FH AACHEN
UNIVERSITY OF APPLIED SCIENCES

Tagung des Forschernachwuchses der FH Aachen

20. November 2013

Tagung des Forschernachwuchses der FH Aachen

20. November 2013

Inhalt | *Index*

Beiträge | *Papers*

Vorwort / *Preface*

„Dankeschön!“ – Mit einem herzlichen Dankeschön für Ihr Engagement, Ihre Begeisterung für Forschung und Wissenschaft sowie Ihr Durchhaltevermögen, das Sie ihm Rahmen Ihrer wissenschaftlichen Arbeiten unter Beweis gestellt haben, leiten wir gerne das Vorwort für den sechsten Graduiertenband der FH Aachen ein.

Das Forschungspotential der FH Aachen basiert wesentlich auf jenen Erkenntnissen, die Sie in den Laboren, Fachbereichen und Instituten der FH Aachen erbringen. Viele Forschungsergebnisse münden direkt in die Anwendung, so dass Ihre Innovationen Impulse für die Technologie von morgen liefern.

Der Forschernachwuchs der FH Aachen stellt in diesem Jahr unter dem Motto: „Wie beeinflussen technische Impulse die Gesellschaft?“ wissenschaftliche Arbeiten aus verschiedenen Fachdisziplinen vor. Er bietet eine Plattform zum Dialog zu den unterschiedlichen wissenschaftlichen Arbeitsergebnissen mit den Mitgliedern der Hochschule und unseren Gästen.

Begleitet von Posterpräsentationen sowie einem Matchmaking zwischen Wirtschaft und Wissenschaft werden Vorträge von neuberufenen Professorinnen und Professoren sowie Präsentationen von Doktorandinnen und Doktoranden, die ihre Promotionsarbeiten bald abschließen, einem interessierten Publikum dargeboten.

Das kooperative Promotionskolleg hat sich innerhalb der Hochschule erfolgreich positioniert. Doktoranden erzielen innerhalb der Hochschule eine verstärkte Wahrnehmung, sie vertreten ihre Belange in den forschungsrelevanten Gremien und erhalten durch Bereitstellung von Rektoratsmitteln eine finanzielle Unterstützung. Das interne Doktorandennetzwerk ist ein fester Bestandteil der Forschungslandschaft unserer Hochschule. Wir unterstützen unsere Nachwuchswissenschaftlerinnen und –wissenschaftler nicht nur bei ihrer fachlichen, sondern auch bei ihrer persönlichen Weiterentwicklung

Als Gastreferent konnten wir Herrn Dr. Frank Hees vom Institutscluster IMA/ZLW & IfU der RWTH Aachen gewinnen, er eröffnet mit seinem Impulsreferat „Technische Metatrends – Herausforderungen und Lösungsräume“ den Forschernachwuchstag.

Wir freuen uns auf einen interessanten Tag gemeinsam mit Ihnen und sind sicher, dass Sie mit Ihrem Beitrag auch in diesem Jahr die wissenschaftliche Landschaft der FH Aachen bereichern werden. Gehen Sie mit uns in die Zukunft !

November 2013

Prof. Dr. Christiane Vaeßen
Prorektorin für Forschung,
Entwicklung und Technologietransfer

Prof. Dr. Michael J. Schöning
Institut für Nano- und
Biotechnologien (INB)

Dr. rer. nat. Frank Hees

Jahrgang 1961

Curriculum Vitae

Ausbildung

1981 bis 1988	Diplomstudium Bauingenieurwesen (bis 12/83), Magisterstudium und Abschluss (Wirtschaftsgeographie/Politik/Internationale Zusammenarbeit)
2001	Promotion an der Georg-August-Universität Göttingen im Fach Wirtschafts- und Kulturgeographie (Mathematisch-Naturwissenschaftliche Fakultäten) zum Dr. rer. nat.

Berufspraxis

1997 bis 1998	Wissenschaftlicher Mitarbeiter am Hochschuldidaktischen Zentrum (HDZ) und Lehrstuhl Informatik im Maschinenbau (IMA) der RWTH Aachen
2003 bis 2006	Leiter des Bereichs Wissensmanagement am Zentrum für Lern- und Wissensmanagements (ZLW) und Lehrstuhl Informationsmanagement im Maschinenbau (IMA) der RWTH Aachen
2001 bis 2010	Seniorconsultant bei der OSTO-Systemberatung GmbH als Kommunikations- und Organisationsberater
1999 bis 2011	Leiter des Bereichs Kommunikations- und Organisationsentwicklung am Zentrum für Lern- und Wissensmanagements (ZLW) und Lehrstuhl Informationsmanagement im Maschinenbau (IMA) der RWTH Aachen
2007 bis 2012	Geschäftsführer der "Arbeitsgemeinschaft betriebliche Weiterbildungsforschung e.V." (ABWF) in Berlin
seit 2010	Geschäftsführender Gesellschafter und Berater der Nets ´n´ Clouds Consulting für Technologieentwicklung
seit 2011	Geschäftsführer des Instituts für Unternehmenskybernetik e. V.
2011 bis 2012	Mitglied des Expertenkreises des Zukunftsdialogs der Bundeskanzlerin
seit 2011	2. Stellvertreter Direktor des Institutscluster IMA/ZLW & IfU
seit 2012	Senator im Bundesverband für Wirtschafsförderung und Außenwirtschaft (BWA) und Präsidiumsmitglied im internationalen Wirtschaftsclub Aachen/Düren/Köln

Mitgliedschaft in Organisationen und Vereinen

- Arbeitskreis Pazifische Studien Aachen (APSA), Gründungsmitglied (1987–2004)
- Berufspolitischer Beirat des Berufs- und Gewerbeförderungszentrums (BGZ) Simmerath (2006 – 2009)
- „Kleiner Runder Tisch“ im Bistum Aachen zur Arbeitsmarktsituation (2005–2010)
- Fachausschuss Arbeit der Regionalkonferenz Region Aachen (2009–2012)
- Verein „Zentrum Mensch und Technik“ e.V. (ZMT)
- Internationalen Wirtschaftsclub Aachen/Düren/Köln, Präsidiumsmitglied
- Bundesverband für Wirtschafsförderung und Außenwirtschaft (BWA), Senator

Nachname | *Name*	Barkschat
Vorname | *First Name*	Kai
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since September 2012

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53844
E-Mail	barkschat@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01C03
Name des Projektes | *Name of the project*	ETL Quadrat
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Bodo Kraft
Partneruniversität | *Partner University*	Universität Kassel
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Albrecht Zündorf
Projektpartner | Project Partner	> antibodies-online GmbH > enet GmbH

Developing ontologies for semantic product data extraction

Kai Barkschat[1]*, Bodo Kraft[1]

[1] FH Aachen, Campus Jülich, 52428 Jülich, Germany

*barkschat@fh-aachen.de

Successful business models of modern companies in the IT sector, e.g. eBay, Google or Amazon, heavily depend on extensive data aggregation of huge and steadily growing information amounts. Efficient and high quality extraction is still a challenging and problematic task because of heterogeneous data sources and quite a lot of different data formats. Especially in the context of the World Wide Web (WWW) information are often expressed informal and written in natural language, which facilitates processing for human readers but at the same time also complicates automated machine processing.

According to the current state of the art such companies use Extract Transform Load (ETL) processes as the basis for their data processing. The problem with classic approaches is that they are fraught with serious disadvantages. For example to achieve high quality results, manual extraction and human resources are required because product documents often contain freeform-texts, which have to be semantically understood before the relevant data can be identified and extracted. This results in poor scalability and fluctuating quality. Beside that there are strongly repetitive tasks, which cannot be automated caused by the natural language component. Additionally high frequent changes of content and structure enforce new dynamic solutions. The rigid approaches of classic ETL do not satisfy the requirements.

Current research work intends to develop a solution for semantic data extraction. Therefore the approach of a combined framework for natural language processing and Ontology based domain modelling is presented which tries to overcome the disadvantages of classic ETL processes. The key idea is to represent domain specific knowledge with the aid of semantic networks which enable IT-systems to imitate human behaviour in the form of machine processable text understanding.

Nachname | *Name*	Bhattarai
Vorname | *First Name*	Aroj
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since January 2013

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53209
E-Mail	bhattarai@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01C03
Name des Projektes | *Name of the project*	BINGO
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Manfred Staat
Partneruniversität | *Partner University*	Universität Duisburg-Essen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Jörg Schröder
Projektpartner | Project Partner	> Medical University of Vienna, Austria > University Hospital of RWTH Aachen > University Hospital of Bonn > FEG Textiltechnik mbH, Aachen

Three-dimensional finite element analysis of the female pelvic floor

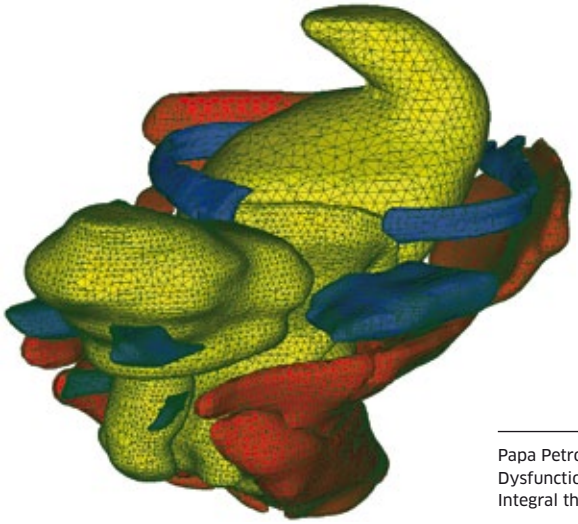
Aroj Bhattarai[1]*, Manfred Staat[1]

[1] FH Aachen, Campus Jülich, 52428 Jülich, Germany

*bhattarai@fh-aachen.de

Pelvic floor (PF) dysfunctions among the aging female has been an understudied research area from the biomechanical perspective. Urinary incontinence: any involuntary loss of urine, is the well known of these dysfunctions which is a socially embarrassing condition. Although such disorders are relatively common, causes can be mainly assumed to be age, numerous vaginal delivery and chronically increased intra-abdominal pressure, thereby damaging the pelvic musculature, fascia and suspensory ligaments of the pelvic floor.

Although significant research has been done, the exact cause of incontinence remains elusive, either because of limited knowledge of pelvic floor anatomy or lack of anatomically realistic FE simulations. With the coordination of Medical University of Vienna, two-dimensional MR imaging has been used to diagnose the pelvic floor structure and to generate the computational models. Such 3D models are used to quantify the performance of the pelvic structures and to verify the incontinence procedure as close as possible. An improved anchoring system PVL mesh developed by FEG Textiltechnik mbH, Aachen will be implanted into the model and further extended for the optimization of pelvic organ relocation and reconstructive pelvic floor surgery according to the Integral theory. Problems related to soft tissues are always complicated because of large non-linear deformations, age dependent tissue constituents, contact behavior and alterations in cadaver and in vivo tissue samples. In order to explore the qualitative simulations and to overcome contradictory literatures regarding soft tissue properties, governing material laws will be developed which will be validated against necessary in vitro experiments. The goal of this work is to provide an ultimate result to the surgeons that would guide them for secure surgical decisions and successful textile mesh implants in order to overcome the incontinence problems.



Papa Petros PE: The Female Pelvic Floor: Function, Dysfunction and Management According to the Integral theory. 3rd edn, Springer, Heidelberg, 2010.

Acknowledgement: The author has been partially funded by the Federal Ministry of Education and Research through the FHprofUnt project “BINGO”.

