3TU.School for Technological Design

STAN ACKERMANS INSTITUTE

The innovation degree

Our selection of designer projects 2014

Contents

With pleasure we present a selection of projects conducted by our talented technological designers in 2014.
The technological designers' programmes of the 3TU.School for Technological Design, Stan Ackermans Institute lead to a Professional Doctorate in Engineering (PDEng) and offer trainees the opportunity to broaden their knowledge and experience in the field of technological design.

During the programme trainees spend their first year following a dedicated curriculum, which involves courses, interactive workshops and group and practical assignments, often in close cooperation with industrial partners. In the second year the designers carry out an in-company design assignment. University experts act as supervisors, providing state-of-the-art technology, advising on the structure and execution of the project and monitoring that the goals of the project are realised. During the design project, the trainees demonstrate their skills in being able to turn knowledge into innovative business solutions for the high-tech industry.

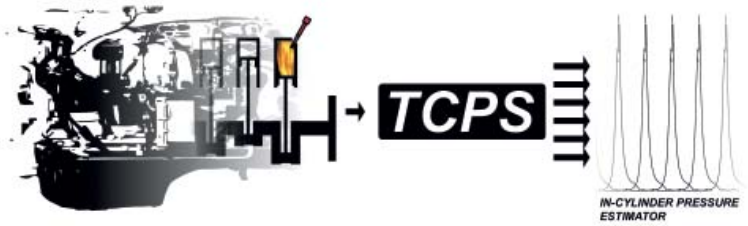
High-tech industry has high expectations with regard to the outcome of these diverse, complex and challenging design projects. Every year our PDEng trainees are challenged to meet the high requirements of the industry. To demonstrate the value of the outcome of the PDEng design projects, we've made a selection of the 2014 industrial projects for you and combined them in this publication. We hope you enjoy reading about the projects produced by our talented PDEng trainees.

With best regards,

Prof.dr.ir. Jan Fransoo
Director 3TU.School for Technological Design, Stan Ackermans Institute

Automotive Systems Design

Transient Cylinder Pressure Sensor Estimator for Heavy-duty Diesel Engines



"Not only did Serkan develop an algorithm that predicts individual cylinder pressure for highly dynamic diesel engine operation, he also managed to deal with the implications on software and hardware control architecture by his system engineering approach. With the practical realisation on a Rapid Control Prototyping system, his work is an important step towards application of TNO's TCPS technology in trucks."

Dr.ir. Frank Willems
TNO Automotive

With the introduction of mass production in-cylinder pressure sensors, closed-loop combustion control became feasible for engine control. This was beneficial for conventional diesel engines to enhance robustness against fuel quality variation, injector wear, (multi-pulse) fuelling accuracy and to minimise after treatment size. In addition, it enabled the introduction of high efficient, advanced combustion concepts, such as Homogeneous Charge Compression Ignition, Pre-mixed Charge Compression Ignition and Reactivity Controlled Compression Ignition, that all rely on controlled auto ignition. Although research shows that closed-loop combustion control is promising, the system costs related to the in-cylinder pressure sensors are assumed to be unacceptably high for truck engines. Also, the installation of pressure sensors increases the complexity of the cylinder head design.

This project introduces a new single cylinder pressure sensor concept with transient prediction capability for heavy-duty diesel engines. Using crank angle and in-cylinder pressure information from one cylinder pressure sensor, the unmeasured pressure signals in the five remaining cylinders are predicted by the combination of a real-time crank shaft model and an adaptation mechanism: so-called Transient Cylinder Pressure Sensor (TCPS) Estimator.

Using a system engineering approach, for a heavy-duty diesel engine, the potential of this concept is demonstrated under transient engine conditions. The simulation studies using experimental input data are performed for the estimator. It is shown that relevant combustion control parameters can be approximated with high accuracy. The TCPS implementation on real-time rapid prototyping hardware is also performed and system functionality is demonstrated for both conventional diesel and advanced dual fuel combustion.

Supervisor: dr.ir. Frank Willems, Senior Research Scientist at TNO Automotive
Trainee: Serkan Külah PDEng

TNO innovation for life

Bioprocess Engineering

Bio-syngas as Ethanol Fermentation substrate: Process Evaluation

"This design shows you what you can achieve with syngas fermentation."

Dr.ir. Henk Noorman
Delft University of Technology and DSM

Syngas fermentation is an alternative to lignocellulosic hydrolysate fermentation, to obtain products such as ethanol. The syngas may be obtained by biomass gasification. Clostridia, a.o., can convert syngas into ethanol. Potential benefits of this process as compared to lignocellulosic ethanol fermentation are: high yield on feedstock since lignin is also used; wider feedstock flexibility; no cellulosic enzymes needed; and no furanics and phenolics that inhibit fermentation.

A hypothetical thermophilic engineered strain was assumed that would only produce ethanol. At high temperature, such cells might be retained in liquid containing 50 g/L ethanol, leading to ethanol-rich off-gas. Calculation of the Gibbs energy of ethanol formation indicated 52°C as maximum fermentation temperature. Due to the poor solubility of CO and H_2 in water, their mass transfer will be the major fermentation rate limiting factor. Another constraint found was that keeping a reasonable gas flow requires recycling, and a purge of unconverted gases, The fermenter type chosen was a bubble column due to low operation and capital cost associated, compared to other options.

