a sensitive product. The scope of the project will cover research and development until the pre-industrialization phases. Within the different phases, the voice of the customer will have to be analyzed in order to fully understand his need in terms of maintainability and reparability.

Results

As it is an on-going project, the main achievement will be to solve the obsolescence issue by finding and validating a new solution. Milestones will have to be followed in order to ensure that industrial standards used within the company are met in terms of documentary traceability. This traceability is a key factor to make sure that its request is delivered on time.

Keywords: product management, customer service, obsolescence issue

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Restoration of a production process C2000

Production engineering

Walid BELBSIR
Academic supervisor: C. DUROS
Industrial supervisor: G. GIACOTTI

Company: Brandt France

Objective/motivation

The decision to restore the production process C2000 was made following the development of a new product. In fact, the new strategy of Brandt France is oriented to upgrade our industrial process. The main purpose of this project is to improve the productivity and resolve the obsolescence of the material. The current capacity of the bonding machine is 20 products/hour. Our aim is to reach 30 products/hour. To achieve this goal, we should work with suppliers specialized in automation, industrial revamping, bonding machines and polymerization stoves.

Results

The achievement of the project has allowed the company to increase the production capacity of this process. Before the project, the machine was able to produce 20 products/hour. Today, the new bonding machine can make up to 56 products/hour. This beneficial improvement in terms of productivity will offer better flexibility for the supply chain department and more availability for the production department. In addition, this process is unique because it is the only supplier of the manufacturing line of Induction hub. That's why we have changed all the obsolete parts of the machine. By achieving this project, we made some great improvements in terms of ergonomics and working conditions. Hence, the operators have expressed their satisfaction about the new process and the goal of the project has been reached.

Keywords: industrialization, production, revamping, machine efficiency, performance improvement

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Rethinking of subcontracting management steering with MS Sharepoint technology on A380 and A400M planes

Production engineering

Baptiste VIALATTE
Academic supervisor: J. FANTINI
Industrial supervisor: F. VINCENTS

AIRBUS

Company: Airbus

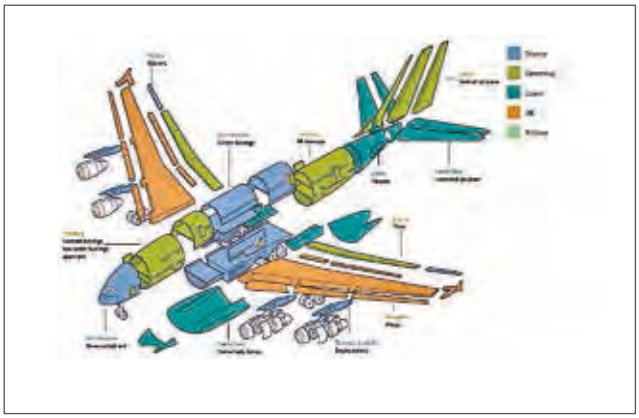
Objective/motivation

One of the roles of the integrated department (A380/A400M Nose and center Fuselage Transverse Engineering) is to support the steering of subcontracting of others entities (Mechanics, Electrical Systems, Structures ...) and consolidate the financial perspective. Following the renewal of several contracts and the transition of a new intranet format (Microsoft SharePoint database), an opportunity presents itself to rethink the steering of this subcontracting management. The aim is to simplify and automate this management and its related indicators to enable autonomous monitoring by technical managers, allowing the activities launched under the new subcontracting contract to be monitored, both from a technical point of view and from a financial perspective.

Results

Transversal involvement of departments in order to obtain efficient management of subcontracting; existing SharePoint database migrated; documented operational process; specifications; improved and expanded SharePoint database; documented tracking tool (users and administrators)

Keywords: subcontracting management, lean office, engineering



Airbus A380 manufacturing

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Retrofit of the 298 valve

Mechanical engineering

Florent ORELLANA
Academic supervisor: J-M. AUFRERE
Industrial supervisor: M. KOUADRI

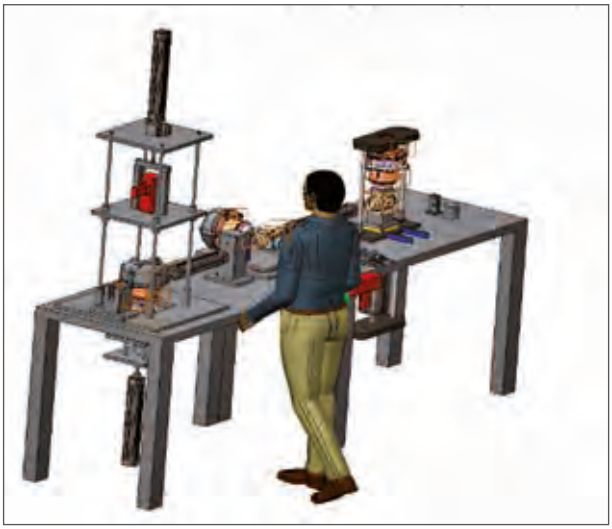
Company: Asco SA

Objective/motivation
The company has chosen to create an after-sale service for the product call 298. The purpose was to create a device able to take apart the 298 valve, change the break parts and reassemble the valve with new components to send valves to the customers. After some analysis, conception, research of parts and a defined budget, I created a line. Current goal: 2 valves per day (without device); project goal: 20 valves per day.

Results
After six months, the production line has been created and is able to take apart and reassemble 21 valves per day with two operators.

Keywords: design, conception, management, supply chain

The 298 valve



Schematic of the new production line

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Setting up a technical, strategic and structural organization of specific tools in a nuclear power plant

Production engineering

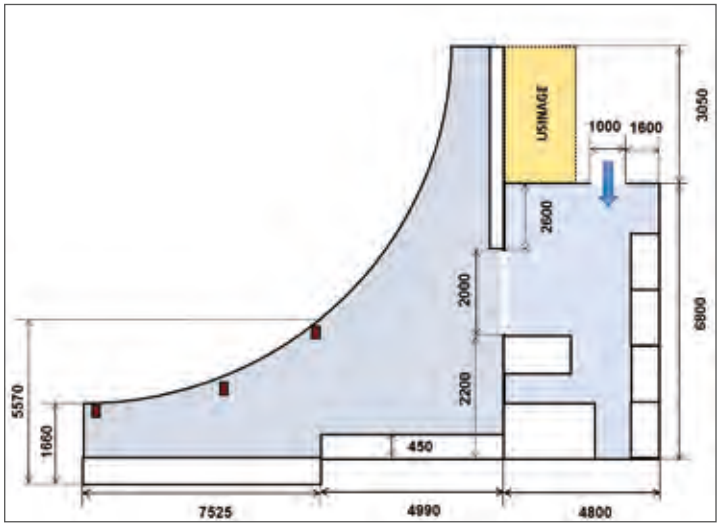
Rémy WATRIN
Academic supervisor: B. BONHEUR
Industrial supervisor: J. RENAULT

Company: EDF CNPE de St-Laurent-des-Eaux

Objective/motivation
The annual production of 420 TWh by the French nuclear fleet is essential to face the energy challenge of tomorrow. This is allowed by the respect of the planned outage duration. This is also an economic challenge for the company because there is an amount of unproduced energy and, therefore, energy that is not distributed to the end user. Several maintenance operations have to be achieved during outages and require the use of specific tools. Therefore, it is essential to make the tools and material available. Currently, the availability of tools is not optimal and affects the duration of outages, which may extend beyond what is initially planned.

Results
Setting up of specific tools management can act to guarantee the planned time duration of maintenance activities during the next outages, due to: getting 100% specific tools availability during the next outages; knowing in real time the state and the availability of the specific tools by workers in charge of the preparation and the realization of the maintenance activities; identification, organization and standardization of dedicated storage in controlled area; and staff awareness and training for a good performance with specific tools management.

Keywords: nuclear, organization, maintenance, specific tools, contaminated area



Layout of the store in control area

Nuclear power plant of Saint-Laurent-des-Eaux

Contact: remy.watrin@etu.univ-orleans.fr

Smart Building

3D factory

Smart building

Coralie CORDIER
Academic supervisor: B. EMILE
Industrial supervisor: I. LHARDY

Company: Lenzi

Objective/motivation

As part of my final year of apprenticeship, I was asked to work on the 3D Factory project in order to prepare for an increase in turnover. This project is part of a process of development of the company and its activity. It consists of redesigning and modifying the configuration of the company installations. The two main axes are the increase of the storage capacity and the introduction of new technologies. All of this aimed at improving productivity, optimizing flows and reducing discomfort. My role is mainly to work on the optimization of the storage space and flows. Moreover, we are a classified installation for the environment's protection company. We are, therefore, very concerned about our impact on the environment which is why I also work on the recycling part of the waste produced by the company and the pollution that it can emit.

Results

The project has just begun and is currently being studied. That's why I cannot present any results at this time. However, I have started a job of census and analysis of store racks. This analysis will enable us to identify the parts that we use very rarely and those that we use on a regular basis. This step will allow us to optimize the parts locations in the storage racks as well as the overall configuration of the store. We have already reorganized the location of the parts at the storage level. Several configurations have been proposed, which should be studied in the coming weeks. With these solutions we should gain about 30% of additional storage capacity. The project of moving the space dedicated to assembly has just begun and we are currently analyzing the flows in order to optimize and increase the productivity of the workshop.

Current warehouse

Keywords: factory, optimization, warehouse, improving productivity

Current layout

Target layout

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Accompanying of an agency for the deployment of charging infrastructure for electric vehicles in the Orne department

Smart building

Alix THIERRY
Academic supervisor: G. LAMARQUE
Industrial supervisor: C. BOGE

Company/Institution: Engie INEO Réseaux Centre, Orne Department

Objective/motivation

I'm doing my internship at INEO Réseaux Centre in Orleans' headquarters. We work in the field of rural electrification, high and low voltage, networks, photovoltaic and wind power and public lighting networks. My role is to help our agencies, especially for the writing of response to call for tenders to meet the needs of local authorities in our fields. My project is therefore to participate in the response for the installation of Electric Vehicle Recharging Infrastructures in the Orne department (61), and, if we succeed, to help the agency when it's necessary. We can divide my project into three main phases: discovery of the technical parts of the deal and therefore the taking into account of the customer's request; definition of the strategy of the response: grouping response with other internal or external companies, variant proposal, choice of subcontractors, etc., and, finally, drafting of our offer.

Results

After the reflection carried out upstream of our reply, we made a proposal slightly different from the customer's request, and we won the contract. Afterward, we guided the customer on certain technical points: choice of the type of outlets, the payment terminal, the car detection system, the subscription for the Wi-Fi hot spot, and the aesthetics of the terminal, etc. This complete project allowed me to get specialized in a subject related to my schooling, and which, in addition, is expanding. Indeed, the development of electric cars, and thus recharging infrastructures, is a major challenge for the reduction of greenhouse gases. It also raises technical problems that professionals and public authorities will have to solve in the years to come.