Nachname | *Name*	Teixeira Boura
Vorname | *First Name*	Cristiano
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since March 2009

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Energy Technology
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 5 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53517
E-Mail	Boura@sij.fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	N112
Name des Projektes | *Name of the project*	(HiTExStor) High temperature moving bed heat exchanger for thermal storage in granular material
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Bernhard Hoffschmidt
Partneruniversität | *Partner University*	RWTH Aachen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Robert Pitz-Paal
Projektpartner | *Project Partner*	Deutsches Zentrum für Luft- und Raumfahrt (DLR)

High Temperature Moving Bed Heat Exchanger (MBHE) for thermal storage in granular material

Cristiano Teixeira Boura[1]*, Julian Eckstein[1], Joachim Göttsche[1], Bernhard Hoffschmidt[1], Haymo von Dahlen[1], Lukas Pospiech[1]

[1] Solar-Institut Jülich, FH Aachen, Campus Jülich, 52428 Jülich, Germany

*boura@sij.fh-aachen.de

This Abstract summarizes research activities that analyse the thermodynamic behaviour of an Air-Sand Heat Exchanger, developed by Solar-Institut Jülich (SIJ) and the German Aerospace Centre (DLR). The numerical 3-D model, new results and a model validation of this particular cross-flow heat exchanger are presented. The simulation was validated with a new 15 kW prototype unit. Ansys, including Ansys-CFX, is used as modelling and simulation platform. Validation is made by a new test rig system. The geometry of numerical model is equal to the inner geometry of the test rig. Furthermore, the 3-D geometry between the air entrance and exit cross section area are considered and simulated within the new numerical model (fig. 1, above). The bulk material is modelled by a porous solid medium without structural dynamic interaction between fluid and solid phase. A constant velocity is imprinted on the bulk velocity field. Material parameter, e.g. permeability, porosity and bulk density, were gained on the one hand from literature and on the other hand from measured results. Thus all thermodynamic medium properties depend on temperature. For bulk material the pressure drop model from Ergun & Forchheimer is used. This model parameters are permeability, porosity, Sauter diameter and Forchheimer coefficient. The parameters for the material quarz sand were validated and fitted with measured values of a separate pressure drop test rig. Additionally a material library was also gained for bulk material with 1-2 mm diameter, i.e. for basalt and spherical ceramic balls.

Validation was made with the 15 kW test facility shown in fig. 1 (below). A quartz glass plate is installed for analysing the bulk flow behaviour and temperature profile inside the heat exchanger, near the pane. Thus the temperature profile can be visualised with an infrared camera. Pressure drop validation shows an accuracy of ± 2 %. In fig. 2 (left) the result of the simulated air streamlines through the MBHE are shown. Inside the HE the air uses a larger cross section area than the filter walls on the inlet and outlet.

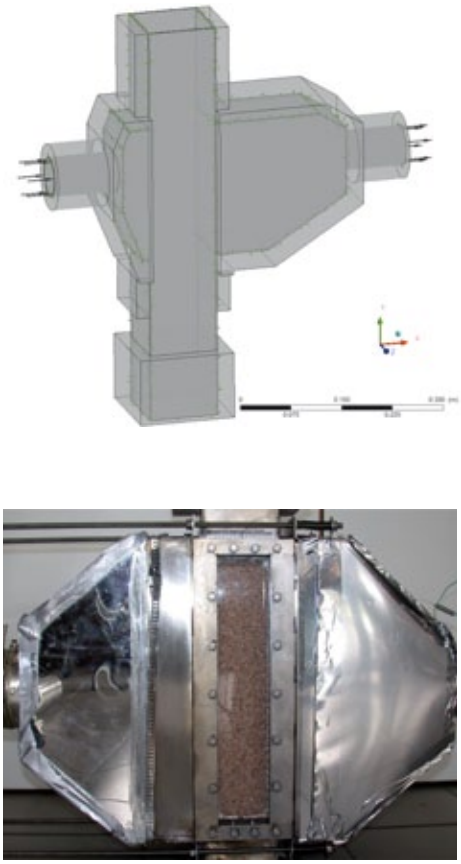


Fig. 1 | 3-D model of MBHE (above), test facility (below)

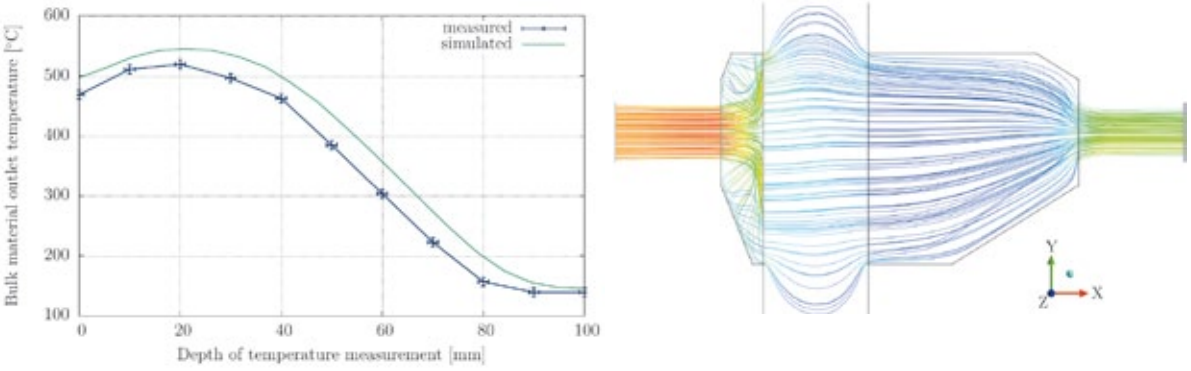


Fig. 2 | Sand outlet temperature profile (left), Air streamline through heat exchanger (right)

Nachname | *Name*	Druckenmüller
Vorname | *First Name*	Katharina
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since 2011

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Chemistry and Biotechnology
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 5374
E-Mail	druckenmueller@sij.fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	E008
Name des Projektes | *Name of the project*	Bioaerosol characterization by Near-Infrared-Spectroscopy and MALDI-TOF Mass Spectrometry
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Gereon Elbers
Partneruniversität | *Partner University*	Universität Bonn
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Matthias Wüst
Projektpartner | *Project Partner*	Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfahlen (LANUV-NRW)

Bioaerosol characterization by Near-Infrared-Spectroscopy and MALDI-TOF mass spectrometry

K.Druckenmüller[1,3], A. Gärtner[2], A.Gessner[2], G.Elbers[1]

[1] FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2] Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfahlen, Emissionsmessungen, 45133 Essen, Deutschland
[3] Rheinische Friedrich-Wilhelm-Universität Bonn, 53113 Bonn, Germany

*druckenmueller@fh-aachen.de

Generally, bioaerosols are ubiquitous in the environment and some have many useful functions. Emissions from industrial facilities like waste treatment plants and livestock farms often contain very high bioaerosol concentrations in the form of microorganisms, endotoxins, spore of mould and allergenic biomolecules. Detailed knowledge about aerosol compositions from these plants is of high relevance in terms of health and environment control, but accurate characterization is not an easy task. In this study, two methods, NIRS and MALDI-TOF MS were evaluated for their capabilities to characterize bioaerosol emissions samples. 21 emission samples from a chicken farm, collected on quartz fibre filters, were characterized by NIRS and MALDI-TOF MS. NIR spectra from such samples treated by chemometric methods revealed that the material composition varies systematically during the fattening period. Furthermore, specific biomarker ions for microorganisms could be identified analyzing MALDI-TOF mass spectra. Using either one of the spectroscopic procedures described, or a combination of the two, for routine bioaerosol characterization represents a highly desirable task, since intricate and time-consuming sample workup procedures (like cultivation of the microorganisms) are not required. However, the results received so far need to be confirmed by more measurements, reference methods /spectra and mathematical analyses, thereby refining the analytical procedures proposed and clearing the way towards a routine analytical protocol.

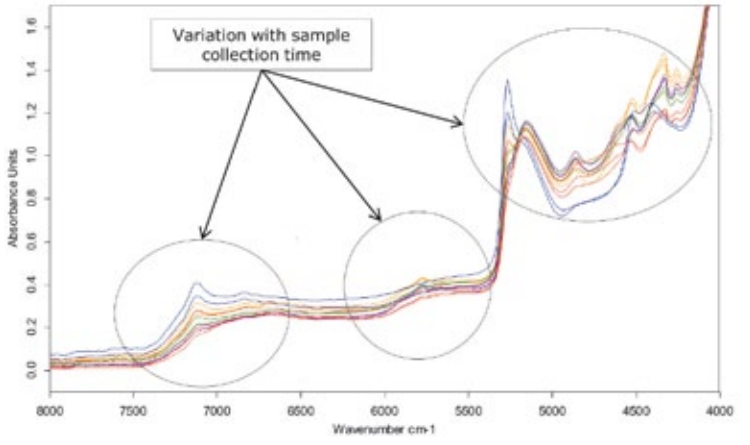


Fig. 1 | Characteristic NIR-absorption bands of emission filter samples a broiler farm

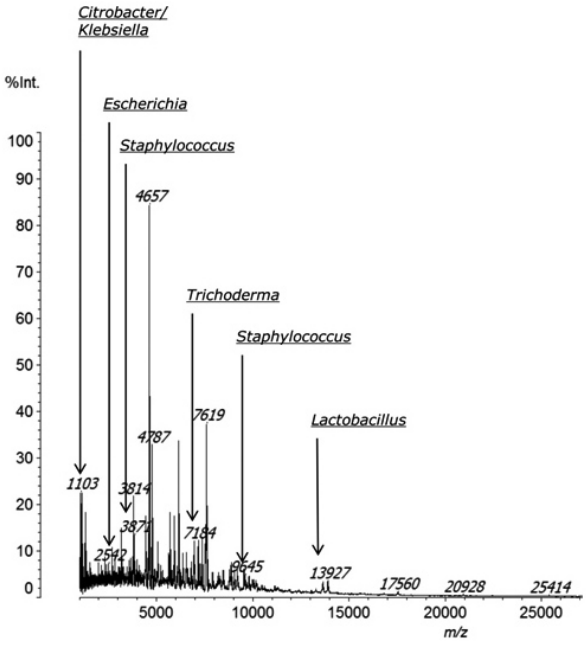


Fig. 2 | MALDO-TOF mass spectrum of a TSP emission from chicken fattening plant

Nachname | *Name*	Du'o'ng
Vorname | *First Name*	Minh Tuãn
Titel | *Title*	M.Sc., M.Eng.

Curriculum Vitae

Ph.D. Student since October 2009

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich, Institute of Bioengineering
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53860
E-Mail	duong@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	OG A54
Name des Projektes | *Name of the project*	Growth simulation of biological soft tissues
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Manfred Staat
Partneruniversität | *Partner University*	RWTH Aachen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Dieter Weichert
Projektpartner | *Project Partner*	> MOET (Ministry of Education and Training of Vietnam) > HUT (Hanoi University of Technology) > RWTH Aachen

Growth simulation of biological soft tissues

Minh Tuãn Du'o'ng[1,2*], Manfred Staat[1*]

[1] Institute of Bioengineering, FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2] Hanoi University of Technology (HUT), Faculty of Mechanical Engineering, Hanoi, Vietnam

*duong@fh-aachen.de, m.staat@fh-aachen.de

This research presents a 3D growth model for biological soft tissues which is implemented into a large open source Finite Element software. Growth of soft tissues has been developed for years, but still considered as the open and demanding topic due to different theories, approaches and tissue complexity. The changing mass of tissues can be modelled at the constitutive level. In this work, the theory based mainly on constitutive framework and the implementation in Finite Element Analysis is discussed, see [1]. Multidecomposition of the mapping of a soft tissue object at initial state (reference configuration) to the grown form (current/spatial configuration) is used. To this end, the deformation gradient will be multiplicatively split into a growth part and an elastic part. Hence, besides the material and the spatial configuration, an intermediate configuration or grown configuration without any elastic deformation is also introduced. Although both, a change in density and a change in volume, can be modelled, we only focused here on the density preservation so that the volume of the tissue can change. An isotropic growth model is studied and implemented for any material, for instance, fiber-reinforced material such as arteries, ureter, or small intestines. The approach is very convenient to be performed because it is built up in the constitutive framework. Therefore, the constitutive equation needs to be adequately modified according to the growth model. The numerical results show the growth simulation in time and the stress state of the tissue. This model can be applied to general soft tissue such as isotropy, transversely isotropy and anisotropy.This model can be applied to general soft tissue such as isotropy, transversely isotropy and anisotropy.

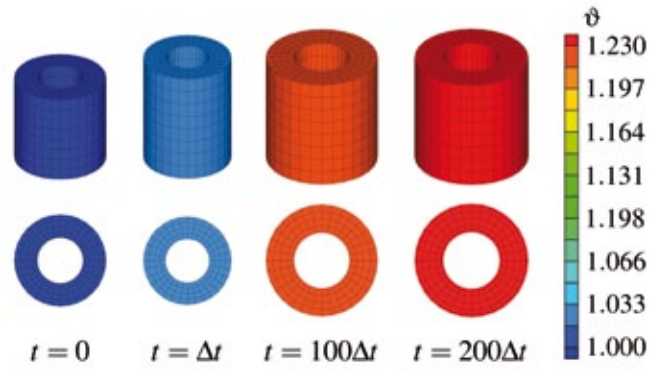


Fig. 1 | Growth simulation of the tube and evolution of the stretch ratio (ϑ) for an axial stretch u=1.0[1].