CAPEX was estimated at 105 M€, with major contributions from the gasifier, the seed fermentor, and the syngas compressor. OPEX was estimated at 84 M€/a, of which 39% was due to biomass, 15% due to heating and cooling energy, and 34% equipment dependent. The resulting ethanol production costs were 0.84 €/kg, which is not competitive. More detailed process optimisation and calculation are required, though.

The conclusions derived from this work were that by using ideal strains, mass transfer will limit complete conversion of syngas and then bioreactor design becomes critical. The water gas shift reaction does not change the requirement for a CO_2 removal step in the process. And finally, under the conditions analyzed ethanol recovery from fermentation off-gas is too costly.

Supervisors: dr.ir. Adrie Straathof and prof.dr.ir. Joseph Heijnen at Delft University of Technology and dr.ir. Henk Noorman at Delft University of Technology and DSM
Trainee: Diana Alvarez-Góez MSc PDEng

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

Chemical Product Design

Conceptual Artificial Leaf

"The PDEng trainees always surprised us with an original angle of view."

Prof.dr. Bernard Dam
Delft University of Technology

The project aimed to transform a laboratory-scale photoelectrochemical (PEC) cell (1 cm^2) to a prototype (100 cm^2). The PEC cell produces H_2 by harnessing solar energy to perform water splitting reactions. This project was funded by BioSolarCells, a Dutch consortium of research institutes and companies, that targets the development of technologies combining biological and artificial components.

During the project the strongest characteristic of the team was the openness, which has led to new ideas and perspectives. As Prof.dr. Bernard Dam put it, "The PDEng trainees always surprised us with an original angle of view." Prof.dr. Ernst Sudhölter added, "With great enthusiasm and creativity, the students performed their design work in concert."

Further, the team has learned how to communicate effectively with each other and with clients. They have improved their time management skills and created a successful design which addressed the needs of the stakeholders. To maximise the learning experience of each individual rotation of management roles was on regularly base. Moreover, evaluation sessions were held to get a constant stream of feedback to improve the project as well as individual performances.

Supervisors: prof.dr. Bernard Dam and prof.dr. Ernst Sudhölter at Delft University of Technology
Trainees: Bengisu Corakci MSc, Nicola Donato MSc, John Paul Garcia MSc, Aurélie Nonclercq MSc, Shriya Reddy Paida MSc, Mercedes Victoria Garcia MSc

Civil Engineering

Systems Engineering within IPM-teams

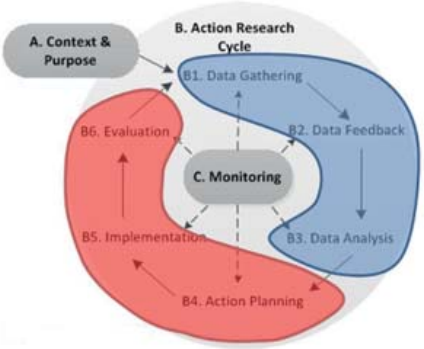
"Rijkwaterstaat is making progress in the field of Systems Engineering. The next step is to enlarge the SE-maturity of IPM-teams. Due to the project of Michiel Loonen, the SE-maturity has been made measurable for Rijkswaterstaat. The interventions are an interpretation of our next step."

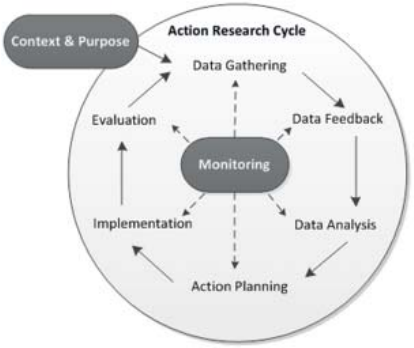
Cees Orij MSc
Rijkswaterstaat

Since 2007, Systems Engineering is used in the Dutch civil engineering sector. The shift contributed to several improvements, however the application of Systems Engineering can still be improved for Rijkswaterstaat. Rijkswaterstaat uses so called Integrated Project Management (IPM-)teams to carry out its projects related to public works and infrastructure. The IPM-team of Rijkswaterstaat consists out of five roles related to: project management, project control, contracting, stakeholders management and technical issues. This project focuses on the further improvement of Systems Engineering within IPM-teams. First, the project identified bottlenecks in the current practice. Currently interventions are under development that aim to improve the application of Systems Engineering within IPM-teams.

Collaboration with Rijkswaterstaat's practitioners and projects is sought to integrate findings in the final design. First, interviews were conducted to investigate the perceptions and the context of IPM-teams in relation to Systems Engineering. Case studies were conducted to analyse the problems and bottlenecks in the current Systems Engineering process. Based on the findings, interventions were developed to overcome the bottlenecks related to System Engineering in teams. The developed interventions will be implemented and evaluated in an IPM-team. The final design consists of both an implementation plan and described interventions that improve the application of Systems Engineering within IPM-teams.