Schematic of the terminal

Keywords: electric cars, charging stations, green energy

The recharging station

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Hearing loop for OTIS lift

Smart building

Clément LORILLOUX
Academic supervisor: P-O. LOMBARTEIX
Industrial supervisor: F. DET

Company: OTIS

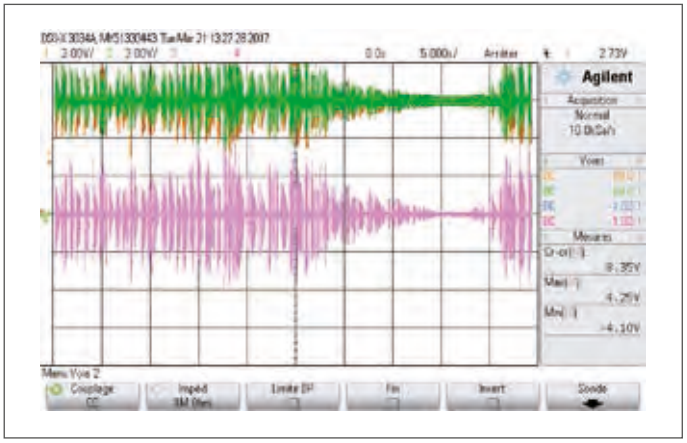
Objective/motivation

Because fifteen percent of the world population has some degree of hearing loss, Otis proposes to equip the lift with an Audio Frequency Induction Loop System (AFILS) or Hearing Loop in option. A hearing loop is a wire that circles a room and is connected to a sound system. The loop transmits the sound electromagnetically. The electromagnetic signal is then picked up by the telecoil in the hearing aid or cochlear implant. The hearing loop is sensitive to the magnetic field created by the electric motors as well as the electronic cards. The metal of the elevator deforms the magnetic field, making an elevator one of the most complicated places to install a hearing loop. Today, this system is developed by a subcontractor, but their system is not competitive. My mission is to design, create and program a new electronic board to make this option more reasonable.

Results

Results not available

Keywords: AFILS, hearing-loop, hearing



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Preparation for the position of assistant business manager

Smart building

Arnaud MAXANT
Academic supervisor: M. JABLOUN
Industrial supervisor: M. GRELIER

Company: Engie INEO Centre Services

Objective/motivation

At the end of this fifth-year project, I am apprenticed to ENGIE INEO CENTER SERVICES in Orléans within the maintenance department. Under the authority of the business manager, the assistant business manager must deal with various tasks such as managing maintenance contracts and intervention resources, monitoring interventions, client reporting, providing intervention reports with quotes, providing assistance with intervention planning, preparing technical and commercial offers, quotations, quotes, analyzing the needs of clients, controlling the risks of his proposals, negotiating and drafting contracts, monitoring commercial profitability, visiting on site and participating in meetings of the management committee of service agencies.

Results

The aim is to be organized and rigorous in order to complete each step of the project successfully. The assistant business manager must also ensure regular monitoring of all his clients, knowing how to be versatile. The role of coordinator requires being a good communicator, having a natural ease in social relations and adapting to each project and to each client and the requests received.

Keywords: assistant business manager, costing, cost estimation, call for tenders

Contact: arnaud.maxant@etu.univ-orleans.fr

The burial of networks in Lazenay

Smart building

Emilie FAUBERT
Academic supervisor: P. REBEIX
Industrial supervisor: E. FERRAND

Company: AEB Electricité

Objective/motivation

As an engineer apprentice at AEB Electricité, I am working in the "HT / LV Networks and Street Lighting" sector. My project is to realize the burial of networks in the main street of a town in the Cher department. We work in collaboration with the Syndicat des Energies du Cher (SDE 18) where the renewal of the works contract occurs every four years. The objectives of the burial of the networks are to beautify the town and to make the networks more reliable. To do this, my role is first to raise the electric poles and define the underground passage in order to establish a plan with the ERAS software program and an estimate of the work for the customer. Then, I am in charge of the administrative file such as building permits and site preparation with the order of the material. I also support the study of lighting using the lighting software DiaLux to provide several proposals to the customer taking into account new technologies as well as standards. During the work period, I will take part in the site meetings to check the good execution of the work.

Results

Results not available

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Technologies for energy, aerospace and engines

Actuator for detachment controlling

Mechanical engineering

Y. WANG

Y. ZHAO

Yichang WANG / Yue ZHAO
Academic supervisors: P. JOSEPH, A. KOURTA

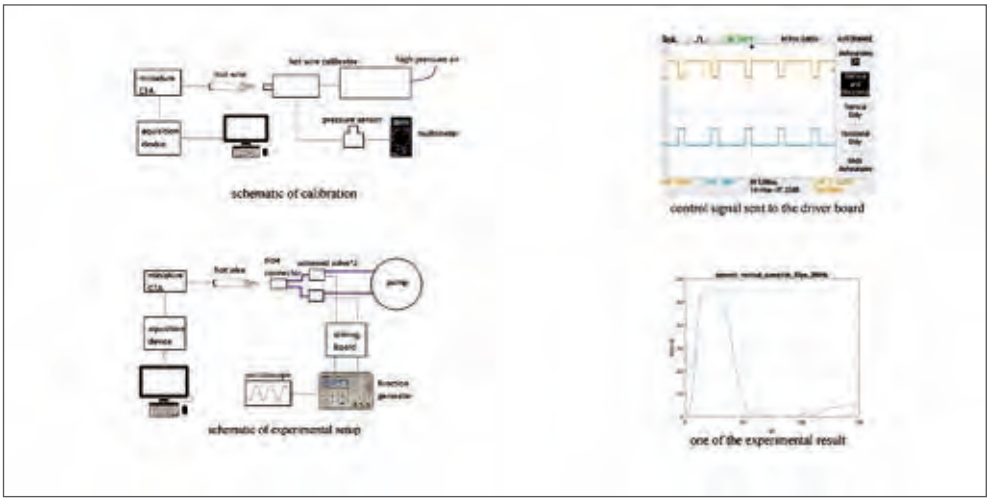
Company: GDR2502 (CNRS)

Objective/motivation

The drag force of an automobile is mostly generated by the detachment of air flowing around the vehicle. It can increase the consumption as well as make the vehicle dirty because of the ash driven by the air being pushed onto the rear part of the vehicle. The drag force will decrease when the position of the flow detachment changes properly, so the study of the detachment control is very useful. We will use the synthetic jet to control the detachment. Synthetic jets are produced by periodic ejection and suction of fluid from an orifice; they are formed without net mass injection. The most basic and important part is to generate a synthetic jet, so that we can study the characteristics of the synthetic jet and the influence on the drag force.

Results

In this project, we made a prototype of an actuator for detachment controlling by generating synthetic jets, which could be applied in the future research of the synthetic jet on the vehicle to reduce the drag coefficient as well as make the vehicle more stable. To make this prototype, we learned the discipline of the hotwire probe, wrote some MATLAB programs, and made several combinations to get the system optimized. What we did was to generate the synthetic jet by opening and closing the two solenoid valves which were linked with the inlet and outlet of a pump. So, energy is also needed to generate the jet. Fatherless experiments will be necessary to make sure that the energy used by this prototype is less than the energy saved by the synthetic jet.



Keywords: synthetic jet, drag force, detachment control, hotwire sensor, prototype

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Aerodynamic study of flow field of axle of airscrew on helicopter

Mechanical engineering

Chen CHEN
Academic supervisors: A.KOURTA, N.MAZELLIER

Company: Airbus Helicopters

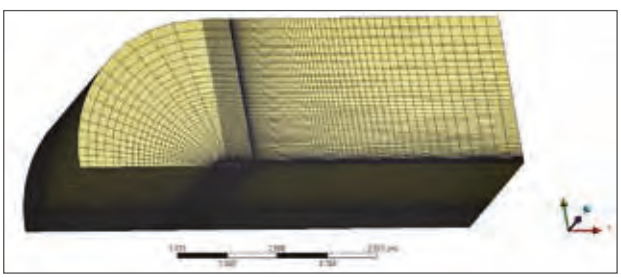
Objective/motivation

This project is the continuity of the project of last year "Helicopter: performance enhancement". Because of the abnormal amount of vibration recorded by test pilots, Airbus requests to study the periodic vortices in the wake of a helicopter and turbulence generated on the tail. The model of last year is focused on the flow field of the fuselage; for this year, the model of axle of airscrew is improved by dynamic form. The project will exhibit the influence of form of the axle of airscrew on the production of vortices.

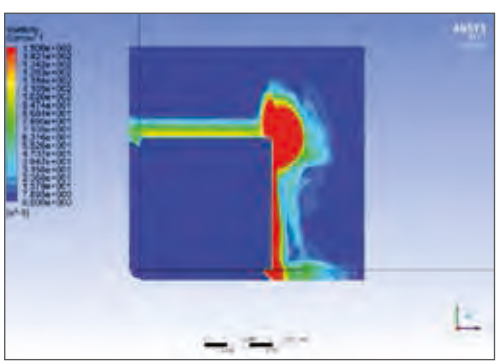
Results

The cubic form and cylindrical form of axle are replaced by the streamlined form as it is known for causing less drag and being closer to the real form. The 2D and 3D simulations have shown differences on frequency of turbulent eddies and on the amount of kinetic energy, which are the most important factors to the generation of vibration. The streamlined form also causes less drag, which can raise the efficiency of the aircraft. According to this study, the further simulation should add the tail on to the fuselage. Thus the simulation concerning the influence on the tail can be conducted.