[1] Himpel, G., E. Kuhl, A. Menzel, and P. Steinmann (2005). Computational modelling of isotropic multiplicative growth. Computer Modeling in Engineering & Sciences 8, 119–134.

Nachname | *Name*	Eickmann
Vorname | *First Name*	Matthias
Titel | *Title*	Dipl.-Ing (FH)

Curriculum Vitae

Ph.D. Student since July 2012

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering
Adresse der Hochschule | *Address of the University*	Hohenstauffenallee 6 | 52064 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52487
E-Mail	eickmann@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	AMA 328
Name des Projektes | *Name of the project*	Hydrogen|CNG blended fuel performance by kinetic native-state Hydrogen exchange
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Thomas Esch
Partneruniversität | *Partner University*	RMIT University
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Sylvester Abanteriba

Hydrogen|CNG blended fuel performance by kinetic native-state hydrogen exchange

Matthias Eickmann[1,2]

[1] Royal Melbourne Institute of Technology, School of Aerospace, Mechanical and Manufacturing Engineering, Melbourne, Australia
[2] Faculty of Aerospace Engineering, FH Aachen, 520764 Aachen, Germany

*eickmann@fh-aachen.de

This research program will be the theoretical and experimental investigation of combustion improvement of CNG fuelled internal combustion engines by using hydrogen as combustion additive. The concept of using hydrogen as an add-on fuel is one promising technology to reduce C-atom based emissions. The strategies to reduce emissions have to be divided into two different engine-operating strategies. For maximum power output the engine will run in a fuel rich condition. For the part-load condition the engine can be operated in the lean mode which leads to higher thermal efficiency. Here the part-load conditions will be considered. However this operating strategy has a number of difficulties which can be linked to the lean combustion mode. It is known that reduced flame speeds reduce the efficiency of combustion. Another undesirable phenomenon is misfiring, which may occur. This contributes to low engine power output and higher emissions derived from unburned hydrocarbons. Using hydrogen is a possible add-on alternative because of its propensity to boost the flame propagation which leads to stabilized combustion. Lean limits of a pure CNG/H2 mixture will improve vis-à-vis those of pure CNG because of the wide ignition limits of hydrogen. CNG and CNG/H2 fuel blends can be seen as a bridging technology to future pure hydrogen combustion.

Normally hydrogen is used in its molecular stabilized form and will be supplied from an external gas tank. The idea is to generate hydrogen on-demand and directly near the place of combustion. When producing hydrogen via e.g. electrolysis it is available for a very short time in its atomic state. Within this period, usually two H atoms react with each other. After this merger, the hydrogen is in an excited state and can be used for improving the flame propagation combustion efficiency compared with the use of stabilized molecular hydrogen.

One focus of the research work will be the generation of on-demand hydrogen in excited condition (OnExHy). Electrolysis as well as catalytic systems will be evaluated. As ignition delay time of CNG and H_2 combustion are already known, characteristic combustion data of CNG/H_2 blends will be checked as well as data of CNG/OnExHy combustion by lab testing. The laminar burning velocities out of the laboratory tests are fundamentally important with regards to developing and justifying chemical kinetics mechanism. It is necessary to have these data to set up a numerical model to predict the combustion behaviour in internal combustion engines in combination with a CFD-simulation. To do this a numerical description of the kinetics of the combustion reaction associated with the OnExHy is needed and will be the scope of work within in the Master-Program.

The research questions which have to be answered include:

- Is it possible to build up an adequate numerical description for the behaviour of the excited hydrogen obtained from electrolysis?
- What are the improvements on combustion behaviour in case of the use of excited hydrogen as fuel additive to CNG?
- What improvements, in terms of internal combustion engine efficiency and emissions, can be established by simulation when blends of the excited Hydrogen are considered in the analysis for part-load operating conditions?

Nachname | *Name*	Frotscher
Vorname | *First Name*	Ralf
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since September 2010

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53861
E-Mail	frotscher@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01A54
Name des Projektes | *Name of the project*	FH-Extra: Messung mechanischer Grundspannungen und Schlagamplituden von Monolayern stammzellbasierter Kardiomyozyten für die funktionelle Medikamenten- und Toxinforschung – Ein Bio-Medical-Engineering Netzwerk FHprofUnt: Optimierung des Systems Netzimplantat-Beckenboden zur therapeutischen Gewebeverstärkung nach der Integraltheorie
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Hans-Jürgen Raatschen (FH Extra), Prof. Dr.-Ing. Manfred Staat (FHprofUnt)
Partneruniversität | *Partner University*	Universität Duisburg-Essen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Jörg Schröder
Projektpartner | *Project Partner*	> Axiogenesis AG > Hitec Zang GmbH > FH Aachen Institut für Bioengineering, Labor Technische Mechanik/FEM > RWTH Aachen, Institut für Pharmakologie und Toxikologie

Modeling and simulation of hollow organs in the female pelvic floor

Ralf Frotscher[1]*, Manfred Staat[1]

[1]Institute of Bioengineering, FH Aachen, Campus Jülich, 52428 Jülich, Germany

*frotscher@fh-aachen.de

In the project “Optimization of the system mesh implant-pelvic floor for therapeutical tissue support” we aim to optimize mesh implants that recover continence in women by full pelvic floor simulations. One major task in this project is the appropriate modeling of the hollow organs. Within the Integral Theory, which describes the static, dynamic and functional anatomy of the pelvic floor, the vagina is in the focus of all examinations. Depending on the stiffness of the ligaments and connective tissue supporting the vagina it either serves as a membrane that helps to keep all the other organs, like bladder and urethra, in its anatomically correct position or it fails and causes pathology, like vaginal or rectal prolapse or incontinence. As the vagina plays a very important role in the Integral Theory it needs to be modeled as accurately as possible.

The geometrical model we are employing has been developed at the Medical University of Vienna basing on real patient data and it includes nearly all important constituents of the pelvic floor. In a finite element context most of the constituents can be viewed as 3D bodies. Contrary to that the hollow organs (bladder, urethra, rectum and vagina) need to be viewed as computationally demanding shell structures. Due to their thin walls a 3D representation would lead to enormous computational costs. In order to be able to simulate the whole range of displacement and deformation going on in the pelvic floor during action (jumping, coughing, stretching of pelvic floor muscles) the shell finite elements need to work in a geometrically and materially nonlinear regime and they potentially have frictionless contact with other elements. Moreover, to keep the computational costs low, they need to be performant and stable. The requirements on those shell elements are extreme and therefore the shell elements that are available in industrial finite element codes need to be combined with advanced methods, like the Arc-Length Method, adaptive time stepping, the Enhanced Assumed Strain Method or the Discrete Strain Gap Method to avoid numerical problems. In this project we are developing a model of the hollow organs that can handle the demanding nonlinearities in pelvic floor mechanics to achieve realistic simulations.

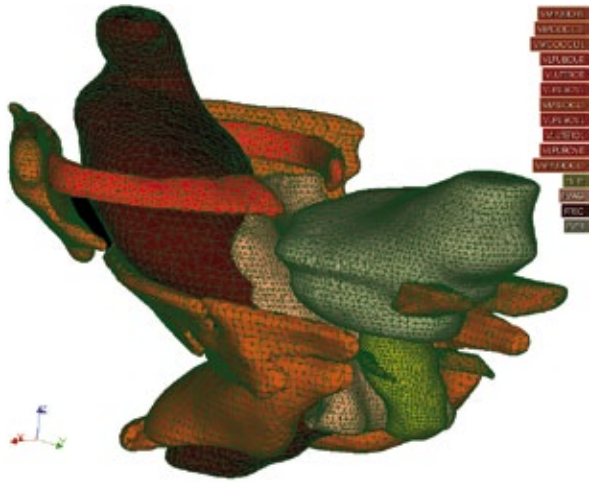


Fig. 1 | The (incomplete) geometrical model of the female pelvic floor. The vagina (pink), the rectum (brown), the bladder (turquoise) and the urethra (green) are hollow organs. The ligaments (red) and muscles (orange) surrounding those organs are 3D tissues.

K. Goeschen, P.P. Petros: Der weibliche Beckenboden, Springer Medizin Verlag, 2009.

Nachname | *Name*	Gerhards
Vorname | *First Name*	Michael
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since February 2011

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53791
E-Mail	m.gerhards@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	OG A66
Name des Projektes | *Name of the project*	History-tracing XML for an Actor-driven Grid-enabled Workflow System (HiX4AGWS)
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. rer. nat. Volker Sander
Partneruniversität | *Partner University*	University of Amsterdam
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Adam Belloum
Projektpartner | *Project Partner*	> Waagenbau Dohmen GmbH, > Jülich Supercomputing Centre, > Forschungszentrum Jülich GmbH

Using provenance data to optimize resource scheduling

Michael Gerhards[1]*, Volker Sander[1]

[1] FH Aachen, Campus Jülich, 52428 Jülich, Germany

*m.gerhards@fh-aachen.de

Grids provide access to computational, storage, and data resources at a large scale. Grid applications are frequently modeled as workflows that are executed under the control of a workflow management system. The workflow management system takes care of the dependencies and the progress of the individual tasks in the workflow. A particular challenge arises when workflows are mapped to resources at different organizations, each providing a heterogeneous system with non-uniform interfaces to access these resources. Grid middleware platforms support the execution of workflows in virtual organizations, where the distributed resources are owned and manipulated by multiple organizations. Abstract grid workflows are described independently of specific resources because new resources can be established or existing ones can be omitted or blocked. The grid scheduler manages distributed resources. It binds workflow tasks to grid resources at workflow runtime. The tasks are scheduled in a batch queue in case of scarce grid resources during a load peek. There, they wait until enough suitable resources are available. To short waiting time, meta-queues or even schedulers were introduced to select the first available resource among an aggregation of resources providing the demanded service. However, the solution relies on the availability physical resources of a virtual organization.

The grid concept of considering only physical resources is gone in the cloud vision of infinite resources. Cloud computing offers a promising alternative infrastructure for using scalable on demand resources. Providers such as Amazon allow users to allocate virtualized computational resources. Of course, those providers allow for porting full applications. However, this might not be the optimal solution, because the already existing on-premise resources are not considered. Therefore, for many scenarios it appears to be opportune to integrate cloud resources with easy-scale and dynamic provisioning into the local grid environment for the execution of computation intensive application parts whereas the other application parts are executed on local available computational resources. An example is a highly parallelized application which could use a Graphics Processing Unit (GPU) in the cloud, while the remainder of the program is executed locally. The extension of grid resources with cloud resources is a possibility to guaranty enough resources to the users when they need it without queue time. But the combination of grids and clouds provides challenges on technical and on organizational side. The allocation of resources in clouds is different than in grids. Theoretically, any number of cloud resources can be instanced on demand. However, the performance of a dedicated cloud resource might vary. Therefore new scheduling algorithms are required.

The importance of validating and reproducing the outcome of computation processes is fundamental to many application domains. This becomes even more important in distributed environments where workflow tasks are loosely bound to computational resources. It is exposed that there is a need to capture extra information in a process documentation that describes what actually occurred. The automated tracking and storing of provenance information during workflow execution could satisfy this requirement. Provenance traces enable to see what has happened during the execution of the workflow. This also enables failure analysis and optimization for future resource scheduling.

Nachname | *Name*	Goßmann
Vorname | *First Name*	Matthias
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since 2010

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53702
E-Mail	Gossmann@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01E20/21
Name des Projektes | *Name of the project*	Entwicklung eines zellulären dreidimensionalen Herzmuskelmodells und Charakterisierung seiner Inotropie für die funktionellen Medikamenten- und Toxinforschung
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Dr. Aysegül (Temiz) Artmann
Partneruniversität | *Partner University*	Universität Duisburg-Essen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Matthias Epple
Projektpartner | *Project Partner*	> Axiogenesis AG > Hitec Zang GmbH > FH Aachen, Fachbereich Maschinenbau und Mechatronik > RWTH Aachen, Institut für Pharmakologie und Toxikologie

Measurement of the contractile forces of autonomously beating cardiomyocytes

Matthias Goßmann[1,2]*, Peter Linder[1], V. Seifarth[1,2] Gerhard Artmann[1], Matthias Epple[2], Aysegül (Temiz) Artmann[1]

[1] Institute of Bioengineering, Laboratory of Cell Biophysics and Laboratory of Medical and Molecular Biology, FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2] Institut für Anorganische Chemie, Universität Duisburg-Essen, Germany

*Gossmann@fh-aachen.de

Considering the fact that the major function of the heart is the generation of force for pumping blood through the body, there is a remarkable lack of methods routinely used for mechanical testing of cardiac myocytes in vitro. Existing approaches share restrictions and drawbacks including complex and labor-intensive setups, hardly controllable geometries, inappropriate mechanical environments, lack of human material and hence use of animal models. Others concepts make use of indirect measures for force or tension which imply strict correlations between mechanical properties and biochemical measures.