Supervisor: Cees Orij MSc, Unit leader technical management at Rijkswaterstaat
Trainee: Michiel Loonen MSc





Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

Clinical Informatics

Improving Healthcare by Next-gen Imaging Workflow and Integrated Speech Recognition

"Speech recognition turned out to be an added value for physicians. Our infrastructure for medical images is ready for the future."

Dr.ir. Klaas Jan Renema
Head Medical Physics Radiology and Nuclear Medicine
Radboudumc

In 2012 Radboudumc started a programme to introduce a new electronic health record system. From the beginning, it was clear that end-users would face huge changes in both their habits, workflow and possibilities. It was also an opportunity to realise an integral image management system and introduce the hospital-wide availability of speech recognition.

Next-gen Imaging Workflow

The search for an enterprise imaging solution that fits the vision of the hospital led to a number of key requirements: safe and accountable patient care, effective, cost-efficient and re-usable, vendor-neutral, interoperable and ready within 9 months. The developed architecture has a closed order-loop system, which requires an order for every image-object stored on the platform. The platform delivers one central viewer for all imaging results coming from several departmental systems. The outcome is an enterprise wide imaging platform that allows for central storage and accessibility of every type of image: it reduces turnaround times, increases availability and therefore vastly improves the quality of healthcare.

Speech Recognition

Having a new imaging platform also invited new speech recognition solutions. Solutions were designed based on functional user requirements for all specialties, with special attention to the departments of Radiology and Pathology. The project included topics like workflow change management (optimising user effectiveness by combining different techniques) and system integration.

With a recognition rate of over 97%, physicians are experiencing faster and more accurate reporting, thus having more time left for the patient, while delivering safer and higher quality results.

Radboudumc
university medical center

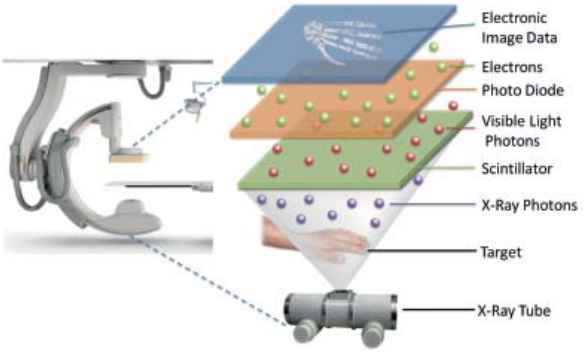
Supervisors: dr. Michiel Sprenger at TU/e, dr. Eric Visser and dr.ir. Klaas Jan Renema at Radboudumc
Trainee: Laurens de Groot MSc PDEng

Design and Technology of Instrumentation

Transparent Barriers on Scintillators for Flat Panel X-ray Imaging Detectors

"The overall conclusion is that Nurcan performed an excellent project. The reporting is clear and complete. Presentations are well structured and brought in a very enthusiastic way. She worked very well with people of all levels within the company. And, while maybe initially she still had to learn how to run experiments in a production environment, she picked this up very well."

Ed Gillissen
Argus Imaging



Flat panel-indirect conversion systems are a well-accepted technology for digital imaging in medical applications. Features include a compact size, immediate access to the digital image and a high image quality. One main part of a flat panel detector is the scintillator. Thallium doped cesium iodide (CsI:Tl) is one of the most preferred scintillator materials for flat panel detectors due to its needle-like structure which acts as a light guide.

Although a CsI:Tl scintillator is advantageous in terms of image quality, its lifetime is very limited. Even very small amounts of moisture will decrease the scintillator efficiency and image quality. Therefore, to ensure a proper commercial product with a lifetime of many years, the CsI:Tl scintillators must be protected from any moisture by a proper barrier. The barrier requirements are of the highest order when compared to other products requiring a moisture barrier.

In this project, industrial problem-solving strategies are used for obtaining commercial scintillator products. First, the problem has been defined by figuring out the failure mechanisms of the scintillators exposed to moist air and the project requirements are set. Second, potential solutions have been defined by reviewing the literature and gathering information from similar industrial fields. Third, the best barrier combination consisting of an organic levelling layer deposited by chemical vapor deposition (CVD), an inorganic nanolaminate layer deposited by atomic layer deposition (ALD), and an organic protective layer deposited by CVD, have been created as the solution. Finally, implementation and optimisation studies have been performed. In the implementation and the optimisation steps, six sigma and design of experiment methods are used extensively. The prototypes are tested successfully, both internally and by customers. Argus Imaging has started to use this barrier structure in the production line.

Supervisor: Ed Gillissen, project manager at Argus Imaging
Trainee: Nurcan Yanarcan Doğan MSc PDEng

Argus imaging

Energy and Process Technology

Design of an Air-Cooler, applied in a Gas-fired Adsorption Heat Pump for Residential Use

"The air-cooler design is a challenging task of working on a complex multidisciplinary subject. The PDEng project has made a considerable contribution to the air-cooler's design, but also to the understanding of the crucial aspects of the air-cooler."