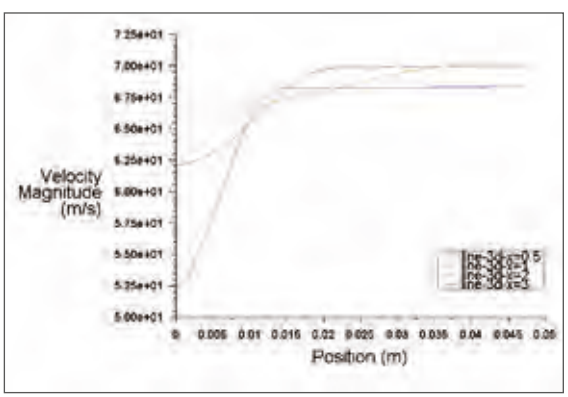
Keywords: flow field, axle of airscrew, helicopter, Fluent



Mesh of aerodynamic form



Contour of velocity of aerodynamic form of axle with point fuselage



Comparison of velocity of 3D aerodynamic form

Contact: chen.chen1@etu.univ-orleans.fr

Analysis of a common liquid injection for high speed propulsion

Energetics

J. DAGAUT

D. MENAGER

Jérémie DAGAUT / David MENAGER
Academic supervisor: I. FEDIOUN
Industrial supervisor: M. BOUCHEZ

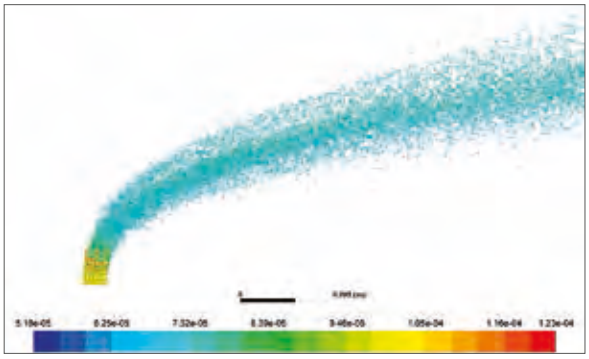
Company: MBDA

Objective/motivation

In today's world, the use of computational calculations is drastically increasing in order to avoid physical experiments which, most of the time, are too expensive. The goal of this project is to simulate, with a commercially available CFD code, a liquid fuel injection and the associated phenomena occurring in high speed propulsion systems called ramjet engines. The thrust of such engines is produced by the combustion of the liquid fuel with the air, but the fuel needs to become gaseous in order to burn. Thus, simulations need to be conducted to fully understand the different steps needed to go from the liquid phase to the gaseous phase of the fuel. The liquid jet will be transformed into small droplets, thanks to the atomization process, and then into vapor, which will finally react with the supersonic air flow in the combustion chamber.

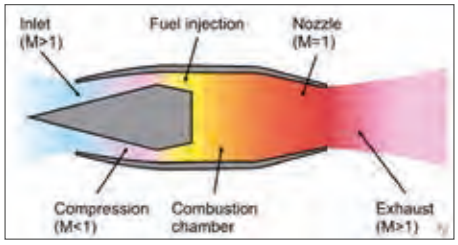
Results

After understanding the physical phenomena, the goal was to characterize them with mathematical equations which are used for numerical simulations in association with physical and chemical models. Indeed, the first simulations had to be physically correct. For example, an increase in the inlet velocity had to lead to a change of the fuel jet shape. A comparison between experiments and simulation results was conducted. We based our comparison on experiments conducted in 2006 at the University of Cincinnati, on transverse water injection into air. The main parameter we compared was the jet inner and outer boundaries. Those boundaries are described by empirical formulae to which we compared our results. The numerical inner and outer boundaries match the experimental results. The next step is to implement new physical models to our simulation in order to fully describe the liquid fuel injection.

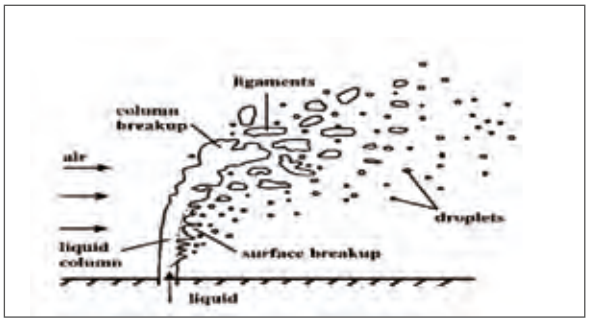


Numerical simulation of a liquid jet

Keywords:
liquid injection, numerical simulation, atomization



Ramjet engine



Liquid jet atomization

Contact: jeremie.dagaut@etu.univ-orleans.fr ; david.menager@etu.univ-orleans.fr

Analysis, characterization and control of ramp flow separation

Mechanical engineering

B. NGOUE

P-H. N'ZI

Brice NGOUE / Paul-Henri N'ZI
Academic supervisors: A. KOURTA , N. MAZELLIER
Industrial supervisor: J-P. ROSENBLUM

Company: GDR 2502, Dassault Aviation

Objective/motivation

Over the past decades, flow control has attracted much attention to address challenging economical and societal issues related to industrial applications. Indeed, as environmental constraints are increasingly urgent, vehicle consumption and gas emission reduction are essential. One solution may be the reduction of aerodynamic resistance and recirculation areas induced by a moving body in a flow. To reach this goal, we have to control the flow separation from which a recirculation zone originates and which is responsible for significant energy losses. The study of separation phenomenon and its control is studied on a receding ramp tilted at 25°. Although this model is an academic case, it is representative of industrial geometries in road and air transport. This type of flow features strong unsteady zones where the boundary layer separates close to the ramp and reattaches after creating a recirculation bubble.

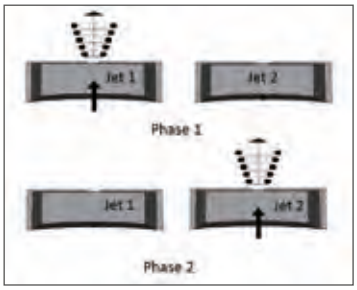


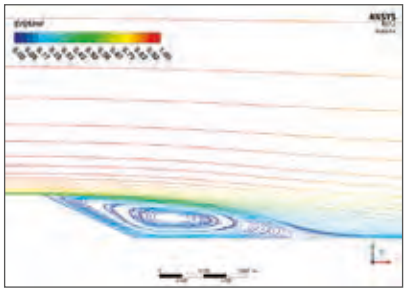
Illustration of oscillating pulsed jets

Results

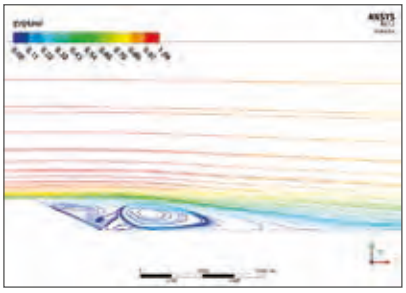
A first part is devoted to the characterization and the understanding of physical phenomena occurring in the flow next to the ramp. The second part is about the flow control, especially how to control the separation. We will use 2 solutions to control the flow: "Synthetic jets", a membrane which oscillates in a cavity, creating suction of the fluid coming from the upstream of the geometry and then blows out the same quantity of fluid; and "Oscillating pulsed jets", the principle of which is close to that of synthetic jets except that we have two adjacent cavities which blow out fluid one after the other. According to the application, these flow control techniques allow us to improve or deteriorate performance.

Illustration of synthetic jets

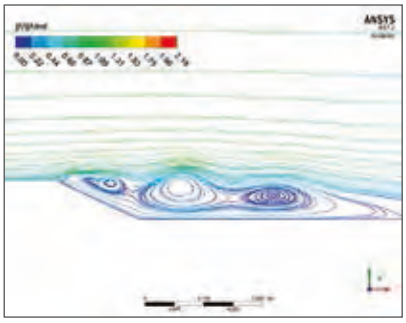
Keywords: synthetic jets, oscillating pulsed jets, flow separation, turbulence, 25°-ramp



Natural ramp flow



Ramp flow controls by synthetic jets



Ramp flow controls by oscillating pulsed jets

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Analytical energy management law for a series hybrid vehicle (SHB)

Mechanical engineering

M. ZHANG

S. ZHANG

Mengyu ZHANG / Sihan ZHANG
Academic supervisor: G. COLIN
Industrial supervisor: S. HADJ-SAID

Company: Renault

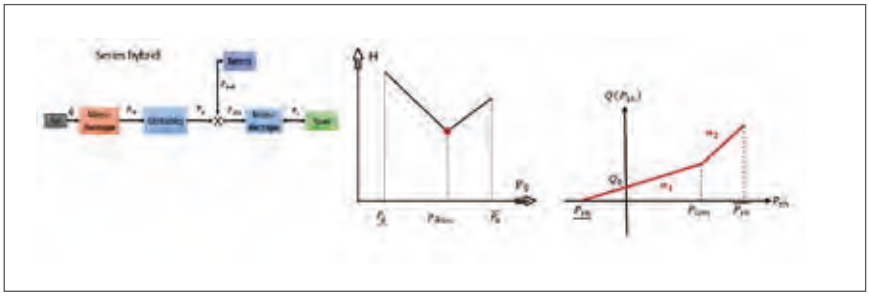
Objective/motivation

The purpose of our project is to optimize the consumption of energy for a series hybrid vehicle of a certain model. First of all, we need to determine the model which will be analyzed. This model uses two distinct types of power: internal combustion engine plus electric motor. In a series hybrid vehicle, the user pedals a generator, charging a battery or feeding the motor, which delivers all of the torque required. The next step will be to calculate the optimal order according to the simplified models. We assume that the vehicle has a velocity 'V' and an acceleration 'a'. We use both combustion engine and electric motor to provide the driving force needed. According to these conditions, we could calculate and finally find out in which condition the consumption of energy (petrol) will be the lowest.

Results

Based on the models of internal combustion engine and other components of the series hybrid vehicle system, applying Pontryagin's minimum principle, the problem is obtained mathematically—the optimal output power of generator and the rotational speed of the vehicle are solved in three different conditions. With the data of the cycle ARTEMIS, which is a standard American urban cycle, the optimal control will be found by Matlab, which means the minimum fuel consumption can be reached if controlling those two variables. In conclusion, it is a simplified problem and the results are able to be applied to several types of vehicles.

Keywords: series hybrid vehicle(SHB), combustion engine, electric motor, consumption, energy



Schematic of the project

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Bench conception of a hybrid UAV and components sourcing

Mechanical engineering

P. FABRE

C. JONDEAU

Pierre FABRE / Clément JONDEAU
Academic supervisors: C. BOURILLON, G. COLIN, J. FANTINI
Industrial supervisor: A. VIDALING

Company: Skydrone

Objective/motivation

The main goal is to multiply the autonomy of an unmanned aerial vehicle by adding a thermal engine to reload the battery while flying. Combining the power of the gasoline engine and the accuracy of electronic driving seemed an attractive challenge to us. We had to characterize the gasoline engine on a power bench while the other team worked on the power management of the system. These two aspects must be precisely related to each other in order to run the propulsion device properly. This project will give us a first approach of the teamwork of an engineer in an innovative company. Moreover, it will require the skills that we have acquired up to now combined with a sense of coordination. The combination of multiple aspects was the reason why we chose this project.

Results

A first meeting with the company gave us the information and the material that we need to work on. After that, we bought a couple of components which are needed to run the engine. We finally built a test bench to characterize the engine. The first test made us realize that the electric machine was not properly linked into the engine. Moreover, we also needed to set up the carburetor to reach an optimal operating point. Now we have a correct engine running on the bench and we are creating parts to make the test bench able to run with the electric machine. Once these parts are ready, we will have to connect the generator in order to characterize it. We will know if this machine can start the engine and what power it can generate. We will finally conclude with the use of a hybrid propulsion device.