The aim of this work is the development of an easy-to-use and accurate artificial model of the human heart muscle for the measurement of the contractile forces of autonomously beating cardiomyocytes for functional drug and toxin research. It is based on the CellDrum system which was developed at the Institute of Bioengineering at the University of Applied Sciences Aachen. In brief, the CellDrum is a cell culture system in which adherent cells are cultured on an ultra-flexible silicone membrane. By application of pneumatic pressure and simultaneous measurement of the deflection and the applied pressure, the cellular tension can instantaneously be calculated. In previous studies, the feasibility of the CellDrum system was successfully demonstrated with various cell types including fibroblasts, endothelial cells and myocytes. In addition, the flexibility of the culture substrate provides the possibility to simulate various physiological and pathological tensile conditions. Thus, the system can serve as a model for several cardiovascular diseases like hypertonia and cardiomyopathy.

We investigated the effects of well characterized inotropes acting on Ca2+ channels (S-Bay K8644/Verapamil), Na^+ channels (veratridine/lidocaine) and β1-adrenergenic receptors (norepinephrine/bisoprolol) on cardiac myocytes derived from human induced pluripotent stem cells (hiPS). We could show that the CellDrum system combined with cardiac myocytes from human origin is a sophisticated and easy-to-use tool for the measurement of inotropic effects.

Nachname | *Name*	Huck
Vorname | *First Name*	Christina
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since October 2009

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53858
E-Mail	huck@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01A53 / 01E36/37
Name des Projektes | *Name of the project*	EMSiG – Entwicklung eines Multisensorsystems in Siliziumtechnik zur Beurteilung der Gärbiologie eines Anaerobfermenters in der Flüssigphase
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Michael J. Schöning
Partneruniversität | *Partner University*	Hasselt University
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Patrick Wagner
Projektpartner | *Project Partner*	> Forschungszentrum Jülich GmbH > Hasselt University

Development of silicon-based sensors for biogas process monitoring

C. Huck[1,2*], M. Bäcker[1,2], S. Chaudhuri[1], A. Poghossian[1,2], P. Wagner[3], M. J. Schöning[1,2]

[1]Institute of Nano- and Biotechnologies (INB), FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2]Peter Grünberg Institute (PGI-8), Forschungszentrum Jülich GmbH, 52425 Jülich, Germany
[3]Institute for Materials Research, Hasselt University, 3590 Diepenbeek, Belgium

*huck@fh-aachen.de

The production of biogas is currently establishing in the group of alternative energies (see Fig. 1). Accompanied by the growing number of biogas plants, the demand for stringent monitoring and control of biogas process is increasing. An implementation of multi-parameter monitoring and control systems could improve the biogas process in terms of process stability and sufficient high-yield and thus, avoid expensive and time-consuming digester breakdowns.

In this contribution, a solid-state sensor array for multi-parameter monitoring of biogas processes is presented. The developed sensor array consists of two sensor chips allowing continuous monitoring and quantification of four chemical and physical parameters by applying different transducer principles and/ or different operation modes.

The first sensor chip is capable of simultaneous amperometric/field-effect monitoring the dissolved hydrogen (H_2) concentration. Dissolved H_2 represents one of the most important parameters for biogas process control, because it is a key factor in the intricate balance between microbial species involved in the multi-step degradation during anaerobic digestion. The sensor chip combines a pH-sensitive capacitive electrolyte-insulator-semiconductor (EIS) sensor consisting of an Al-p-Si-SiO2-Ta2O5 structure and thin-film Pt electrodes for field-effect and amperometric measurements, respectively. The (EIS) pH sensor has been applied for the indirect measurement of dissolved H_2 detecting the product of H_2 oxidation, i.e. H^+ ions generated at the polarized working electrode of the amperometric sensing part. The combination of two different transducer principles for the detection of the same parameter might allow a more accurate, selective and reliable measurement of dissolved H_2.

The second chip integrates several individual sensors for the control of bulk pH value, conductivity and temperature in biogas medium. An EIS sensor is utilized as a pH sensor, thin-film platinum interdigitated electrodes served as impedance sensor for electrolyte conductivity measurements and a thin-film platinum resistor was used as temperature sensor. To protect the platinum electrodes, both the conductivity and the temperature sensors were electrically isolated from solution by a protection layer of barium strontium titanate.

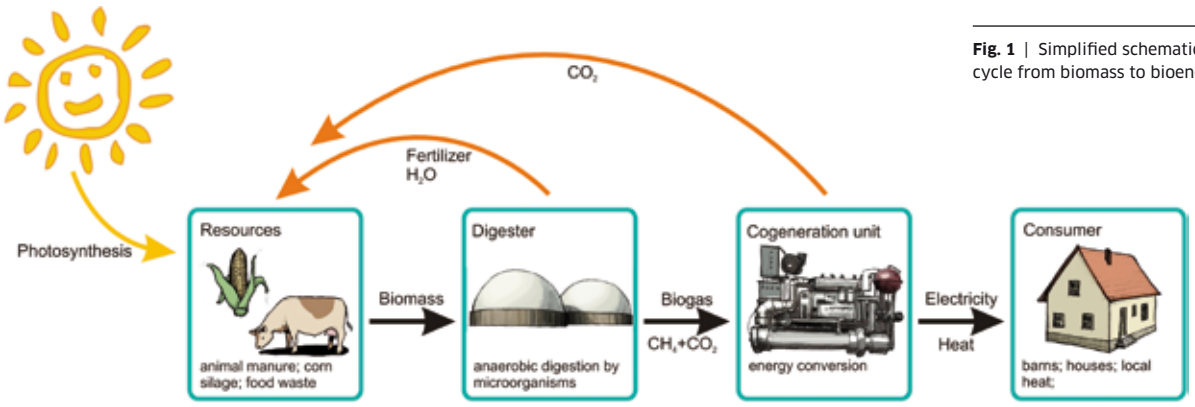


Fig. 1 | Simplified schematic production cycle from biomass to bioenergy.

Nachname | *Name*	Keinz
Vorname | *First Name*	Jan
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since 2012

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering
Adresse der Hochschule | *Address of the University*	Hohenstaufenallee 6 | 52064 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52808
E-Mail	keinz@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	02113
Name des Projektes | *Name of the project*	Adaption and optimization of the Dry-Low-NO_x-Micromix-Application with high energy densities using hydrogen and hydrogen-rich syngas
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Harald Funke
Partneruniversität | *Partner University*	Université Libre de Bruxelles (Belgium)
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Patrick Hendrick
Projektpartner | *Project Partner*	> B&B-AGEMA GmbH > Böwema GmbH > RJ Lasertechnik GmbH

Adaption and optimization of the Dry-Low-NO_X-Micromix-Application with high energy densities using hydrogen and hydrogen-rich syngas

Jan Keinz[1*], Harald Funke[1]

[1] Faculty of Aerospace Engineering, FH Aachen, 52064 Aachen, Germany

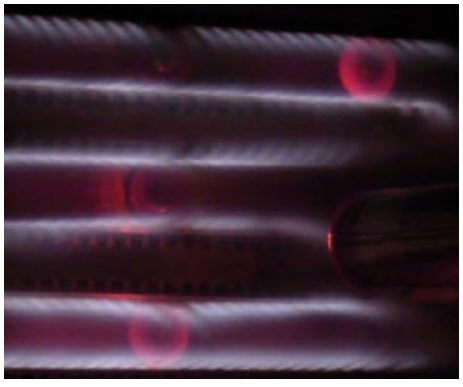
*keinz@fh-aachen.de

The research and development of renewable energy sources is driven by the need to reduce greenhouse gas emissions. Especially the reduction of CO_2 and NO_x is of great importance since forced by the European emission trading system from 2013 on. For future scenarios, hydrogen combustion systems can play an important role when hydrogen is produced by renewable and sustainable energy like wind- or solar-power and stored for combustion in industrial gas turbine applications. When hydrogen is burned with air in gas turbines no CO_2 emissions occur but NO_x emissions arise.

Against the background of secure and low NO_x combustion of hydrogen the Dry-Low-NO_x-Micromix burning principle is developed for years at Aachen University of Applied Sciences and was first invented for the use in aircraft jet engines to significantly reduce NO_x-emissions. Previous research activities proved the significant NO_x reduction ability of the Micromix principle based on cross-flow mixing of air and gaseous hydrogen burning in multiple miniaturized diffusion-type flames (Fig. 1a) with the advantage of inherent safety against flash back.

Current research work intends to increase the energy density of the Micromix application for the use in stationary high-power generation gas turbines in combination with hydrogen and hydrogen-rich IGCC-syngas fuel. Those fuels are composed of hydrogen, carbon-monoxides and hydro-carbons and are an outcome from carbon capture power plant technologies. To adapt the Micromix principle to increased energy density and syngas fuel it is necessary to conduct a deep analysis of the key design hydrogen and syngas combustion chamber parameters influencing the formation of emissions at high-power density applications and experimentally and numerically investigate the combustion characteristics by means of Micromix test burner applications (Fig. 1b).

a



b

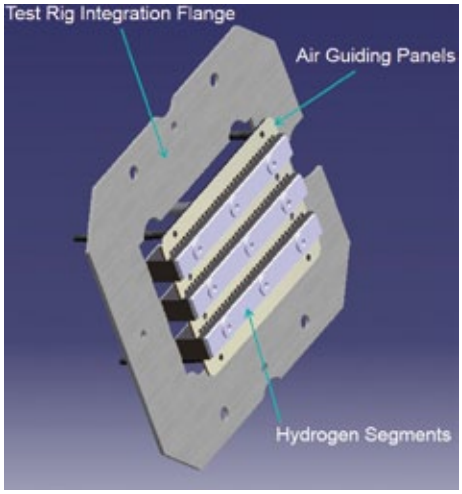


Fig. 1 | (a) Micromix Combustion, (b) Micromix Test Burner Application

Nachname | *Name*	Kreyer
Vorname | *First Name*	Jörg
Titel | *Title*	Dipl.-Ing., M.Sc.

Curriculum Vitae

Ph.D. Student since July 2013

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering
Adresse der Hochschule | *Address of the University*	Aachen-und-Münchener Allee 1 | 52428 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52827
E-Mail	kreyer@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	AM 331
Name des Projektes | *Name of the project*	Load- and operation mode synchronized thermo management for utility vehicles with hybrid drive concepts
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Thomas Esch
Partneruniversität | *Partner University*	RWTH Aachen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Stefan Pischinger

Load and operation-mode synchronized thermo management for utility vehicles with hybrid drives

Jörg Kreyer[1]*

[1] Faculty of Aerospace Engineering, FH Aachen, 52064 Aachen, Germany

*kreyer@fh-aachen.de

This research sub-program is part of an associated research program of the Univeristy of Applied Sciences Aachen in cooperation with the RWTH Aachen. The goal of this associated program is the investigation and characterization of potentials in fuel-, emission- and noise reduction in the field of utility vehicle development. Its short title is ANFAHRT and it consists of 10 sub-research programs. The objectives are pursued through different approaches. They range from an overall system analysis for evaluation of the primary energy consumption over the optimisation of the propulsion systems, especially of the hybrid systems by context information and adaptive strategies for recurring, non-predictabel constrains, up to the optimization of vehicle subsystems like power- and energy storage devices. Furthermore the propulsion systems, the combustion engine behaviour and the hybrid drive, amongst others are under examination.