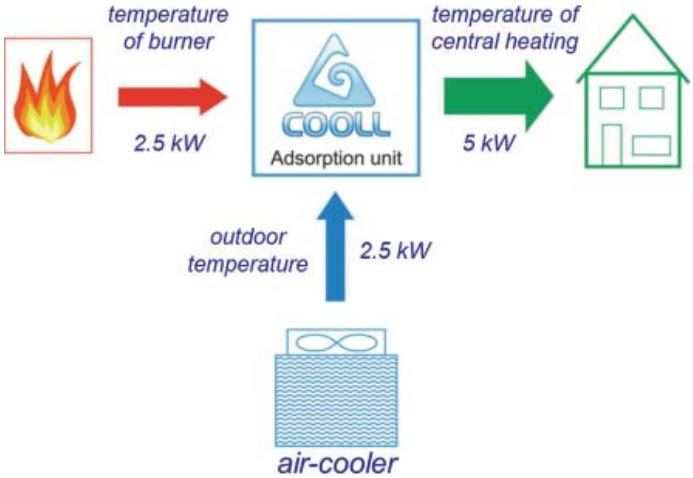
Dr.ir. Johannes Burger
Cooll Sustainable Energy Solutions

Cooll Sustainable Energy Solutions is a spin-off company of the University of Twente, originating from the research group 'Energy Materials and Systems'. Cooll is cooperating with a number of experienced partners to develop a gas-fired adsorption heat pump for the use in existing homes and small offices. The adsorption heat pump is driven by heat which is supplied by a gas burner, which is similar to the burner in the widely used condensing boiler. However, the energy efficiency of the gas-fired heat pump is potentially significantly higher than the efficiency of the current condensing boilers.

The subject of the project was the design of the interface between the heat pump and the outside air heat source: the air-cooler. Heat pumps for commercial heating purposes are mostly combined with a ground (heat) source or an air (heat) source. The use of a ground source is only suitable for a limited number of existing buildings. The possible use of an air heat source significantly increases the potential market share.

The air-cooler is one of several key components in the gas-fired heat pump system. To prepare for further product development the development of the air-cooler's design was required.
Several key design aspects were:

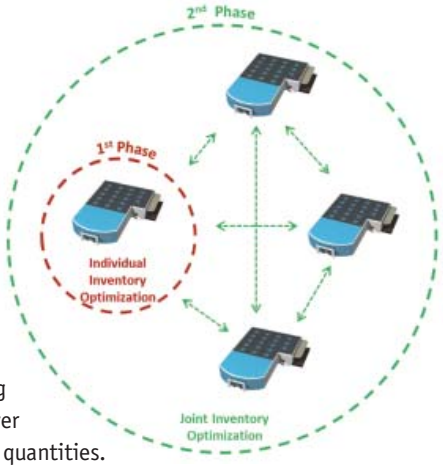
- Optimisation of space usage by components
- Noise level minimisation
- Incorporation of a defrost cycle
- Cost minimisation



Supervisor: dr.ir. Johannes Burger, founder and CEO at Cooll Sustainable Energy Solutions
Trainee: Wietse Offringa MSc PDEng

Industrial Engineering*

Inventory Pooling among Dutch Steel Stockholders



The objective of this project was to design an inventory pooling system between Dutch steel stockholders who are operating in a highly competitive market. In the first phase of the project, we designed the tool StockOp Simulation that compares the actual stock levels and buying activities over a certain period of time with a simulation over the same period using optimised reorder points and reorder quantities. This will give management insight in the possible savings. Also, we designed StockOp Production, which recalculates on a daily basis the policy parameters S and Q of each SKU. It adjusts the inventory levels for the operation, advising the purchase department about how much to stock, when to reorder and how much to reorder. In the second phase of the project, we developed StockOp Pooling Optimisation, a decentralised inventory pooling strategy that identifies bleeders (SKU's with revenues not covering the variable costs) and calculates the savings from pooling bleeder SKU's with colleagues/competitors. A cooperative approach leads to a win-win situation for every participant. The tool produces three results: identification of bleeders, maximum price to buy and minimum price to sell. For a bleeder the stockholder has two options:

- Remove the SKU from stock and buy it as a cross dock product from a colleague when needed, or
- Keep additional stock of this SKU to fulfill the demand of colleagues who remove this SKU from their portfolio.

With the maximum and minimum prices the buying stockholder can define the maximum price to pay for an item he no longer keeps to stock, and the selling stockholder can define the minimum price to ask for a SKU stocked for colleagues. Both parties profit by reducing losses or increasing profits compared with the current situation. The tools developed were tested at three stockholders and stock level reduction opportunities of 43% were found, which is an inventory carrying cost reduction of 28%.

Supervisors: ir. Marcel van Loosbroek, owner of INAD, dr. Marco Slikker, Associate Professor at the Industrial Engineering & Innovation Sciences department of TU/e and prof.dr.ir. Will Bertrand, former managing director of Industrial Engineering programme of TU/e
Trainee: Ezequiel A. Paez MSc PDEng