Keywords: Hybrid Drone Autonomy Vehicle

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Characterization of two turbojet test benches

Energetics

Jules BOUEDEC
Academic supervisors: P. BREQUIGNY, G. COLIN

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

Institution: Polytech Orléans

Objective/motivation

In a way to improve the quality of the training at Polytech Orléans, the management staff of the TEAM department wanted to add some new practical works in the aeronautic field. To do so, and as a first part of the project, they have invested in a new virtual test bench which simulates the total behavior of a turbojet. This test bench works as an experimental tool useful for applying the theory seen in lectures. The objectives of this project were to create new practical works based on this new test bench. As a second part of this project, my teachers wanted to install inside a room at Polytech a real test bench adapted to a little turbojet. I had to budget the total cost of the room for a legal, safe installation of the bench.

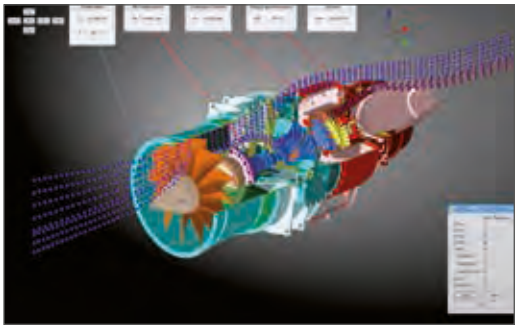
Results

We decided with the management team's teachers to center the work on two main practical works. The first practical work is centered on the "control study". In this work, students are guided to establish a global control of the turbojet. At the end, they have to test their work on a full flight cycle and prove that their work can be certified and applied on a real engine. The second work is centered on "the thermodynamic study". At the end, they will be able to understand how the simulation test bench works. Concerning the future test bench, I have researched in the acoustic field and in French law to find a good way to create a test bench. The acoustic study showed us that we should isolate the test bench room to control noise. The law research showed us the different procedures and costs to respect in terms of security and safety. All the tasks have been written in a financing file.

Test bench

Keywords: practical works procedures

Mini turbine



Test bench interface

Contact: jules.bouedec@etu.univ-orleans.fr

Cooling system for an electric go-kart's brushless motor

Mechanical engineering


P. CARDERA


K. LE DEM

Paul CARDERA / Kilian LE DEM
Academic supervisor: C. HESPEL
Industrial supervisor: C. BOURILLON

Institution: Benjamin Franklin High School, Orléans, France

Objective/motivation

The Limoges French International Pedagogical Meeting of Electric Kart e-Kart 2017 is a meeting of high school students who build electric go-karts. To attempt this competition, a student team of the high school "Lycée Benjamin Franklin" bought a second-hand thermic engine go-kart a few years ago. First, the chassis was adapted to fit new specifications: 4 high-capacity lead batteries and an electric motor. For this year, the new team is sponsored and they bought a new brushless electric motor. This motor is more powerful and more resistant because it is sealed against water and dust. However, with this motor there is risk of overheating. That is why the motor is equipped with a water cooling inlet and outlet. Our project is to help high school students with our knowledge in thermics and design the cooling system.


Cooling system detail

Results

After the theoretical study of the motor heating, we will be able to define the next steps of the project: decide if the motor needs a cooling system (theoretical thermic study of the system/Excel preliminary calculation and sizing); if a cooling system is needed, define the physical characteristics of the radiator (numerical simulation on Matlab/Simulink); write a request for proposal for different cooling systems; create the mechanical parts to set up the materials (design of the cooling system/water pump, intercooler, pipe, adaptation to the chassis); create a complete report of our tasks; and perform racetrack tests and verifications on the new go-kart.

Keywords: cooling system, go-kart, electrical, motor, thermal


Motor and cooling system


Brushless motor


Devcon DVT software

Contact: paul.cardera@etu-univ.orleans.fr ; kilian.le-dem@etu-univ.orleans.fr

Determination of heat transfer correlations in cross flow for tube bundles

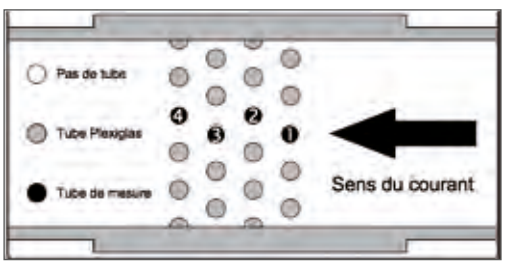
Energetics

Guillaume CARRARA
Academic supervisor: M. CAILLOL
Industrial supervisor: M. MERRIAUX

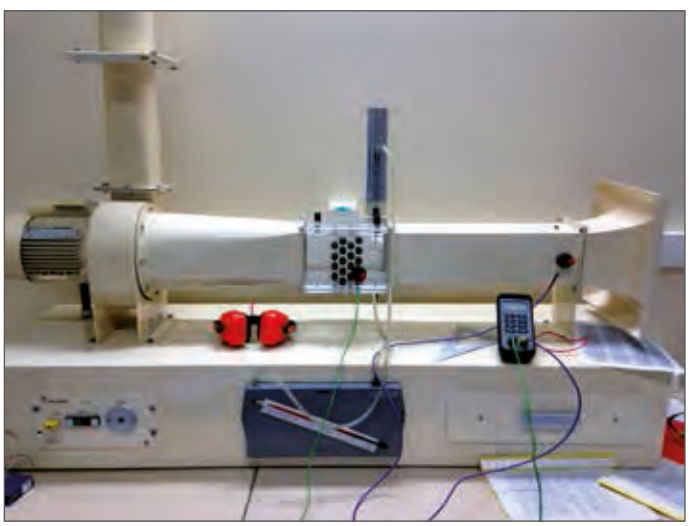
Company/Institution: undisclosed

Objective/motivation

I'm working with a company which proposes this project and their goal is to optimize the efficiency of heat exchangers. To achieve this goal, we need to focus on the fluid behavior and then determine correlations about it. My project is divided iton three parts: the experimental, computational and analytical aspect. The experimental part: from a test bench, currently in one of our rooms and which is supposed to simulate a real heat exchanger, I have to make a database with different speed velocity, temperature and so on. With these data, I have to determine correlations which correspond to the fluid behavior and the position of the tube within the heat exchanger. The goal is then to compare these correlations with others found in my bibliographic research (analytical part). Finally, the computational part: The goal is to simulate with a Computational Fluid Dynamics software (Fluent in our case) the behavior of the fluid within the heat exchanger. First, I have to carry out several simulations to refine my mesh around my cylinders and then apply the appropriate hypothesis to the fluid to approach to the reality as much as possible. At last, a comparison of these results with the results found in the analytical and experimental part will be carried out. Ideally, I should run simulations for two types of fluid, air and water because in the heat exchanger used by the company there is water but in the test bench used in the experimental part there is air.



Tube bundles



Test bench

Results

Results not disclosed

Keywords: correlations, heat exchanger, CFD, fluid

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Determination of parameters related to the evaluation of macroscopic physical properties

Energetics, Smart building

Elias LACHIRI HADDACH
Academic supervisor: J-M. FAVIE

POLYTECH ORLÉANS
École d'Ingénieurs de l'Université d'Orléans

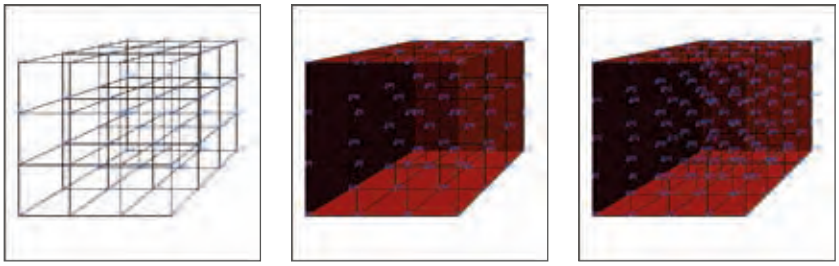
Institution: Polytech Orléans

Objective/motivation

The aim of the project is to define the impact of porosity, permeability, and diffusivities of a heterogenic multiphase system on the temperature inside a model by using the value of the exchange coefficient. This study will be applied on building construction. The entire project is about programming temperature inside a model (cube) by the software PHP, which is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. The code enables the meshing of the model and control of all the thermal conductivity (the effect of different values affected to the thermal conductivity on the temperature inside the model) in the equations, that varies according to the characteristics of the position of the point where we are calculating the temperature.

Results

We obtain a code that controls all the parameters defined in the temperature equations and the different flow that crosses the model (six cube surfaces (Conduction-Convection)). The code allows us to quantify the deviations according to the calibration solution. The calibration solution is an example of a big cube divided into 27 cubes where the thermic conductivity, lambda, was initialized at 1 $W \bullet m^{-1} \bullet K^{-1}$. This solution will serve as a reference that will enable the comparison between a single-phase system and a biphasic one. To visualize the temperature variations, the code divides the cube into four surfaces according to the chosen axis and draws the isotherms curves according to the temperature variations in the different surfaces.



Meshing

Contact: eliaslachiri@gmail.com

Determination of the relaxation coefficients of the Ant Colony Optimization (ACO) method for the control of heat exchanges

Thermodynamics

Nicolas TRAFNY
Academic supervisor: J-M. FAVIE

Company: Thermor

Selected participant
11th Annual Final Year Projects Forum

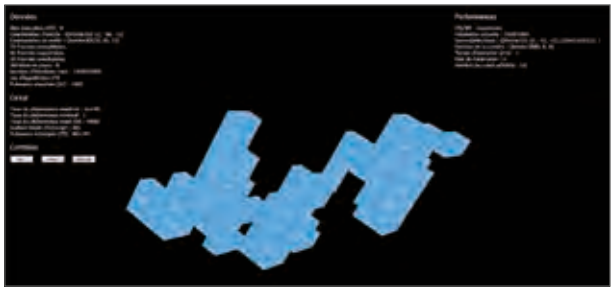
Objective/motivation

This project consists of designing a software able to find the most effective geometry for a heat exchanger with fixed constraints of space, power and temperature. The goal is to find a new optimal geometry for heat exchanges in order to reduce the energy consumption of many systems and to offer a new approach for the heater designers. The software is designed in C++ and uses the QT and OpenGL libraries. Otherwise, it's based on the Ant Colony Optimization method which mimics ant colonies' behavior.

Results

The software is able to find the most effective geometry for a heat exchanger with fixed constraints of space, power and temperature. Based on the ACO method, the software mimics the ants' behavior and designs a new geometry every millisecond. Many parameters can be managed: the location of flow intake and outlet, the size of the field, the number of ants, etc. After launching the algorithm, thousands of geometries will be generated and displayed every minute. Then, the number of geometries will decrease and finally the software will display only one of them: the most effective. Actually, the convergence time is long (around 5 hours). After each launch, the user can observe a solution and have access to a thermodynamic simulation to see the profit given by this new geometry.