Against the background of optimization of the thermo-management of hybrid utility vehicles, this sub-program is presented. This thesis focuses on the evaluation of waste heat recovery systems (WHR-systems), which can be used to provide additional driving power and shows the necessity of the heat- and cooling demand for the vehicle. The thesis also looks at the optimization of the controlling strategies of the thermal management in a driving cycle based on the load- and hybrid specific operation mode. For the investigation, the diversity of utility vehicle classes has to be taken into account., therefore a systematisation of the vehicle classes as well as their characteristics in an operational environment has to be regarded.

Based on this the influence of the measures on the thermal management are investigated by simulations as well as measurement runs of test vehicles in field operations.

The following procedures are part of the sub-program:

- Literature research for systematisation and localisation of potential fields
- Analysing of heat sources and heat sinks and generation of a exergy analysis
- Simulation of the thermal management with special software
- Validation of the simulation with the help of a test vehicle

Nachname | *Name*	Nagle
Vorname | *First Name*	Anuja
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since May 2009

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering (Atomotive Laboratory)
Adresse der Hochschule | *Address of the University*	Boxgraben 98-100 | 52064 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52934
E-Mail	nagle@fh-aachen.de
Name des Projektes | *Name of the project*	Methodology for a semi-analytical design approach for automotive space-frame structures considering crash behaviour
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Thilo Roeth
Partner University	RWTH Aachen, Institut für Allgemeine Mechanik, IAM
Professor attending to the University	Prof. Dr.-Ing. Dieter Weichert
Project Partner	> Imperia GmbH

Methodology for a semi-analytical design approach for automotive space-frame structures considering crash behaviour

Anuja Nagle[1,2]*

[1] Faculty of Aerospace Engineering, FH Aachen, 52064 Aachen, Germany
[2] Institut für Allgemeine Mechanik (IAM), RWTH Aachen, 52062 Aachen, Germany

*nagle@fh-aachen.de

The automotive industry is changing continuously in various aspects, the changing customer demands being one of the main drivers for these alterations. Due to increasing requirement for vehicle derivatives and decreasing lead time between introduction of new vehicle designs, application of fast and efficient design techniques in vehicle design has gained utmost importance. Considering the structural design aspects, owing to the scarcity of fuel and environmental protection issues the current trend is to design lightweight vehicles. Moreover, innovative design techniques are continuously researched in order to meet the ever increasing safety requirements. As the car body structure accounts for a larger portion of the weight and safety characteristics of a vehicle, its design is of high importance.

In order to achieve a balance between all the above design requirements a design approach is developed in the present doctoral project. Here a methodology is proposed for carrying out a performance oriented design of the car body by integrating knowledgebase in three fields: geometrical construction, manufacturing technology and structural design. Accordingly the car body design process is divided into seven logical steps. Each of these steps can be realized using one of the knowledgebase.

The present dissertation focuses on the development of structural knowledgebase for the car body design. This approach uses the space frame based FlexBody construction concept as the basis for the development of this knowledgebase. Owing to its profile and joint based construction and multi-material concept FlexBody possesses high potential for constructing lightweight car body structures. The structural knowledgebase developed under this doctoral project proposes methods for determining the safety performance targets for the individual FlexBody components and uses semi-analytical methods for finding suitable component geometry to match these targets. The basic data required for developing this knowledgebase is extracted from numerous non-linear numerical vehicle simulations.

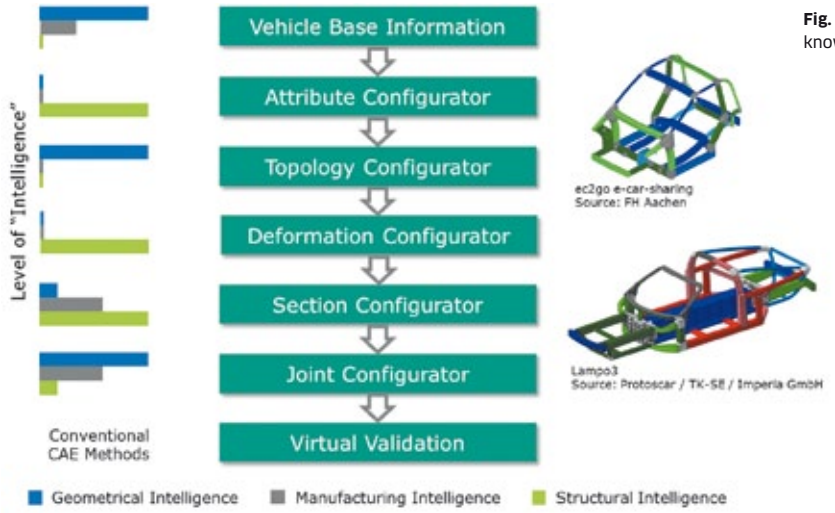


Fig. 1 | Design methodology integrating knowledgebase in car body design

Nachname | *Name*	Neu
Vorname | *First Name*	Eugen
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since July 2012

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering (Aerodynamic Laboratory)
Adresse der Hochschule | *Address of the University*	Hohenstaufenallee 6 | 52064 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52481
E-Mail	neu@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	O2120
Name des Projektes | *Name of the project*	Vibration-based Structural Health Monitoring on Composite Wings under In-Flight Loads
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Frank Janser
Partneruniversität | *Partner University*	RMIT University
Betreuender Professor an der Universität | *Professor attending to the University*	Dr. Adrian Orifici

Vibration-based structural health monitoring on composite wings under In-Flight Loads

Eugen Neu[1]*

[1] Faculty of Aerospace Engineering, FH Aachen, 52064 Aachen, Germany

*neu@fh-aachen.de

Development of automatic methods for continuous airplane Structural Health Monitoring (SHM) is a major challenge in modern aeronautical engineering. Such a system would simultaneously increase passenger safety and decrease maintains cost compared to “Time Between Overhall (TBO)”-based monitoring. Approximately 60% of a system's total life cycle cost is used for sustainment. The increasing use of composite materials brings along a variety of new damage cases (e.g. delamination) which are hard to detect by visual examination. This further increases the drive for alternative damage detection methods. Vibration-based techniques are the most popular class of SHM methods. Damage will alter a system's mass, stiffness and energy dissipation properties. Modal parameters (natural frequencies, mode shapes and damping ratios) are directly related to those properties and can comparatively easily be extracted from vibration measurements. Comparing actual measurements of a damage sensitive feature with an undamaged reference state will allow for damage detection (I) and sometimes localization (II). Adding information about the system's damage dependent dynamic behaviour will further allow for damage classification (III) and severity estimation (IV). Remaining lifetime forecasting (V) is conceivable, provided measurements of the current system state (SHM), future loading estimations and damage propagation models are available. These are the five stages that define a complete SHM and Damage Prognosis (DP) system and increasing system knowledge is necessary to elaborate every subsequent step.

In traditional experimental modal analysis (EMA) thorough excitation force measurements are needed for modal parameter. This is infeasible for an operating aircraft. Other fields of engineering also struggle with structures that are hard or impossible to excite artificially.Outgoing from research in civil engineering the field of ambient excitation or operational modal analysis (OMA) was developed around the turning point of the new millennium.
All OMA techniques have in common that exact excitation force measurements are replaced with certain assumptions about their stochastic properties. The input force is assumed to be a stationary (probabilistic distribution of load events is not a function of time), zero mean, Gaussian distributed broadband (white noise) signal. To which extent these assumptions are valid for an aircraft wing in-flight was not researched yet and will be investigated in this project.

The goal of this research program is to evaluate if a vibration-based SHM method for composite wings can be developed that uses in-flight loads as excitation source and can detect (I), locate (II) and estimate the severity (IV) of delamination damage. The major research questions are:

- Can in-flight loads be used for modal parameter identification of a composite wing?
- Can an SHM system for a composite wing be developed that uses in-flight loads?
- Can analysis of in-flight loads be used for damage severity estimation of a composite wing?

Nachname | *Name*	Oberländer
Vorname | *First Name*	Jan
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since January 2013

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich, Institute of Nano- and Biotechnologies
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53838
E-Mail	oberlaender@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	00A69
Name des Projektes | *Name of the project*	Realisation and characterisation of a chip-based impedance platform for the detection of microbiological deformations
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Michael J. Schöning
Partneruniversität | *Partner University*	Philipps-Universität Marburg
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Michael Keusgen
Projektpartner | *Project Partner*	> Elopak EQS GmbH, Mönchengladbach > Forschungszentrum Jülich GmbH, Jülich

Manganese(IV) oxide as catalyst for calorimetric hydrogen peroxide gas sensors

J. Oberländer[1,2], P. Kirchner[1], H.-G. Boyen[3], M. Keusgen[4], M.J. Schöning[1,2]

[1]Institute of Nano- and Biotechnologies (INB), FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2] Peter Grünberg Institute (PGI-8), Research Centre Jülich GmbH, 52425 Jülich, Germany
[3] Institute for Materials Research, Hasselt University, 3590 Diepenbeek, Belgium
[4] Department of Microbiology, Biological Faculty, Philipps-Universität, 35032 Marburg, Germany

*oberlaender@fh-aachen.de

In the food industry the application of composite packages on aseptic filling machines, especially for sensitive food products such as milk and juice, has been established. In order to maintain a long shelf life and consumer-safe product, it is mandatory to perform a sterilisation of all food contact surfaces of the packages prior the product filling. For this purpose, hydrogen peroxide (H_2O_2) in the gas phase, at elevated temperatures (up to 300 °C), is one of the commonly used sterilisation media[1].

Calorimetric gas sensors have been developed to facilitate a method to monitor the H_2O_2 concentration during the sterilisation process. These sensors are based on a differential set-up of two temperature sensors, as schematically shown in Fig. 1. On the right temperature sensor the gas temperature will be detected, whereas the left temperature sensor is catalytically activated by manganese(IV) oxide (MnO_2), to induce the exothermal decomposition of H_2O_2. The temperature difference between both temperature sensors serves as a measure for the present H_2O_2 concentration.

In this work, material analyses by means of XPS (X-ray photoelectron spectroscopy) were conducted, to reveal the surface chemistry of H_2O_2 on the catalyst. Therefore, the catalyst MnO2 has been investigated at different sensor operation states, pure MnO2, dispersion of MnO2 adhered with SU-8 photoresist, and MnO_2 after a long-term exposure to H_2O_2 vapour at elevated temperature. In Fig. 2, the survey scans of these analyses are shown. The analyses depict that the MnO2 surface is covered partly by the SU-8 photoresist, indicated by the strong peak of carbon (C 1s). After an exposure to H_2O_2 vapour the distinct carbon peak is extenuated to the initial height. This is an evidence that the layer of SU-8 on the catalyst surface is eliminated by H_2O_2 vapour and the active sites of the catalyst are available for the H_2O_2 decomposition.

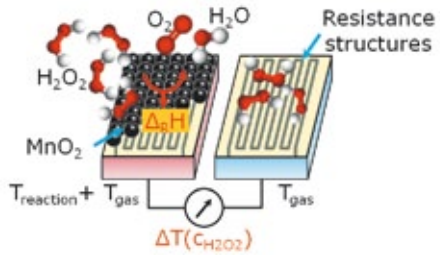


Fig. 1 | Schematic principle of the sensor set-up. Left side: gas temperature and heat of reaction will be detected; right side: detection of gas temperature.

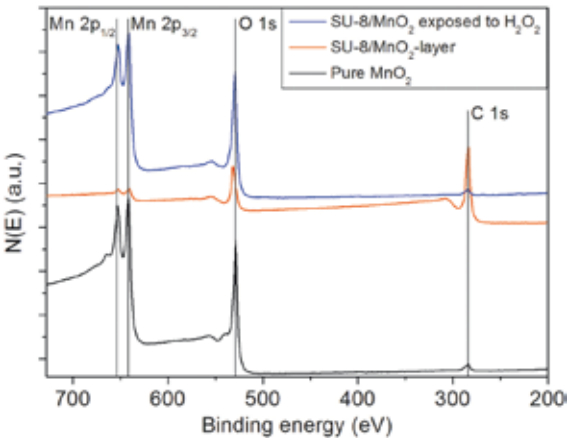


Fig. 2 | XPS survey scans of the catalyst at different sensor operation states.

[1] I. A. Ansari, A.K. Datta, Food Bioprod. Process. 81 (2003) 57-65

Nachname | *Name*	Rahier
Vorname | *First Name*	Michael
Titel | *Title*	M.Eng.