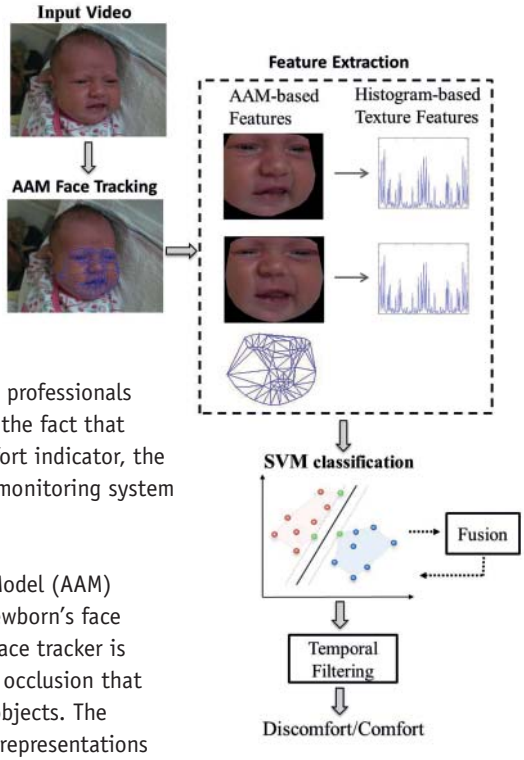
*formerly known as Logistics Management Systems

Information and Communication Technology

Video-based Facial Discomfort Analysis for Infants

"Eleni was the first student who could construct a bridge between the technical world of advanced computer vision and the delicate world of fragile neonates: she managed to design a novel hard-core algorithm for indicating a soft objective, the comfort feeling of a baby."

Prof.dr.ir. Peter H.N. de With
Eindhoven University of Technology



Pain and discomfort are major indicators of infant illnesses, while persistent unrelieved pain can cause complications such as nervous system changes and delayed development. Medical staff is responsible for assessing infant pain and discomfort, as infants are unable to directly report their experiences. However, neonatal pains are brief and may pass unnoticed since healthcare professionals cannot provide continuous surveillance. Based on the fact that facial expressions are the most prominent discomfort indicator, the aim of this project is the design of a novel video monitoring system for automatic discomfort detection in infants.

The proposed system uses an Active Appearance Model (AAM) to robustly track both the global motion of the newborn's face as well as its inner features. The developed AAM face tracker is able to provide recovery after partial or total face occlusion that may occurs due to infant movements or external objects. The system detects discomfort by employing the AAM representations (shape, appearance, frontal synthesised appearance) of the face on a frame-by-frame basis, using a Support Vector Machine classifier. For a higher robustness, the effect of applying different image pre-processing algorithms for correcting illumination conditions is explored to evaluate possible detection improvements.

The facial expressions of newborn infants, experiencing heel puncture, diaper change, hunger, resting or sleeping, were monitored in the neonatal intensive care unit. The results of the study are promising and reveal that there is high potential to develop an automatic discomfort detection system in real time.

máxima medisch centrum

VCA Video Coding & Architectures research group

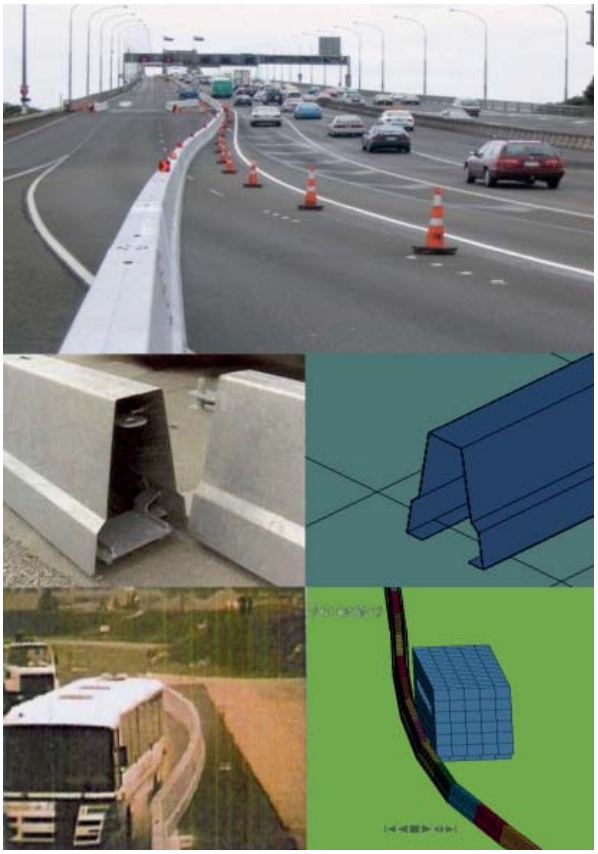
Supervisors: prof.dr.ir. Peter H.N. de With and dr. Sveta Zinger at TU/e, prof.dr. Sidarto Bambang Oetomo at TU/e and Máxima Medisch Centrum and Walther E. Tjon A Ten at Máxima Medisch Centrum
Trainee: Eleni Fotiadou MSc PDEng

Mathematics for Industry

Design Tool for Next Generation of Safety Barrier

"With her knowledge, curiosity and accuracy Azar will make complex problems transparent and she can be an asset to each team."

Friso de Vries
Laura Metaal



A road safety barrier keeps vehicles within their roadway and prevents them from colliding with obstacles. In case of construction work on the road, temporary safety barriers are used to provide appropriate safety levels for workers behind the barrier and for drivers on the roadway under construction.

The main goal was optimisation of barriers produced by Laura Metaal. Another goal was to replace expensive crash experiments to certify the safety barriers by simulation tests. Therefore, in this project design parameters were identified and a design space characterised. Subsequently, a design tool was developed by which the design characteristics of a barrier can be simulated.