Keywords: Ant Colony Optimization, heater, C++, IT, software, environmental impact



Contact: nicolas@trafny.net

Eboost prototype of the hybrid vehicle

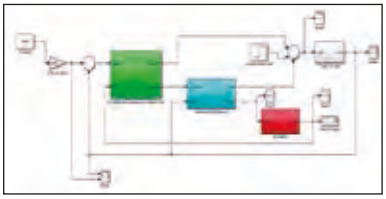
Mechanical engineering

Mehdi AZIZ
Academic supervisor: A. CHARLET
Industrial supervisor: E. DUARTE

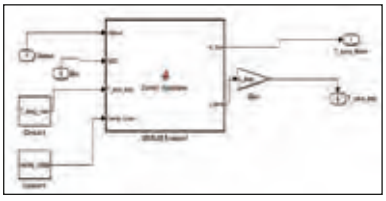
Company: John Deere

Objective/motivation

The aim of this project is to develop a model of an electric system composed of an electrical engine and batteries on Matlab/Simulink to hybridize John Deere tractors. The purpose of this electric hybridization is to provide an electrical boost to the existing ICE (Internal Combustion Engine) of John Deere tractors so that the speed drop due to load impact at low speed can be avoided. A competitive study (benchmarking) had to be done to avoid copying the existing technology. The characteristics were chosen from the collected data. The model aims to decrease the "recovery time" of the ICE. The simulations will be done at John Deere using their tractor ICE model and our electric model. According to the results obtained upon completion of the simulations, a feasibility study of the technology modeled will be done.



Simulink model

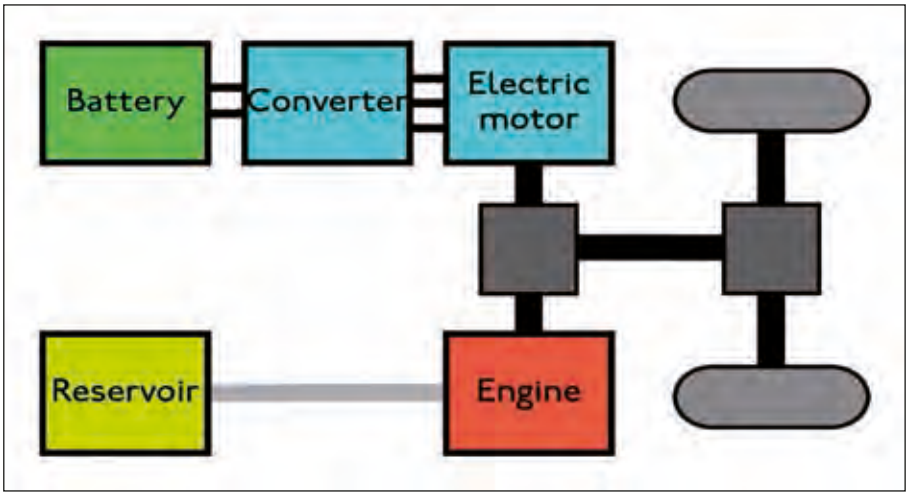


Hybrid system control

Results

The benchmarking part has been approved by the supervisors, leading to the next part. In this part a suitable brushless DC motor was chosen along with the battery as per the requirements of the model. A prototype model of the electric part of the engine was done on the software Simulink. This model is speed controlled. The characteristics of this model are derived from the data mapping done earlier. Following that, some simulations were done. The simulation was completed successfully with some warnings from the system for specific parts like the battery. The curves obtained show that the model developed fulfills the requirements to some extent although the model still requires some changes for better optimization. The response of the ICE at lower rpm is expected to improve with the boost provided by an electric engine.

Keywords: hybrid vehicle, electrical boost, Matlab, simulation, speed control



Parallel hybridization

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Eco-driving optimal control problem for conventional and electric vehicles

Mechanical engineering


P. BAUDRILLARD


R. VIGNALI

Paul BAUDRILLARD / Romain VIGNALI
Academic supervisors: G. COLIN, K. GILLET

Institution: PRISME Laboratory

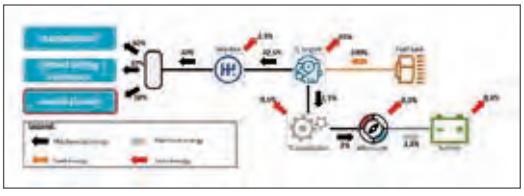
Objective/motivation

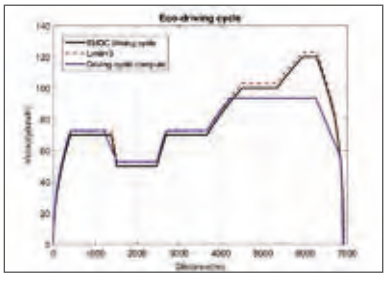
Eco-driving is a term used to describe the energy efficient use of vehicles. It is a major way to reduce energy consumption by road transport so that less energy is used to travel the same distance. The eco-driving problem was studied for three different types of vehicles: conventional vehicles, electric cars and hybrid electric cars. Under contract with PSA, PRISME laboratory has developed a user interface on Matlab which generates an eco-driving trajectory of a vehicle. The interface can use a real driving cycle like WLTP (Worldwide harmonized Light Vehicles Test Procedure). The interface gives information about torque, gears, speed and energy consumption. The global objective of this project was to study the interface behavior for each type of vehicle.

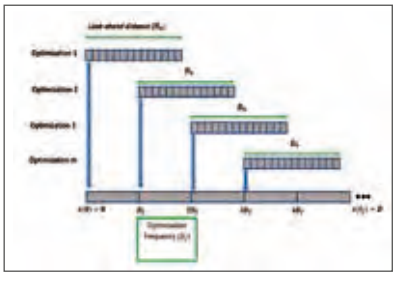
Results

In the interface, there are some parameters to adjust in order to obtain the best optimization of energy consumption. A big part of our work was to determine theoretical laws between some of those parameters. Moreover, in real situations, future driving conditions (speed limitations and traffic information) are uncertain. They depend on many factors such as local traffic, infrastructure status, non-vehicle actors and weather conditions. To deal with this situation, dynamic optimization approaches based on Model Predictive Control (MPC) techniques were considered as an effective solution.

Keywords: eco-driving, conventional vehicles, electric cars, driving cycle computation


Conventional vehicle model


Simulated driving cycle


Model of predictive control scheme

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Energy balance of the latest Toyota Yaris hybrid

Mechanical engineering

Ningyu NIU
Academic supervisor: G. COLIN
Industrial supervisor: P. BREJAUD

Institution: University of Orléans, Polytech Orléans, IUT of Orléans

Objective/motivation

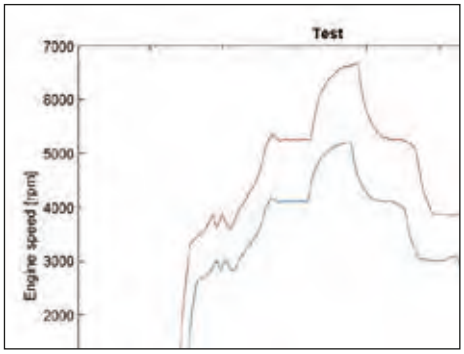
The University of Orleans received a hybrid electric vehicle, the Yaris, as a gift from Toyota last year. For use in practical classes, first it is necessary to have access to the various variables of the vehicle including the state of charge of the batteries, engine speed, fuel consumption, etc. For this project, the Controlled Area Network Bus needs to be learned, and tests on different rolling cycles are carried out to get data with CAN communication tools. Decoding CAN frames is the first important task. In order to check the quality of the data acquired, an energy balance needs to be done. Then a model of the vehicle will be built. The operation of the Hybrid Electric Vehicle with its energy management strategy will be detailed.

Results

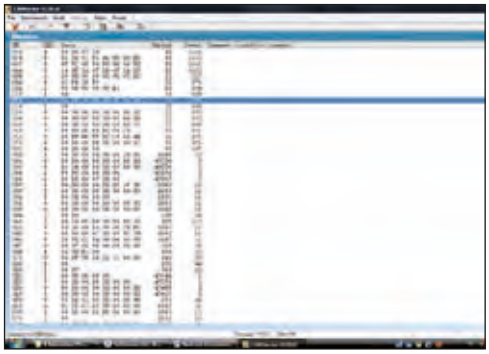
By the bibliographic study, the CAN bus of the Yaris has been learned. The tests are first carried out on the conventional Toyota Yaris. Two softwares are used to acquire CAN data: one for the raw data (CANHacker) and one for the decoded data (Techstream). Since the data obtained by CANHacker can't be read directly, a program of decoding is written in Matlab in order to identify the identifier of CAN message. Then, a correlation between the data acquired by the two softwares is done in order to decode the raw data. For the preparation of the tests on the hybrid Yaris, some previous work on Prius 2 has been read.

Keywords: CAN bus, decoding, HEV, energy balance

Toyota Yaris



Engine speed comparison between CANHacker and Techstream



CAN Message received with CANHacker

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Engine test bench post processing results using a 0D AMEsim model

Energetics


V. SENQUE


S. TARTIERE

Vincent SENQUE / Simon TARTIERE
Academic supervisor: P. BREQUIGNY

Company/Institution: undisclosed

Objective/motivation

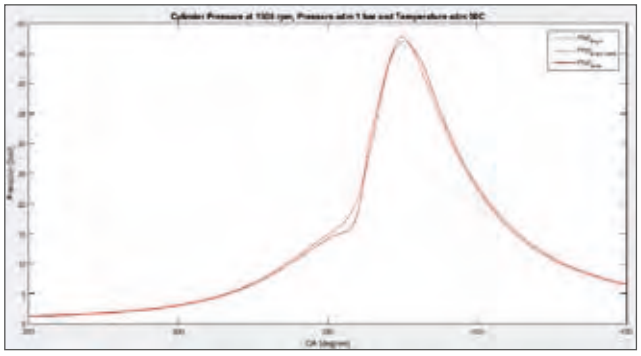
Our project mainly revolves around the post processing of the engine test bench results from the PRISME laboratory. In 2005, a researcher named S. Richard developed a 3D internal combustion engine model on a software called AMEsim. In 2009, Richard downgraded the model to a 0D model so it could be used to post process test bench results in order to deduce values such as the heat release, knock delay and pollutants. The downgraded model was very useful for the laboratory as it enabled researchers operating the PSA EP6 engine test bench to calculate the values previously mentioned in a precise way. The model was adjusted in order to provide the same pressure values as the real engine so the calculated values are close to real expectations. The goal of our project is to put the downgraded model back into use as the researchers are interested in using it for their work.