Curriculum Vitae

Ph.D. Student since July 2013

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Electrical Engineering and Information Technology
Adresse der Hochschule | *Address of the University*	Eupener Straße 70 | 52066 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52198
E-Mail	rahier@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	H215
Name des Projektes | *Name of the project*	Usage optimisation of alternatively powered utility vehicles by means of context information
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Thomas Ritz
Partneruniversität | *Partner University*	RWTH Aachen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Stefan Pischinger

Usage optimization of electrically driven utility vehicles by means of context information

M. Rahier[1]*

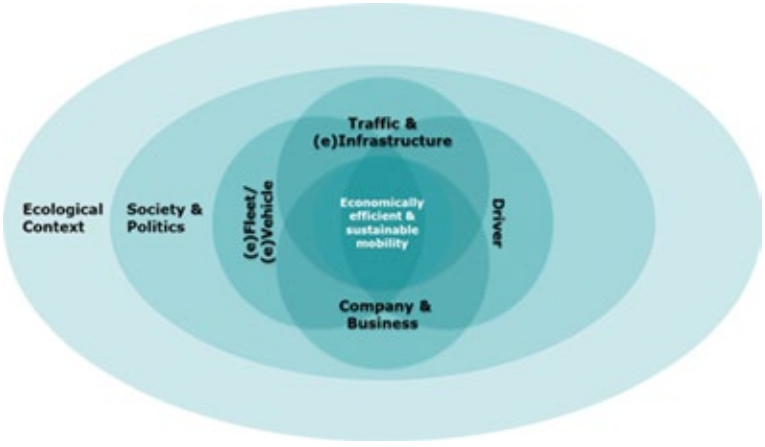
[1] Faculty of Electrical Engineering and Information Technology, FH Aachen, 52066 Aachen, Germany

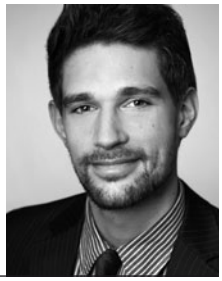
*rahier@fh-aachen.de

The project ANFAHRT is a cooperation of RWTH Aachen University and FH Aachen University of Applied Sciences aiming to face the challenges of current alternative drive concepts for utility vehicles. Although the technical feasibility is already proven, most of the concepts lack economic efficiency and attractiveness for industrial usage. Beyond technological optimization, the project aims to raise the overall attractiveness of these concepts in order to promote economically efficient and sustainable mobility. ANFAHRT is divided into 10 subprojects, one of them is described in the following.

In this subproject, relevant context information is used to develop an intelligent fleet management for electrified utility vehicle fleets, called eFleets. This eFleet management is not only based on conventional mission and fleet management but also takes into account all the aspects of electromobile information logistics, like range restriction and loading infrastructure. In addition to this electromobile context information, other information about the driver, the vehicle, the traffic as well as (shared) business information is used to parameterize an innovative algorithm. This algorithm can then be used for different purposes, for example tour planning with integrated loading management as well as mission mapping considering the remaining range. That way an economically efficient and sustainable mobility is enabled that can finally be merged with both logistics and supply chain management.

By connecting an eFleet to the so called SmartGrid, batteries of electrified utility vehicles can be used as a buffer for peaks of urban electricity demand. Energy suppliers pay for this kind of energy feeding and thus generate additional income for a company. All these actions form an attractive package, especially for small and medium-sized enterprises, that encourages them to switch over to eFleets.





Nachname | *Name*	Rupp
Vorname | *First Name*	Matthias
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since July 2013

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Energy Technology
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53022
E-Mail	rupp@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01A06
Name des Projektes | *Name of the project*	Overall system analysis of developed drive concepts
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Isabel Kuperjans
Partneruniversität | *Partner University*	RWTH Aachen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Heinz Pitsch

Overall system analysis of utility vehicle powertrain concepts

Matthias Rupp[1*]

[1]NOWUM-Energy, FH Aachen, Campus Jülich, 52428 Jülich, Germany

*rupp@fh-aachen.de

The project ANFAHRT is a cooperation of RWTH Aachen University and FH Aachen University of Applied Sciences aiming to develop and evaluate alternative drive concepts for utility vehicles with regard to a cleaner and sustainable environment. ANFAHRT is divided into 10 subprojects, one is described here.

For the evaluation of environmental impacts and sustainability, life cycle and technology assessment as well as primary energy balances are already used in many fields. Common in the automotive sector are so called "well-to-wheel balances", though without regard to energy input for disposal i.e. However, energetically and ecologically necessary is a consideration of the whole life cycle including production, utilization, disposal as well as involved supply chains (see picture). In particular the utilization of electricity from the public grid for battery charging needs to be considered while balancing primary energy demand and CO2 emissions, since it emphasizes disadvantages of electromobility.

Within this research project an overall system analysis will be executed, focussing on life cycle assessment of the different and innovative utility vehicle's drive systems. For each drive concept a detailed sustainability evaluation will be performed: In a first step, appropriate boundary conditions have to be defined and significant impact category indicators have to be chosen. Beyond the common indicators like global warming potential or resource use the drive's efficiency will be incorporated. For trucks and buses specific evaluation factors need to be integrated in the studies to ensure a maximum precision.

Based on the results of the life cycle assessment, scenario analyses will be executed and examined to evaluate, how the drive concept's overall balance varies according to changes in composition of various electricity mixes. Finally, a decision matrix will be derived to ensure an optimized application of each drive system according to vehicle type and requirements as well as route information.

Fig. 1 | Life cycle assessment of developed powertrain concepts

Nachname | *Name*	Schirra
Vorname | *First Name*	Julian Claudius
Titel | *Title*	Dipl.-Ing., M. Eng.

Curriculum Vitae

Ph.D. Student since July 2012

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering
Adresse der Hochschule | *Address of the University*	Hohenstaufenallee 6 | 52064 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52416
E-Mail	schirra@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	O2114
Name des Projektes | *Name of the project*	Highly non-planar lifting systems – A relative assessment of existing methodologies to accurately estimate the induced drag
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dipl.-Ing. J.-Michael Bauschat
Partneruniversität | *Partner University*	Royal Melbourne Institute of Technology
Betreuender Professor an der Universität | *Professor attending to the University*	Dr. Jonathan Watmuff

Highly non-planar lifting systems – A relative assessment of existing methodologies to accurately estimate the induced drag

J. C. Schirra[1,2]

[1] Faculty of Aerospace Engineering, FH Aachen, 52064 Aachen, Germany
[2] Royal Melbourne Institute of Technology, School of Aerospace, Mechanical & Manufacturing Engineering, Melbourne, Australia

*schirra@fh-aachen.de

For a commercial aircraft during stationary cruise flight, induced drag accounts for roughly 40 percent of the total drag. Aiming to reduce the induced drag fraction, several conceptual design studies have been conducted for highly non-planar lifting systems recently. Commonly, induced drag estimates are obtained by means of numerical methodologies based on potential flow theory. Vortex-lattice and panel methods are classical representatives. The trailing wake is prescribed as a flat and thin vorticity sheet leaving the trailing edge in the freestream direction. Although this shape differs generally from the physical, rolled-up and force-free wake, sufficiently accurate induced drag estimates can be provided for planar wings at small angle of attack. The reason for this is given by the fact that the wake model is aligned with the freestream. It is therefore at least drag-free. It is further reasonable to argue that the roll-up process occurs so slowly that the near-field portions of the wake, having the most dominant influence on the bound vorticity and therewith on the induced drag, are not significantly altered from their initial shape.

Applicability and accuracy of linear potential methods in the context of highly non-planar lifting systems have not been considered as an issue so far. Promoting a high degree of non-planar character in the near-wake, interactions between bound vorticity and shedding wake become more profound. Higher order effects like wake shape and induced lift, a unique feature of non-planar concepts, are supposed to have significant effect on the induced drag, its prediction and associated design parameters. Neglecting these contributions, estimates obtained by means of linear potential methods may therefore be inaccurate or even ill-conceived.

Within the scope of the present research, the accuracy of existing methodologies predicting the induced drag of highly non-planar lifting systems is assessed. Research additionally aims to qualify the impact of non-linear flowfield contributions on the induced drag characteristics of these systems. Besides the analytical finite wing solution, numerical approaches based on linear potential theory as well as Euler flow models are employed. The influence of non-linear flow field properties on the induced drag and associated spanload is evaluated by means of two Euler flow codes and a custom wake integration procedure. In contrast to potential methods, the trailing wake shape needn't be prescribed but is inherently included in the solution process. The approach depicts the most comprehensive inviscid flow model; however induced drag computation is still challenging and cumbersome.

The research questions to be answered include the following:

- Can potential methods predict the induced drag of highly non-planar lifting systems with sufficient accuracy?
- How do non-linear flow field properties impact on the induced drag, spanload and height-to-span ratio of highly non-planar lifting systems?
- Which relative error is introduced for highly non-planar lifting systems by neglecting non-linear contributions?

Nachname | *Name*	Schreiber
Vorname | *First Name*	Marc
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since September 2012

Universität | *University*	FH Aachen
tandort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52416
E-Mail	marc.schreiber@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01C03
Name des Projektes | *Name of the project*	Optimizing Natural Language Preprocessing Pipelines with Agile Software Development Techniques
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Bodo Kraft
Partneruniversität | *Partner University*	Universität Kassel
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Albert Zündorf
Projektpartner | *Project Partner*	antibodies online GmbH, ene't GmbH

Optimizing natural language preprocessing pipelines with agile software development techniques

Marc Schreiber[1], Bodo Kraft[1]

[1] FH Aachen, Campus Jülich, 52428 Jülich, Germany

*marc.schreiber@fh-aachen.de

Successful business models around the World Wide Web (WWW), e. g. trivago or Hotel Reservation Service, are based on the extensive data aggregation of huge information amounts from different sources and mostly heterogeneous data formats. Those companies currently use Extract, Transform and Load (ETL) processes to collect data and to transform them into their specific data models.

In many domains of the WWW market transparency does not prevail and information is generally provided in a format which makes it difficult to apply classic ETL processing. In fact documents containing relevant information and data are often described informal using natural language text. To overcome the disadvantages of classic ETL approaches Information Extraction (IE) systems have been developed.

All IE systems require Natural Language Processing (NLP) preprocessing pipelines. For example, most IE systems apply Named Entity Recognition (NER) to recognize Named Entitys (NEs) in natural language text which requires Text Segmentation (TS). Ideally all NLP preprocessing steps should produce results with F1 score equal to 100% to guarantee that IE works correctly. In fact current state-of-the-art Machine Learning (ML) NLP systems produce results with F1 score less than 100%.

The central question is, how it is possible to raise the F1 score of NLP preprocessing so that an IE system on top of the NLP preprocessing produces high quality results. To answer this question we suggest the usage of a Continues Integration (CI) pipeline for improving and testing NLP preprocessing tools.

Nachname | *Name*	Schulze
Vorname | *First Name*	Sven
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since November 2013

Universität | *University*	FH Aachen
Standort | *Location*	Aachen
Fachbereich | *Faculty*	Aerospace Engineering
Adresse der Hochschule | *Address of the University*	Hohenstaufenallee 6 | 52064 Aachen
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 52476
E-Mail	sven.schulze@alumni.fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	
Name des Projektes | *Name of the project*	Optimization of hybrid operation strategies by the use of adaptive memory functions for stochastic recurring, non-predictable constraints
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Günter Feyerl
Partneruniversität | *Partner University*	RWTH Aachen University
Betreuender Professor an der Universität | *Professor attending to the University*	Univ.-Prof. Dr.-Ing. Stefan Pischinger

Optimization of hybrid operation by adaptive strategies for recurring, non-predictable constraints

Sven Schulze[1*]

[1] Faculty of Aerospace Engineering, FH Aachen, 52064 Aachen, Germany

*sven.schulze@alumni.fh-aachen.de

The two different drive modules of hybrid vehicles offer additional degrees of freedom for delivering driving force. The vehicle control unit uses different operation strategies by coordinating the two different drive modules for increasing the efficiency. Common approaches optimize the operation strategies based on real time data of the vehicle condition and the actual driving situation. Changing and unpredictable boundary conditions such as the driver behaviour are not taken into account within this “classical” optimization. However, these factors have a strong influence on the efficiency of the vehicle, which is demonstrated by a hybrid-bus (Fig. 1).