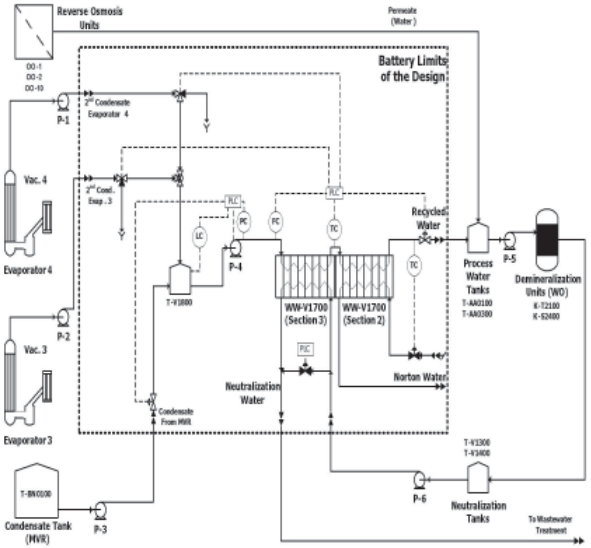
The simulation model is based on LS-DYNA Finite Element software. A design-of-simulations was developed and carried out to determine the optimum design parameters. On basis of the analysis, a new design shape was proposed that has a performance comparable with the one of competition. The developed design tool can be used to simulate future designs of safety barriers, or predict outcome of actual crash tests.

Supervisors: dr.ir. Stef van Eijndhoven, scientific director MI programme at TU/e, Friso de Vries at Laura Metaal
Trainee: Azar Dastouri MSc PDEng

LAURA METAAL
ROAD SAFETY

Product and Equipment Design

Process simulation and Re-design Manufacturing Processes for FrieslandCampina



This project was carried out at a production site of FrieslandCampina. The site hosts two plants at the Bedum (Netherlands) site, called 'Cheese' (cheese production) and 'Domo' (baby powder and food ingredients). To cope with the large rise in available milk in the market in the coming years, a large expansion and the installation of a new production line in the Domo plant were implemented, doubling the production capacity.

The project was mainly related to the investigation of how the capacity expansions affected the water and energy use – not only overall average, but especially the short term effects. Based on this investigation the PDEng trainee was requested to propose design possibilities to decrease tap water consumption and to look for opportunities to re-utilisation at the Bedum site. Viable design alternatives were thus proposed that can bring potential water and energy savings to the site in nearly 50% and 20% respectively.

The main objective was to use the scheduling software package RobEx® for optimizing water consumption at Domo Bedum. However, it was successfully demonstrated that it can also lead to higher production capacity and lower energy consumption. Therefore, it is used nowadays for investigating and optimising the production capacity and utilities usage at the Domo plant.

After identifying the largest consumers of water and energy at both plants, several design proposals were presented to optimise their consumption. Some of these proposals were immediately implemented while others were further evaluated depending on technical and economical performances. Next to the scheduling simulation tool, also the so-called 'pinch methodology' was used to determine the optimal design. The design proposals included, among others, the use of heat pump systems and energy integration across both plants.

Supervisor: ir. R. Tijsma at FrieslandCampina, prof.dr.ir. Harry van den Akker, ir. Pieter Swinkels, ir. Jeu Lambrichts at Delft University of Technology
Trainee: Carlos Duque MSc PDEng

Process and Product Design

Design of a Processing Method for Plastic Packaging Waste with Enhanced Properties

"Benny is an excellent design enigneer."

Prof.dr. Jan Meuldijk
Eindhoven University of Technology

Annually about 265 million tons of polymers are produced for a variety of applications. The major plastics market is packaging, accounting for 40% of the total polymer material production. After use, the packaging is disposed, still in many cases possessing valuable properties. Recycling of plastic waste can be done in the form of energy recovery by incineration, chemical recycling or mechanical recycling into new products. Mechanical recycling is preferred in terms of sustainability. However, the products currently made from recycled plastics are thick-walled and have insufficient mechanical strength, which limits application. To address this problem, the PDEng trainee subjected sorted polypropylene (PP) waste to an advanced polymer processing method, yielding oriented tapes with enhanced mechanical properties. The tapes can be used as intermediate products in new, more demanding applications e.g. suitcases.

The opportunities and limitations of recycled PP in the solid-state drawing process were investigated, thereby closely monitoring process conditions. Both strength and stiffness of recycled PP were one order of magnitude improved with the solid-state drawing method.

Contribution to industry
A processing method was designed that converts the applicability of recycled PP from thick-walled products into advanced materials with mechanical properties that approach those of virgin PP. Currently, the results of his design project are applied on a pilot-plant scale with an industrial partner, which aims to use it in their product portfolio.

Supervisors: dr.ir. Han Goossens former assistant professor at TU/e, dr. Ulphard Thoden van Velzen, Wageningen UR Food & Biobased Research, prof.dr. Jan Meuldijk, scientific director PPD programme at TU/e
Trainee: Benny Luijsterburg MSc PDEng

TI FOOD NUTRITION

Robotics

A Setup to Apply Controlled Disturbances to Bicycle Dynamics

"In the development of a robotic device to support human function it was important that Hielke deepened his knowledge on man-machine interaction during the PDEng programme."