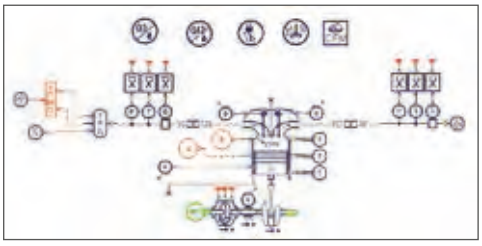
Results

We spent the bulk of the time that was dedicated to the project debugging the old AMEsim model and the Matlab code that was last used by a doctoral student named Jianxi ZHOU. Once we managed to debug both the model and the Matlab code, we had to calibrate the model's thermodynamic compression ratio in order for the model geometry to be comparable to the real engine geometry. To do so, we used the optimization function that is integrated in our Matlab code to modify the compression ratio until the in-cylinder pressure of our model was identical to the real life in-cylinder pressure. Once that was done, we checked that the in-cylinder pressures were still identical when taking into account the combustion of methane and isooctane. Finally, we wrote a user manual for the people that will be post processing the EP6 engine test bench results using our model and our Matlab code.

Keywords: engine, test bench, post processing, AMEsim, model


EP6DT engine


Cylinder pressure graph


AEMsim model of EP6DT engine

Contact: vincent.seneque@etu.univ-orleans.fr ; simon.tartiere@etu.univ-orleans.fr

Evaluation of CFD SU2 on axial and centrifugal rotors

Mechanical engineering

H. DIAGNE

M. TOURKI

Hawa DIAGNE / Mayssoun TOURKI
Academic supervisor: N. MAZELLIERS
Industrial supervisor: S. RAYNAL

Company: Altran

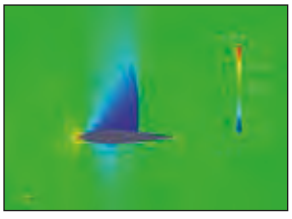
Objective/motivation

In this work, which is carried out in collaboration with Polytech Orléans and the company Altran, leader in the consulting and engineering market, we will study the software SU2. Altran has suggested this project because of the growing need of aeronautical engine constructors to optimize the performance of their machines by the optimization of their components. For that, Altran has set an internal project called FEPS (Fluid Energetics in Propulsive Systems) to create and develop an optimization tool with the ability to do a 3D CFD simulation. The subject of the project is to test SU2 for simulations of two types of rotors, a centrifugal and an axial rotor called ROTOR 67. This kind of test is known in the world of CFD simulation to confirm the performance of a solver and to know its capacities and limitations.

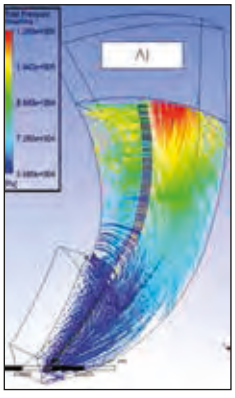
Results

To get familiar with SU2, we did test cases provided with the installation package of the software. Indeed, this part is intended to suit the solver and to know its different functionalities. Since we mastered the basic cases with success, we could set up the configuration files and launch the simulations of the axial and centrifugal rotor. During this part, we proceeded with the exploitation of the different models used by SU2 to carry out the simulations of the rotors (grid model, turbulences, etc.). SU2 is quite simple to use for external aerodynamics simulations and matches with the criteria of a reliable CFD software, in terms of accuracy and rapidity of the calculations. However, for ducted flows with rotating geometries like rotors, our challenge remains difficult to meet.

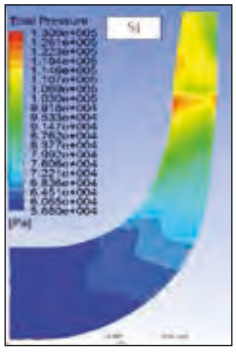
Keywords: rotor, centrifugal, CFD, axial, simulation



Pressure



Centrifuge image 1



Centrifuge image 2

Contact: cfd.su2@gmail.com

Instant Energy Performance Diagnosis using infrared photography

Energetics


A. CARRICART


G. MUNIER

Alice CARRICART / Guillaume MUNIER
Academic supervisor: J-M. FAVIE

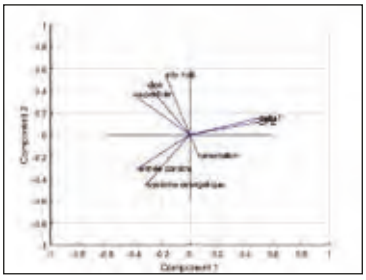
Company/Institution: undisclosed

Objective/motivation

The purpose of our project is to find whether, using infrared pictures of outdoor walls, we can correlate the temperature gap between outdoor walls and the outside to the diagnosis of energy performance of a house. This would finally decide whether thermal cameras can be used in another way than they are now used (for educational purposes). In order to see if we can correlate it, we use a statistical treatment called PCA (Principal Component Analysis), which allows us to quantify the correlation between the criteria and the DEP. Those criteria are, for example, the age, sex, profession, and number of inhabitants. We need a lot of data from different houses to make the statistical analysis, and those data are very difficult to obtain.

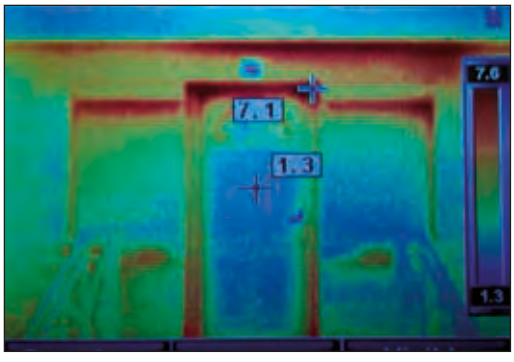
Results

After finishing the Matlab program for the PCA, we needed data in order to make it work. We tried to get infrared pictures with our thermal camera, but we only had ten pictures after two hours of walking in the streets during the night, and the more the better. We then tried to contact some governmental companies which organize what they called "thermographic walks", in which they show some private individuals the need for good insulation, in order to get their IF and DEP pictures, but we had either the DEP or the infrared pictures but never had both. We couldn't have results due to the missing data. In order to get them all together, we went to the same houses where we had taken pictures in order to ask the residents for information. We only had three responses which is so low that we cannot draw conclusions, but the program is ready to be used as soon as more data is available.


PCA on our data

Keywords: DEP (Energy Performance Diagnosis), thermal, infrared, statistics, PCA (Principal Component Analysis)


Picture of a house at night



Infrared view of the same house at night

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Numerical analysis of head losses in an aircraft engine fuel manifold

Mechanical engineering, Energetics

R. BESSET

A. DENIS

Romain BESSET / Alex DENIS
Academic supervisors: P. BREQUIGNY, C. HESPEL, N. MAZELLIER
Industrial supervisor: B. AUTHIER

Company: SENIOR Aerospace ERMETO

Objective/motivation

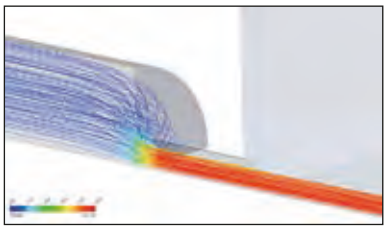
SENIOR Aerospace ERMETO, based in Blois (41), has made aerospace hydraulic components its main activity since 1995. It is specifically in charge of the machining of fuel manifolds and injectors for aircraft engines. Injectors are composed of three different parts: the body, the diaphragm, and the head. After carrying out some experimental tests of the manifold set and injectors, it appears that initial pressure conditions and the diameter of the diaphragm have a direct impact on the flow rate measured at the injectors outlet. SENIOR Aerospace ERMETO would like to better understand the behaviour of the kerosene flow and then to predict the outlet flowrate for each initial condition. The project will then be focused on the numerical analysis of head losses in the manifold and injectors. Different models will be delivered as a complement to experimental data.

Aircraft engine

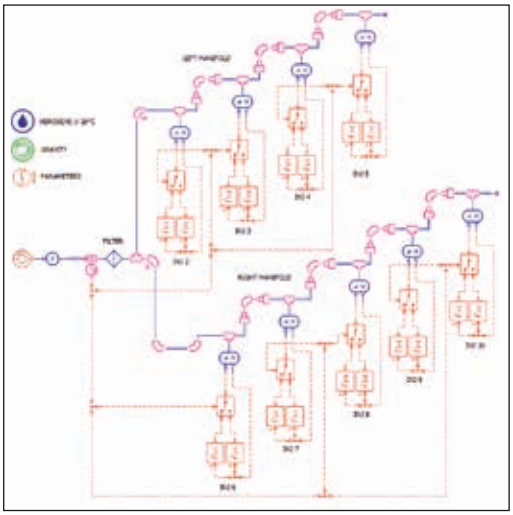
Results

Calculations of each component of the manifold are carried out in both LMS AMESim (1D) and ANSYS Fluent (2/3D). In AMESim simulation, each head loss source is defined thanks to the Idel'cick laws and then corrected by a factor to be the closest possible to the experimental data. The CFD model is then used to check the 1D results which don't consider all the fluid phenomena caused by the manifold geometry. After a month and a half, the injector model is completed and a first version of the whole manifold model has been presented. The results matched our expectations. Nevertheless, this model must be improved as the AMESim and Fluent simulations don't give exactly the same results, especially concerning the flowrate distribution. Otherwise, a user-friendly dashboard has been designed to control the model by changing the inlet pressure and the diameter of the diaphragm. This tool should be useful to avoid carrying out costlier experiments.

Keywords: numerical simulation, ANSYS Fluent, LMS AMESim, head losses, fluid dynamics



Diaphragm CFD calculation - ANSYS Fluent



1D model of the manifold - LMS AMESim

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Numerical simulation of the internal combustion engine with the CFD code CONVERGE

Energetics


O. NOGUES


A. SYLLA

Olivier NOGUES / Aly SYLLA
Academic supervisor: P. BREQUIGNY

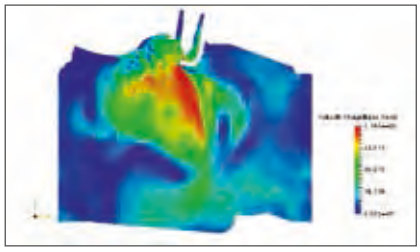
Company/Institution: Groupe PSA, PRISME Laboratory

Objective/motivation

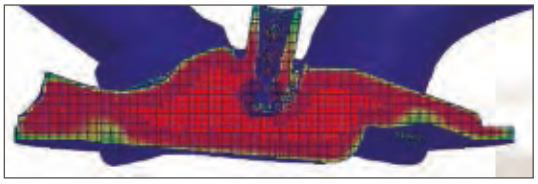
The design and manufacture of the Internal Combustion Engine (ICE) constitute the major concern of car manufacturers. Because of performance needs and for economic and environmental reasons, car manufacturers must develop more innovative solutions for future engines. The design and combustion phenomena inside the cylinder constitute some parameters of the engine with a non-negligible influence on its performance, its fuel consumption and the formation of pollutants. Digital tools such CFD are mainly used to control these essential parameters in order to improve engine performance and predict the formation of pollutants. The project consists of doing a numerical simulation with the CFD code CONVERGE of an ICE which is called EP6CDT and was designed by PSA. It is currently being tested on the PRISME Laboratory test bench. The aim of the study is to compare simulation results to those provided by the experimentation and to write some tutorials for future academic use of the software at Polytech.