This thesis focuses on the optimization of the operation strategy using adaptive functions for the following unpredictable boundaries:

- Behavior of the driver
- Varying vehicle mass due to passenger amount and load
- Daily profile
- Air-Conditioning requirement for passenger compartment and cargo area

After the determination of these four boundary conditions, relevant parameters for their detection are investigated. For instance, an aggressive driver can be distinguished from a calm one by different variables, e.g. acceleration and deceleration gradient. In the next step, the influence of the detected conditions is examined regarding the operation points of each drive unit and the resulting efficiency of the whole powertrain. A generated matrix covers the influence of simultaneously occurring adaptable conditions. Based on this adaption matrix the operation strategy is optimized by the adaption of:

- Recuperation / Torque assist strategy
- ICE load point / Operation point shift
- Charging / Discharging strategy
- Thermo and auxiliary management

In further steps the adaptive boundary conditions can be combined with clearly predictable boundary conditions from GPS-Data and Context information to gain further efficiency improvements.

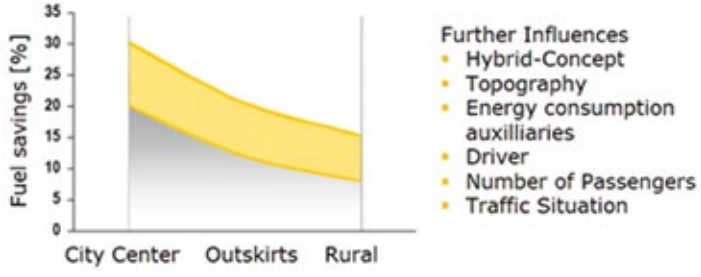
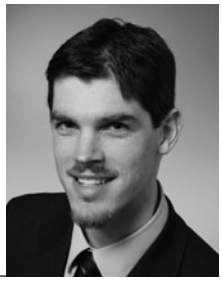


Fig. 1 | Potential fuel savings dependent on unpredictable boundary conditions (Source: transport-efficiency.com)



Nachname | *Name*	Schusser
Vorname | *First Name*	Sebastian
Titel | *Title*	Dipl.-Ing.

Curriculum Vitae

Ph.D. Student since May 2010

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich, Institute of Nano- and Biotechnologies
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53855
E-Mail	schusser@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01A51
Name des Projektes | *Name of the project*	BioMiMedics - Determination of polymer degradation by a semiconductor-based sensor system
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Michael J. Schöning
Partneruniversität | *Partner University*	Hasselt University
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Patrick Wagner
Projektpartner | *Project Partner*	> Maastricht University > RWTH Aachen > University of Liège > Hasselt University > Materia Nova, Mons, Belgium

Sensor system for real-time in situ degradation studies on biodegradable polymers

S. Schusser[1,2]*, M. Leinhos[1,2], A. Poghossian[1,2], M. Bäcker[1,2], P. Wagner[3], M. J. Schöning[1,2]

[1] Institute of Nano- and Biotechnologies (INB), FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2] Peter Grünberg Institute (PGI-8), Research Centre Jülich GmbH, 52425 Jülich, Germany
[3] Institute for Materials Research, Hasselt University, 3590 Diepenbeek, Belgium

*schusser@fh-aachen.de

Biodegradable polymers have become attractive for various applications. Their nature to disappear in a biological environment has led to a great interest in these materials ranging from packaging industry up to medical healthcare. Thus, researchers have started to investigate those materials in detail and to search for strategies to adapt the degradation behaviour with respect to the application's needs. Even though a lot of information about degradation processes have been gathered in the past, the manifold fields of application still raise questions.

In general, there is a lack of techniques providing real-time in situ monitoring for studies on the degradation behaviour. Thus, investigating and improving a particular polymer is a time-consuming process. In the present work, a chip-based sensor system is presented enabling real-time in situ monitoring of degradation processes. The approach should help to improve degradation studies towards a higher throughput.

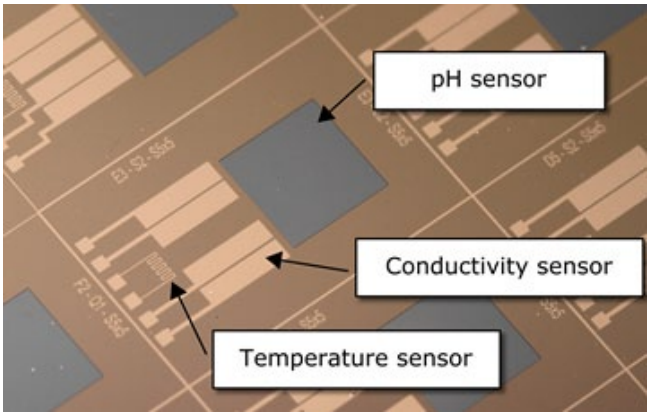


Fig. 1 | Photograph of fabricated parts of the sensor system. The shown unit contains sensors for pH, conductivity, and temperature measurement of the surrounding degradation medium.

This research is part of the Interreg EMR IV-A project BioMIMedics (www.biomimedics.org) and is co-financed by the European Union, local governments, research institutes and SMEs. The European Commission, investing in your future.

Ministerium für Wirtschaft, Energie, Bauen, Wohnen und Verkehr des Landes Nordrhein-Westfalen

Nachname | *Name*	Seifarth
Vorname | *First Name*	Volker
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since July 2011

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53726
E-Mail	seifarth@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01E20/21
Name des Projektes | *Name of the project*	UREPLACE-Harnleiterprothese
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr. Aysegül (Temiz) Artmann
Partneruniversität | *Partner University*	Universität Duisburg-Essen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr. Matthias Epple
Projektpartner | *Project Partner*	> Matricel GmbH, Herzogenrath > RWTH Aachen, Urologische Klinik > HiTec Zang GmbH, Herzogenrath

A bioreactor system for the generation of tubular tissue equivalents

V. Seifarth[1*], H.P. Janke, J. Grosse[2], W. Zang[3], G.M. Artmann[1], A. (Temiz) Artmann[1]

[1]Laboratory of Medical and Molecular Biology and Laboratory of Cell Biophysics, FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2]Department of Urology, RWTH Aachen University, 52074 Aachen, Germany
[3]HiTec Zang GmbH, 52134 Herzogenrath, Germany

*seifarth@fh-aachen.de

Today, the life expectancy is still increasing due to the high medical standard in industrial countries. Nevertheless, society suffers because of organ failures, which are based on malformation, accident or disorders like cancer. For that reason, there is a high demand for organ transplants. That demand cannot be satisfied adequately, so that the growing interdisciplinary field of tissue engineering in the regenerative medicine tries to overcome the problem by the generation of organ-equivalents as implants. These tissue-equivalents are generated in vitro under special conditions, where parameters, like temperature, pH-value and oxygenation are kept constant in specific ranges. The basic composition of these implants and their scaffolds can be of highly diverse materials, ranged from modern plastics and industrial manufactured biological compounds to allografts or xenografts. In order to increase the acceptance of the patient to the new organ, autologous cells are used, which are gained by small biopsies. These autologous cells form, in combination with the scaffold material, so called biohybrids, which are cultured and functionalized in vitro in a bioreactor system. The aim of this study is to develop a system for the generation of tubular hollow organs for the application in the urological clinic.

Material & Methods: The requirements on the system are defined with an improved handling, an automatized exchange of cell culture medium as well as the observation of parameters like temperature, carbon dioxide (CO_2) concentration and pH-value. To achieve that, an incubator is built with integrated peristaltic pump heads, a CO_2 inlet pipe and a sensor and a tangential fan. Moreover, a cylindrical bioreactor is prepared for the uptake of tubular structures made out of synthetic or biological materials. This bioreactor is connected to two reservoirs, which are equipped with two pH-electrodes and filled with cell culture medium.

An interface, provided by the HiTec Zang GmbH, is used to connect all actuators and sensors to the computer. The corresponding software is used to design a user surface to read out and store data as well as to control the actuators.

Results and Conclusion: The development of the incubating system and the bioreactor shows suitable characteristics in the organ handling, based on the decoupling of the components. Parameters like temperature and CO_2 concentration can be precisely controlled, so that the cells in the bioreactor are not affected by outer factors.

Cultivation periods for more than 14 days showed that different cell types like primary smooth muscle cells or established cell lines like NIH-3T3-fibroblasts can proliferate inside this bioreactor on a collagen material.

All in all, the system shows its integrity, whereas further investigation has to be done on the scaffold material, where the cell cultures are embedded.

Nachname | *Name*	Stollenwerk
Vorname | *First Name*	Dominik
Titel | *Title*	M.Sc.

Curriculum Vitae

Ph.D. Student since July 2011

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Energy Technology
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53021
E-Mail	stollenwerk@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01A05
Name des Projektes | *Name of the project*	MIND-Energy
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Isabel Kuperjans
Partneruniversität | *Partner University*	RWTH Aachen
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. André Bardow
Projektpartner | *Project Partner*	> Carpus+Partner AG, Aachen > Perpendo GmbH, Aachen > InfraServ GmbH Co. Knapsack KG, Hürth > Pigmenttec GmbH & Co. KG, Aachen > BOLDER Arzneimittel GmbH & Co. KG, Köln

Time series compression for simulation and optimization of energy systems

D. Stollenwerk[1]*, I. Kuperjans[1]

[1]NOWUM-Energy, FH Aachen, Campus Jülich, 52428 Jülich, Germany

*stollenwerk@fh-aachen.de

MIND-Energy Sustainable energy supply for producing companies

Background | Today, companies strongly depend on fossil fuels besides electrical power to keep their production running. Facing the rising demand of fossil fuels in emerging countries, it is assumed that in about 20 years in Germany oil and gas due to low availability and high prices only can be used to a very limited extent for production processes and space heating. The alternative use of electric energy is partially physically impossible, thermodynamically ineffective or too expensive.
Companies must make strategic decisions in the near future, which energy sources are suitable for them and their processes.

Objectives and methodology of the research project | The aim of the study MIND-Energy is to enable companies to select a sustainable energy system, suitable for them and to blueprint their strategic plan over the next 10-20 years. For this purpose, a software-based methodology is developed. Using that, the company is able to check which forms of renewable energy and energy storages are suitable for their production process and their location. Furthermore, they can estimate the costs associated with the conversion of the energy system. The energetic, technical and economic potential of all available renewable energy carriers can be determined and the matching conversion technology can be chosen.

Result of the study will be a catalogue of structures and methods with that, while maintaining the production outcome and comfort for companies in Germany, with much less energy use and the use of regionally available renewable energy carriers, companies can ideally become energy autarkic. Hence, securing operation of the plant by innovative strategies for future energy supply, time and cost plans for the coming years, and -if necessary by contracts- secure locally available fuels and storages are possible.

State of the study | To simulate and optimize the energy system for producing companies is a very time and computational resource intensive procedure. Therefore it is necessary to apply time series compression methods to decrease the number of operation points of the system.

These methods are well known for data mining operations in large databases and for similarity searches. For simulation and optimization this methods have to be adapted and tuned, to reach the needed accuracy and to incorporate important layout parameters like peaks or part-load boundaries. Therefore the most commonly used compression methods: PAA (Piecewise Aggregate Approximation), APCA (Adaptive Piecewise Constant Approximation) and PLA (Piecewise Linear Approximation) are investigated and their influence on the simulation results of certain energy system configurations is determined. In the next step their influence on the MILP (Mixed Integer Linear Programming)-Optimization of the afore mentioned systems is investigated and a guidance framework for choosing the right compression algorithm for the different tasks will be developed.

Nachname | *Name*	Trần
Vorname | *First Name*	Ngọc Trình
Titel | *Title*	M.Eng.