Prof.dr.ir. H.F.J.M. Koopman
University of Twente

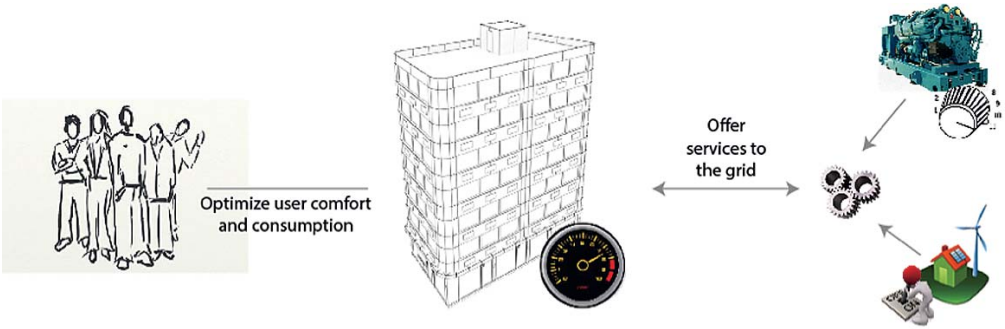
The SOFIE project aims to improve the understanding of bicycle and rider stability in order to increase the safety of elderly cyclists. In the framework of this project, an advanced multi-body model of bicycle and rider dynamics, including the influences of the environment, is developed. The purpose of this model is to test, in the design phase, different concepts of so-called Intelligent Assist Devices. In order to give direction to product design and development through mathematical modelling, it is of highly importance that results of this model are accurate.

The experimental setup that is designed to validate the model is the main focus of the PDEng project. In this setup a bicycle is instrumented with sensors to monitor dynamic behaviour of the rider and bicycle. Thereby determining the balance control strategy of the rider. In the setup the rear wheel of the instrumented bicycle rotates freely on a roller bench. The front wheel rotates on a treadmill to preserve the tire-road contact; steering can still be used to maintain balance. The roller bench is situated on a six degrees of freedom Stewart platform. The movement of the platform can be controlled in each direction. Therefore, it is possible to apply multiple disturbances to the bicycle with a predetermined multisine disturbance signal for identification purposes. Reference data is collected, in a save laboratory environment within controlled circumstances, to validate the mathematical model. Subsequently, it is possible to subject products which enhance balance during cycling to controlled testing.

Supervisor: prof.dr.ir. H.F.J.M. Koopman at University of Twente
Trainee: Hielke Kiewiet MSc

Smart Energy Buildings & Cities

Integration of Smart Grid Services in Office Buildings



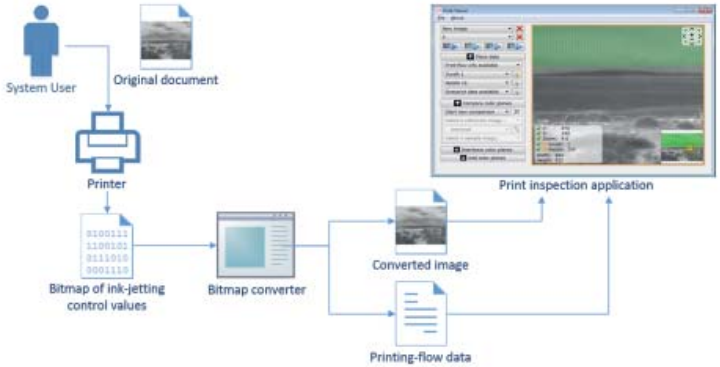
Both the energy and building services industries are in a phase of transition. Companies active in the built environment need to become more service-oriented as performance requirements increase, in terms of energy consumption, costs and comfort. In the energy sector, the Smart Grid paradigm is being adopted to address future technical and financial challenges. Flexibility is key in both of these transitions to ensure effective and efficient operation of buildings and grid. Flexible control of the energy consumption of processes in office buildings can create value for public energy grids by contributing to congestion management and supply/demand balancing. To provide flexible operation and ensure comfort and energy performance, advanced control schemes must be implemented for building users, while comfort and energy performance can be guaranteed. The goal of this assignment was to design an effective building control concept enabling Smart Grid services and values. Lastly, business cases for Smart Grid integration with office buildings were developed, supported by a realistic case study and data-driven models.

Supervisors: M. Hommelberg MSc at BAM Techniek, L. Pennings MSc and prof.dr. W. Kling at Eindhoven University of Technology
Trainee: Dennis van Goch MSc PDEng

bam techniek

Software Technology

Virtual printer: an Environment for Digital Print Modelling and Inspection



"Vadim has constructed a tool to reconstruct and display the bitmaps printed by large format printers. He has tackled this far from trivial challenge in a systematic and organised way, resulting in a versatile tool, with a well thought out design, being appreciated by its users."

Dr. Lou Somers
Océ-Technologies B.V.

Océ-Technologies B.V. specialises in solutions for enterprise printing, large format printing, and production printing. Software is an important part of a modern printer. One of the tasks for inkjet-printer software is to transform input print data into timed sequences of firing commands for inkjet-nozzles. The output of this process is usually saved in a bitmap.