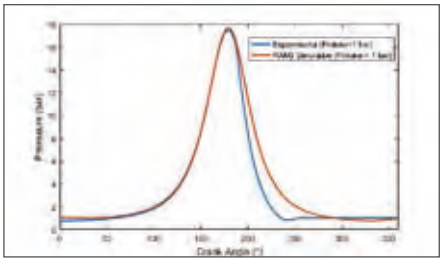
Results

During the first two weeks of the project, we learned how to use the software CONVERGE by simulating different cases for engine applications. Then we started our simulations on the engine EP6CDT whose geometry has been provided by PSA. Then we focused our study only on the design and combustion phenomena inside the cylinder of the EP6CDT. For the design study, the simulations have been conducted to simulate the behavior of the flow phenomena during the full operating cycle of the engine. The CFD results at a speed of 1500 rpm allowed us to visualize the tumble inside the cylinder on 3D geometry and to get a maximum cylinder pressure of 17,5 bar close to the experimental value at 17,4 bar. Finally, for the combustion modelling, by using two different fuels, methane (CH4) and isooctane (IC8H18), and different models of combustion, we obtained good tendencies compared to the experimentation.


Aerodynamic results 1500RPM

Keywords: energetics, CFD, combustion, engine, design


Combustion mesh


Comparison aerodynamic results 1500RPM

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Numerical study of the unsteady atmospheric dispersion of pollutants

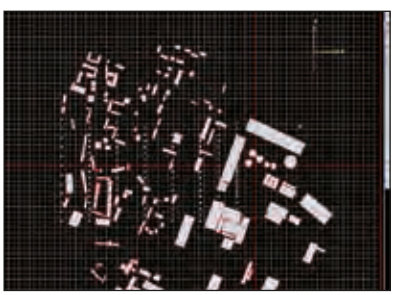
Energetics

Moussa ABADA
Academic supervisor: Ana IBARRA VELAZQUEZ
Industrial supervisor: A. TRIPAHI

Company: Fluidyn

Objective/motivation

As part of the "Dysco" project, a numerical analysis of the unsteady atmospheric dispersion of pollutants will be developed. In the project, the experiment is situated on an industrial site, close to Toury (Eure et Loir), and the analysis is focused on the potential pollutants emitted from a pool fire accidentally ignited in a containment basin. The configuration is characterized by having an area-source placed in a complex topography. The studies of atmospheric dispersion of substances released into the environment have increased over the past few decades due to the challenges in human health and environmental care that human settlements have to face. Due to the fast development and intensive usage of numerical tools in the past decades, the modelling of pollutant dispersion has considerably progressed, making Computational Fluid Dynamics (CFD) a good tool to provide the whole flow and dispersion field data. The software FLUIDYN has a module dedicated to atmospheric dispersion called PANACHE; such a module will be used during this study. A variety of cases will be developed and results will be compared with their corresponding experimental counterparts.

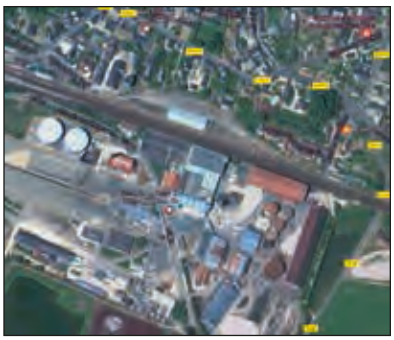


Industrial site modelization on Fluidyn Panache

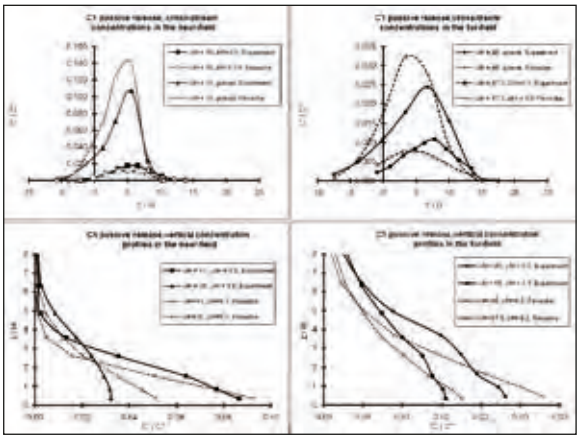
Results

During the first weeks, we focused on reading the tutorial of the Software FLUIDYN Panache. Although FLUIDYN is a well-known software, this is quite new for us so we needed some time to get accustomed to this system. In the meantime, we visited the Lucien Malavard wind tunnel in order to check the scale model of the industrial site we had to study. The next step was to run a variety of different tests with different entrance conditions by specifying the properties of the source data, which correspond to the area from where the pollutants will be released. All those properties have a great effect on the results. Indeed, depending on the velocity, the mass flux or the meteorological parameters, the results will differ significantly. To measure the concentration of pollutants in different places, we plotted one hundred monitor points that gave us information about the evolution of the pollutants on the industrial site.

Keywords: atmospheric dispersion, cfd



Toury industrial site



Concentration profiles

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Optimization of a drying nozzle and the assembled box

Mechanical engineering


J. WANG


J. XING

Junsong WANG / Jian XING
Academic supervisor: N. MAZELLIER
Industrial supervisor: B. SIX

Company: Komori-Chambon

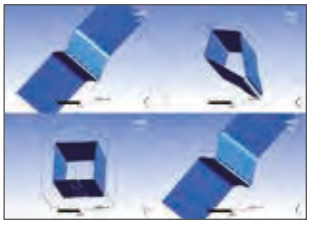
Objective/motivation

The drying system is one of the key components of offset pointing, and its energy consumption in the production is considerable. The objective of this project is to optimize a blowing nozzle of a rotogravure dryer and reduce using cost. The product to be dried is a sheet of board covered with an ink deposit. The essential factors of drying include temperature, velocity and distribution of hot wave. According to the problems above, a computational fluid dynamics (CFD) method and a CFD software will be implemented to optimize the structure of the drying oven. To reduce the cost and simplify manufacturing, the nozzle will be shaped to increase the velocity of air and distribute the air evenly.

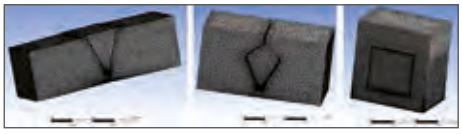
Results

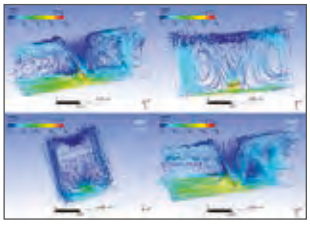
Due to the limitation of numbers of elements in mesh, as well as the accuracy of computation, it's impossible to simulate all nozzles; only some nozzles could be simulated. According to the three models supplied by the client (V-shaped nozzle (original model), diamond-shaped nozzle, rectangle-shaped nozzle), three methods were proposed to improve the efficiency on the basis of the original model. The first is to shorten distance between nozzle and carton, the second is to add holes in the nozzle, the last is to shorten the distance on base of the second one. The models were divided into grid in Mesh, then the grid was optimized to simulate a boundary layer in the surface of high velocity and heat transfer. The results of 5 models were computed by the Viscous-SST k-omega model in Fluent. The diamond-shaped nozzle proved to be the optimized model with the best drying effect.

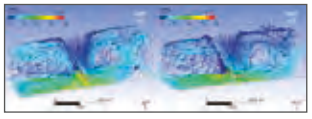
Keywords: rotogravure dryer, blowing nozzle, CFD


Physical model 1


Physical model 2


Meshing


Streamline 1


Streamline 2

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QBlade performance study

Environmental engineering

A. JEUNET

Antoine JEUNET / Ilan ROBIN
Academic supervisor: P. DEVINANT
Industrial supervisors: S. BOULESTEIX, C. MASSE, G. MILLOT

I. ROBIN

ALTRAN

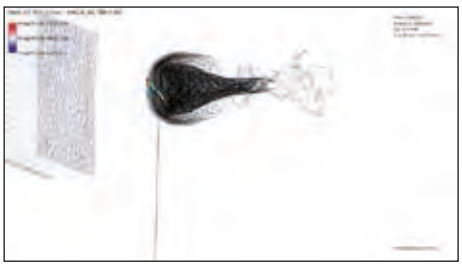
Company: Altran

Objective/motivation

In order to increase their range of action, ALTRAN is looking for new software dedicated to wind turbines. But before including a new tool in their commercial offer, they need to know its capabilities and limitations. That is why they told us to check the validity of the results of one of this software: QBlade. This Open Source software can simulate a complete wind turbine using different digital tools and could be used to predict the performance and the wake of every wind turbine. We had to compare all experimental data we had with the QBlade results. Moreover, we offered to write a more accurate practical manual than the one offered by the QBlade developers. We also agreed to study the impact of some QBlade functions results in order to predict the error.

Results

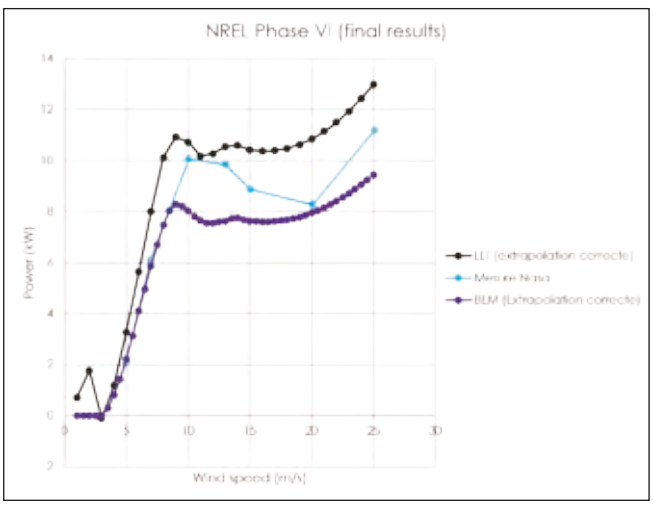
During this project, we learned to use QBlade, both in theory and practice. We also wrote different reports to describe our progress: QBlade tutorial; different methods of extrapolation (Montgomerie/Viterna); different calculation methods (BEM/LLT); performances; limits; impact of some factors on results. Each report contains comparisons between experimental and QBlade results. We concluded that the software is useful to predict wind turbine performances but that it is really sensitive to initial conditions. Finally, we presented our results to a team of engineers from Altran who wanted to compare QBlade to their own software, which is more expensive in terms of calculation.



Simulation QBlade

Keywords: wind turbine, aerodynamic simulation, performance study, QBlade, renewable energy

Pale QBlade



Deflexion result

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Rebuild and critical analysis of wing and tailplane aerodynamics of "L'Oiseau Blanc" of Nungesser and Coli

Mechanical engineering

X. TOUPET

S. VIOLETTE

Xavier TOUPET / Sébastien VIOLETTE
Academic supervisor: P. DEVINANT
Industrial supervisor: B. VAILLOT

Company: Galaxie Presse

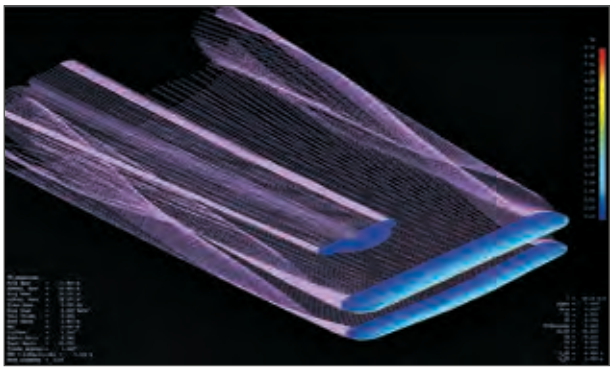
Objective/motivation

The goal of our project is the study of "l'Oiseau Blanc" the aircraft of Nungesser and Coli which attempted to cross the Atlantic ocean on May 8, 1927. We have to analyze the profiles of the wings and the tailplane of the aircraft. To this end, we will simulate them in the software XFLR 5 in order to calculate performance and technical characteristics of this new aircraft. The first step is to calculate each part individually to prepare all extrapolation of the software. The second one is to get them to function at the same time and get closer to the reality. Those calculations will conduct the model fabrication for the wind tunnel test. The final aim is to build "L'Oiseau Blanc" in real scale using new technologies.

Results

After a study on all profiles, we reduced the test to seven profiles instead of seventeen. We begin with the upper wing at cruising speed and we continue with the other parts at the same velocity. The study includes the comparison with mobile parts of the plane's wing and tailplane. The simulation of each part (profile, upper and lower wings and the tailplane) provide a recovery of the main characteristics of the aircraft and comparison with recent technologies. This comparison enabled us to replace the original profiles by fully controlled NACA profiles. These modifications can have an impact on all the preparation from simulation to production of this plane.

Keywords: aerodynamics, XFLR-5, simulation, wing profiles



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Study of boundary layer transition with sonic wall injection for hypersonic flight

Mechanical engineering

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Company: MBDA

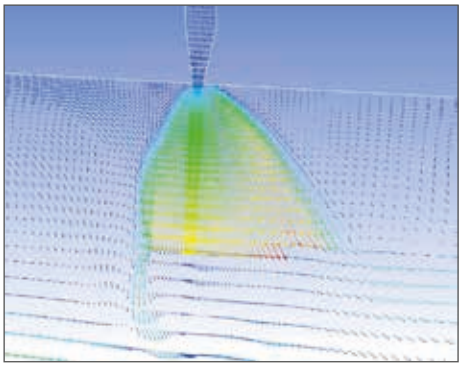
Objective/motivation

Due to the benefits of having a turbulent boundary layer on hypersonic vehicles, MBDA, a European leader in the aerospace and defence industry, wants to be able to manage the laminar-turbulent boundary layer transition for successful hypersonic flights. Passive devices already exist such as roughness on the body but the transition is systematic and cannot be controlled. The aim of this project was to study an active device that can be adjusted to match flight conditions: sonic wall-normal injection. The incoming flow considers the jet as an obstacle and this generates the transition mechanisms. In order to avoid having a tank on board to supply the injection, we want to use the total pressure generated at the nose of the vehicle and inject it into the boundary layer.

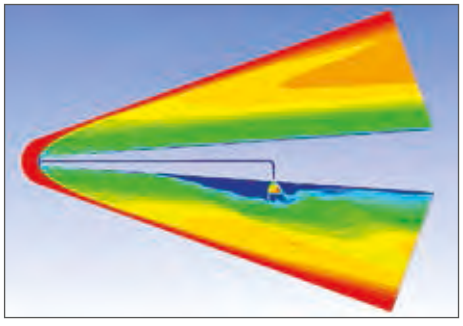
Results

First, we did a preliminary theoretical analysis, calculating the different data needed to clearly define all the shocks and flow features. The next step of the project was to design the geometry of our model with CAD (Computer Aided Design) software. Using the CFD (Computational Fluid Dynamics) Software Fluent, after setting up the materials characteristics, the numerical models and other data needed to compute, we simulated the flow around the vehicle and at the injection port for different flight conditions of speed and altitude. After this we started post-processing work to compare the results we had obtained during the simulations with our analytic ones. We are using pressure, velocity and temperature indicators to check our calculations and the observed jet is strong enough for an effective tripping.

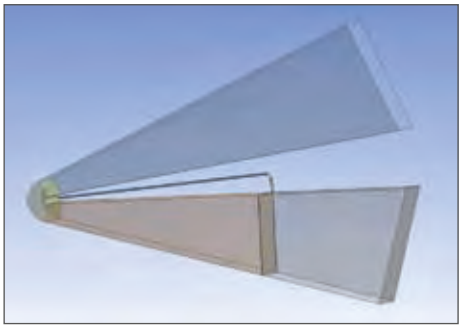
Keywords: CFD (Computational Fluid Dynamics), boundary layer transition, hypersonic, shock



Vectors following the Mach number at injection



Speed contours following the Mach number



3D geometry

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Study of filtration chamber for nuclear safety

Mechanical engineering


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Company: CAMFIL

Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

The purpose of this project is to understand how high-temperature air circulates in tight lock casings that can contain up to 12 filters. Is the temperature distribution totally homogeneous or not? Another purpose of this project is to observe the thermal aspect around the filters, which are made of steel. These tight lock casings are used only in case of emergency; they are the last barrier between the radioactive particle and the atmospheric air. When an accident occurs, the air is forced to go through the filter inside the tight lock casing before entering the atmosphere. We have to be sure that this system works well in order to avoid radioactive particles being released into the atmosphere.

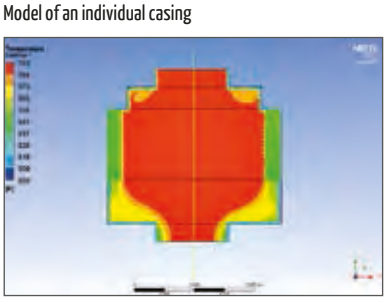
Results

For this study, we mainly worked on Fluent (a Computational Fluid Dynamics software). First, we started to study the tight lock casings with one filter inside, which we called “the box inside the box”. We had to simulate the porosity in the filter from the data the company gave us to be as close as possible to the real filter. Then, in order to observe the behavior of the fluid inside the tight lock casings, we visualized the temperature, the velocity and the pressure. Once it was done, we just duplicated the filter three times or six times according to what we had to study and we got similar results for each variable. We also noted that the temperature seems lower around the filter since there is not recirculation as we had supposed at the beginning of the project.

Keywords: filtration, nuclear, safety


Model of an individual casing


Model of a casing with 6 filters


Temperature distribution in an individual casing


Pressure distribution in a casing with 6 filters

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Tractor model simulator improvement

Mechanical engineering

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Company: John Deere Power Systems

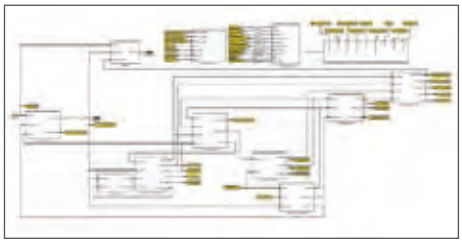
Selected participant
11th Annual Final Year Projects Forum

Objective/motivation

Nowadays, John Deere vehicles are increasingly efficient and comfortable. This is mainly due to the great improvements brought to the engines. They have to offer a level of performance but also respect much stricter emissions standards. The activity of John Deere Power Systems, based in Saran, is to develop, produce and sell engines for off-road machines, principally for John Deere but also for other brands. The only way they can check if their tuned engines will fit the vehicle is to put them in a real tractor, and test the expected performance, but this is a long and expensive process. The aim of the project is to improve a computer model of a tractor in order to simulate its behaviour according to the engine fitted to the machine.

Results

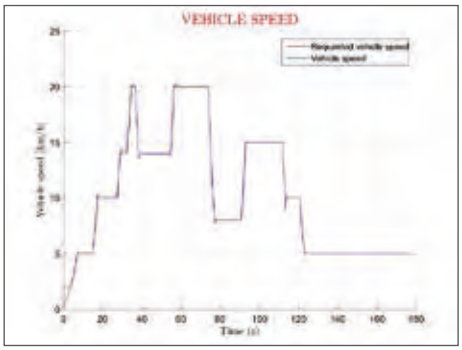
During this project, different aspects of the model were improved: the rolling resistance coefficient determined during a previous study was fitted to the model. The precision improvement was considerable. The wheel inertia, which is very important in a tractor due to the size and weight of this part, was determined thanks to the 3D files of the tractor included in the model. Now, the model is good: it follows speed set points well. For the future, it is necessary to include hydraulic losses and plan new tests on the real tractor to record the inputs (what the driver requires of the tractor) and the output of the system (what the tractor does) and put them into the model. It will thus be possible to compare the response of the real tractor and the answer of the model for the same inputs.



The Simulink model

Keywords: tractor, modelling, simulation, engine in the loop, performance

The tractor (John Deere 6195R)



The response of the model to a speed setpoint

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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 under the direction of Jean-Jacques Yvernault. 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.

For a list of all participants in the Final Year Projects Forum of 2017, please see page 155.

Our remarkable equipment

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 100m^2 is in service at the GREMI laboratory of Polytech Orléans. Students working in the Ecotechnologies, Electronics and Optics specialty carry out their practical work study projects in micro/nano-technologies and plasma processes in this facility.

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.

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 ambiant temperature up to 1600°C).

Index of students

Index of participants in the Final Year Projects Forum

1st place
2nd place
3rd place
4th place
5th place
Innovation Award
High Schooler's Choice Award

Index of participating companies and institutions

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