To test a new transformation algorithm or to verify its implementation in a printer, it is necessary to inspect the printer output bitmap and correlate it with information about the printing process. A complicating factor is the image size that can reach tens of thousands of pixels in every dimension. Such images are hard or even impossible to display without applying special techniques.

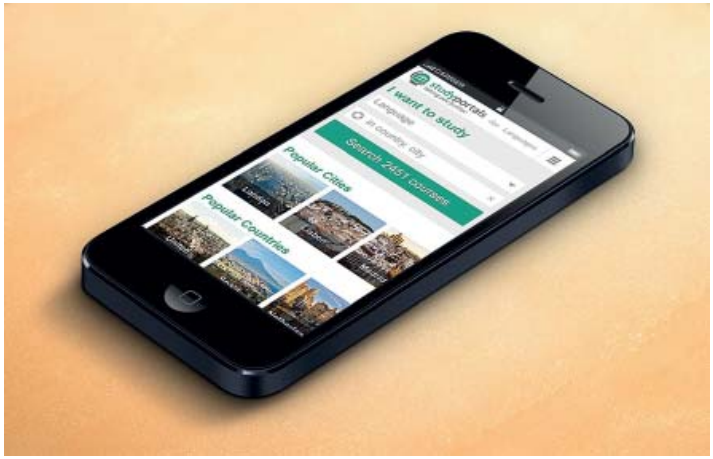
The goal of the project is to develop a virtual printer for the R&D department of Océ that accommodates multiple Océ printer models. The developed virtual printer provides Océ specialists with a means for advanced printer output bitmap conversion and detailed inspection of the artifacts. With the viewer tool, full-size images can be displayed on various scales, navigated, compared using various criteria, e.g., presence of pixels in all compared images. For single-color images, the result of their combined multi-color printing can be modelled. Using the printing-flow data, it is possible to indicate when a pixel was printed, by which printing element, and the number of times the pixel was touched.

In the future, the system can be extended with additional algorithms for image and printing-flow data visualisation and extra facilities advancing the end-user experience.

Supervisor: dr. Lou Somers at Océ-Technologies B.V.
Trainee: Vadim Marchenko MSc PDEng

User System Interaction

LanguageLearningPortal.com: User-centred Design in an agile Portal Website Development Project



"Denys joined our team for the development of LanguageLearningPortal.com. As a dedicated person, he has succeeded in designing a high performing responsive website. Moreover, he has helped his colleagues from diverse backgrounds work together as an effective team, all with the common goal of producing outstanding results."

Toon Van Craenendonck
MSc PDEng
StudyPortals

The project is situated within the creation of LanguageLearningPortal: a global high quality language courses aggregator and provider aiming to help users finding language learning opportunities. The development of this portal is based on the existing StudyPortals platform. LanguageLearningPortal is the visible outcome of the project "Home of European Language Learning Opportunities (hello!)", funded by the European Commission.

Adapting the principles of Scrum development provided a basic framework for project development and management. Therefore, iterative design was ensured by applying a user-centred design methodology during the whole duration of the project. In order to make the web service future proof, Mobile First and Responsive Design principles were applied. Key activities in the process included wireframing, information architecture, usability testing, improving cooperation between design and development team, conceptualising design ideas, designing interaction and as a result developing a high quality web service platform which can be improved gradually.

At the end of this project the first functional version of the LanguageLearningPortal was launched. This beta version was evaluated in order to continue web service improvement in the future. These suggestions will be applied on the portal, aiming to release a high quality user-focused web service helping thousands of language learners finding a language course according to their wishes.

Supervisors: Toon Van Craenendonck MSc PDEng at StudyPortals and dr.ir. Bart Hengeveld at TU/e.
Trainee: Denys Tserkovnyi MSc PDEng

studyportals
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The Professional Doctorate in Engineering (PDEng) programmes in brief

Programme	Founded	Graduates to date	Location
Logistics Management Systems*	1988	330	TU/e
Information and Communication Technology (incl. Healthcare Systems Design)	1988	226	TU/e
Process and Product Design	1989	364	TU/e
Mathematics for Industry	1989	276	TU/e
Software Technology	1990	386	TU/e
Design and Technology of Instrumentation	1991	143	TU/e
Process and Equipment Design	1991	170	TUD
Bioprocess Engineering	1994	109	TUD
Architectural Design Management Systems**	1996	91	TU/e
User System Interaction	1998	273	TU/e
BioProduct Design	2008	32	TUD
Comprehensive Design in Civil Engineering	2010	5	TUD
Automotive Systems Design	2011	13	TU/e
Smart Energy Buildings & Cities	2011	8	TU/e
Energy & Process Technology	2011	1	UT
Robotics	2011	-	UT
Civil Engineering	2011	-	UT
Clinical Informatics	2012	23	TU/e
Chemical Product Design	2012	-	TUD
Healthcare Logistics	2014	-	UT
Maintenance	2014	-	UT
Qualified Medical Engineer	2014	-	TU/e

* Nowadays Industrial Engineering
** This programme is being built down and stops her activities as of 2016. The current trainees will be supported during their finalisation of the programme in order to receive the PDEng degree.

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