Curriculum Vitae

Ph.D. Student since March 2012

Universität | *University*	FH Aachen
Standort | *Location*	Campus Jülich
Fachbereich | *Faculty*	Medical Engineering and Technomathematics
Adresse der Hochschule | *Address of the University*	Heinrich-Mußmann-Straße 1 | 52428 Jülich
Telefon (Büro/Labor) | *Phone (Office/Laboratory)*	+49. 241. 6009 53209
E-Mail	trinh.tran@fh-aachen.de
Raumnummer (Büro/Labor) | *Room Number (Office/Laboratory)*	01E16
Name des Projektes | *Name of the project*	Optimization for elasto-plastic structures under shakedown conditions
Betreuender Professor an der FH Aachen | *Professor attending to the FH Aachen*	Prof. Dr.-Ing. Manfred Staat
Partneruniversität | *Partner University*	TU Braunschweig
Betreuender Professor an der Universität | *Professor attending to the University*	Prof. Dr.-Ing. Georgios Stavroulakis
Projektpartner | *Project Partner*	> MOET (Ministry of Education and Training of Vietnam) > TU Braunschweig

Optimum plastic design of trusses

Ngọc Trinh Trần[1,2]*, Manfred Staat[1], Stavroulakis Georgios[3]

[1]Institute of Bioengineeering, FH Aachen, Campus Jülich, 52428 Jülich, Germany
[2]Hanoi Architectural University(HAU), Faculty of Civil Engineering, Hanoi, Viet Nam
[3]Institute of Applied Mechanics, TU Braunschweig, Germany

*trinh.tran@fh-aachen.de

Truss structures consist of flexible truss members under axial forces only and are pin-connected at joints. Due to the light-weight and easy assembling, these structures play an important role and have numerous applications such as bridges, towers, cranes, roof supports, building skeletons, space deployable structures, etc.

This work presents the ground structure approach for topology optimization of trusses. This topology optimization method selects an optimal subset of bars from the set of all possible bars defined on a discrete grid. In the optimization problem of a truss at elastic state, the objectives used are based either on minimum compliance or on minimum volume. In the optimization problem of trusses at limit state, the objectives are maximum applied forces and maximum stiffness.

Typically structures are subjected to different loads cases. Shakedown design selects trusses which are simultaneously optimum for the convex hull of all load cases.

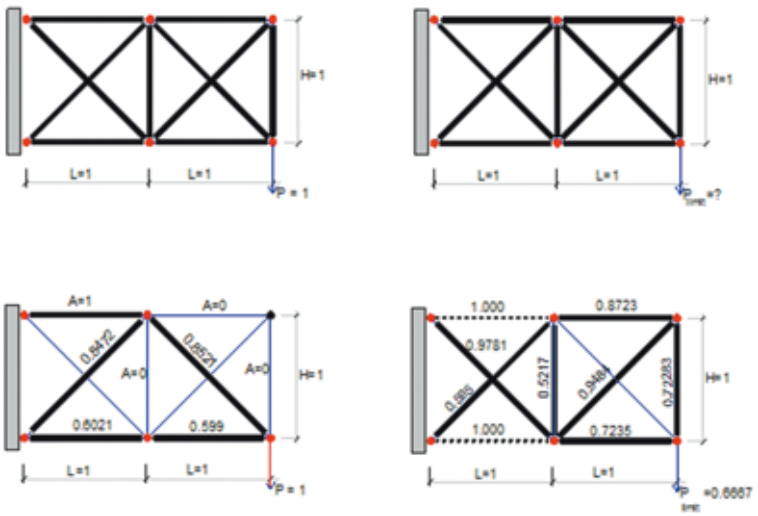


Fig. 1 | Optimum truss design at elastic state (left) Optimum truss design at limit state (right)

Literature:
M.P. Bendsøe, O. Sigmund: Topology optimization - Theory methods and applications. Berlin: Springer (2004).
J. Atkočiūnas: Optimal shakedown design of elastic-plastic structures. Vilnius: Technika (2011).
M. Staat, M. Heitzer (eds.): Numerical Methods for Limit and Shakedown Analysis. Deterministic and Probabilistic Approach. NIC Series Vol. 15, Jülich (2003). http://hdl.handle.net/2128/2926

Literatur / *References*

Referierte Publikationen

N. Huynh Nguyen, **M. Tuan Duong**, T. Ngoc Tran, P. Tinh Pham, M. Staat "Influence of a freeze-thaw decomposition on the stress-stretch curves of capsules of porcine abdominal organs" in: Journal of Biomechanics 45 (2012) 2382–2386.

D. Leonhäuser, **V. Seifarth**, K. Strick, N. Gaisa, I. Heschel, R. H. Tolba, J. Grosse "Bladder wall substitution with autologously seeded collagen scaffolds "Optimaix" in a Göttingen minipig model" in: European Urology Supplements (Vol. 12, p. e871) (2013). 871. doi:10.1016/S1569-9056(13)61350-0.

D. Leonhäuser, K. Strick, **V. Seifarth**, N. Huppertz, C. Fera, N. Gaisa, J. Grosse „Vergleich zweier biodegradierbarer Kollagenscaffolds „OPTIMAIX" als möglicher Blasenwandersatz im Göttinger Minipig Modell" in: DGU (Deutsche Gesellschaft für Urologie) Dresden (2013).

V. Seifarth, J. Grosse, M. Goßmann, I. Heschel, W. Zang, G. M. Artmann & (Temiz) A. Artmann "Tubular matrices for biohybrids" in: European Urology Supplements (Vol. 12, p. e250) (2013) 250. doi:10.1016/S1569-9056(13)60737-X.

V. Seifarth, D. Schehl, J. Grosse, W. Zang, S. Tholl, S. Koch, (Temiz) A. Artmann "An automatized bioreactor system based on tubular collagen matrices" in: Kongress der Deutschen Gesellschaft für Urologie e.V. Leipzig (2012). doi:ISBN 978-940017-96-3.

V. Seifarth, D. Schehl, P. Linder, M. Goßmann, I. Digel, G. M. Artmann, (Temiz) A. Artmann "Ureplace: Development of a bioreactor for in vitro culturing of cell seeded tubular vessels on collagen scaffolds" in: KazNU Bulletin (biological series) (2011), 2(48), 56–58. doi:ISSN 1563-0218.

C. F. Werner, **S. Schusser**, H. Spelthahn, T. Wagner, T. Yoshinobu, M. J. Schöning "Field-programmable gate array based controller for multi spot light-addressable potentiometric sensors with integrated signal correction mode" in: Electrochimica Acta 56 (26) (2011) S. 9656–9660. DOI: 10.1016/j.electacta.2011.03.012.

K. J. Engel, D. Geller, T. Köhler, G. Martens, **S. Schusser**, G. Vogtmeier, E. Rössl "Contrast-to-noise in X-ray differential phase contrast imaging" in: Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment 648 (Supplement 1) (2011) S. S202 - S207. DOI: 10.1016/j.nima.2010.11.169.

S. Schusser, A. Poghossian, M. Bäcker, M. Leinhos, P. Wagner, M. J. Schöning "Characterization of biodegradable polymers with capacitive field-effect sensors" in: Sensors and Actuators B: Chemical (2012) DOI: 10.1016/j.snb.2012.07.099.

S. Schusser, M. Leinhos, M. Bäcker, A. Poghossian, P. Wagner, M. J. Schöning "Impedance spectroscopy: A tool for real-time in situ monitoring of the degradation of biopolymers" in: physica status solidi (a) 210 (5) (2013) S. 905–910. DOI: 10.1002/pssa.201200941.

M. Staat, E. Trenz, P. Lohmann, **R. Frotscher**, U. Klinge, R. Tabaza, R. Kirschner-Hermanns "New measurements to compare soft tissue anchoring systems in pelvic floor surgery" in: Journal of Biomedical Materials Research: Part B -

S. Börner, H. H.-W. Funke, **J. Keinz**, P. Hendrick, E. Recker "Low NOx Hydrogen Combustion Chamber for Industrial Gas Turbine Applications" in: Honolulu, Hawaii, USA (2012).

S. Börner, H. H.-W. Funke, **J. Keinz**, K. Kusterer, D. Kroniger, J. Kitajima, et al. "Numerical and Experimental Chracterization of Low NOx Micromix Combustion Principle for Industrial Hydrogen Gas Turbine Applications" in: Copenhagen, Denmark (GT2012-69421) (2012).

J. Keinz, H. H.-W. Funke, S. Börner, A. Haj Ayed, K. Kusterer, N. Tekin, et al. "Experimental and Numerical Characterization of the Dry Low NOx Micromix Hydrogen Combustion Principle at Increased Energy Density for Industrial Hydrogen Gas Turbine Applications" in: San Antonio, Texas, USA (GT2013-94771) (2013).

J. Keinz, H. H.-W. Funke, S. Börner, P. Hendrick, R. Elsing "Testing and Analysis of the Impact on Engine Cycle Parameters and Control System Modifications Using Hydrogen or Methane as Fuel in an Industrial Gas Turbine" in: Munich, Germany (2013).

P. Kirchner, **J. Oberländer**, H.-P. Suso, G. Rysstad, M. Keusgen, M. J. Schöning "Monitoring the microbicidal effectiveness of gaseous hydrogen peroxide in sterilisation processes by means of a calorimetric gas sensor" in: Food Control 31 (2) (2013) S. 530–538.

P. Kirchner, **J. Oberländer**, H.-P. Suso, G. Rysstad, M. Keusgen, M. J. Schöning "Towards a wireless sensor system for real-time H2O2 monitoring in aseptic food processes" in: physica status solidi (a) 210 (5) (2013) S. 877–883.

D. Stollenwerk, T. Kuvarakul, I. Kuperjans "Renewable Energy Supply for Power Dominated, Energy Intense Production Processes - A Systematic Conversion Approach for the Anodizing Process" in: IOP Conference Series: Earth and Environmental Science 16 (1) (2013) S. 12142. Online verfügbar unter http://stacks.iop.org/1755-1315/16/i=1/a=012142.

M. Gerhards, A. Belloum, F. Berretz, V. Sander, S. Skorupa "A History-tracing XML-based Provenance Framework for Workflows" in: The 5th Workshop on Workflows in Support of Large-Scale Science (WORKS10) (2010).

M. Gerhards, M. Jagodzinska, V. Sander, A. Belloum "Realizing the flexible Integration of Cloud Resources into Workflows" in: International Transactions on Systems Science and Applications, Special Issue on Cloud Computing and Services (2012).

M. Gerhards, V. Sander, A. Belloum "About the flexible Migration of Workflow Tasks to Clouds - Combining on- and off-premise Executions of Applications" in: The Third International Conference on Cloud Computing, GRIDs, and Virtualization (CLOUD COMPUTING 2012) 3 (2012).

M. Gerhards, V. Sander, A. Belloum "Seamlessly Enabling the Use of Cloud Resources in Workflows" in: The Fourth International Conference on Cloud Computing, GRIDs, and Virtualization (CLOUD COMPUTING 2013) (2013).

M. Gerhards, V. Sander, T. Matzerath, A. Belloum, D. Vasunin, A. Benabdelkader "Provenance Opportunities for WS-VLAM - An Exploration of an e-Science and an e-Business Approach" in: The 6th Workshop on Workflows in Support of Large-Scale Science (Works11) (2011).

M. Gerhards, S. Skorupa, V. Sander, A. Belloum, D. Vasunin, A. Benabdelkader "HisT/PLIER: A two-fold Provenance Approach for Grid-enabled Scientific Workflows using WS-VLAM" in: 12th IEEE/ACM International Conference on Grid Computing (Grid 2011) (2011).

M. Gerhards, S. Skorupa, V. Sander, P. Pfeiffer, A. Belloum "Towards a Security Framework for a WS-HumanTask Processor" in: 7th International Conference on Network and Service Management (CNSM2011) (2011).

D. Krott, **M. Gerhards**, S. Skorupa, V. Sander "NHiLA - Bridging the Gap between. NET and UNICORE" in: UNICORE Summit 2011 (2011).

C. Huck, J. Schiffels, C. N. Herrera, M. Schelden, T. Selmer, A. Poghossian, M. E.M. Baumann, P. Wagner, M. J. Schöning "Metabolic responses of Escherichia coli upon glucose pulses captured by a capacitive field-effect sensor" in: Physica Status Solidi A 210(5) (2013) 926-931.

C. Huck, A. Poghossian, P. Wagne, M. J. Schöning "Combined amperometric/field-effect sensor for the detection of dissolved hydrogen" in: Sensors and Actuators B: Chemical 187 (2013) 168-173.

Tagungsbeiträge

M. Tuan Duong, N. Huynh Nguyen, M. Staat „Finite Element Implementation of a 3D Fung-type Model" in: 8th European Solid Mechanics Conference (ESMC 2012), Graz, Austria, under the auspices of EUROMECH, July 9-13, 2012.

M. Tuan Duong, N. Huynh Nguyen, M. Staat "Enhancing numerical stability of directional hyperelastic behaviors" in: 6th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2012), Vienna, Austria, September 10-14, 2012.

S. Börner, H. Funke, **J. Keinz**, P. Hendrick, E. Recker “Low NOx Hydrogen Combustion Chamber for Industrial Gas Turbine Applications“ in: 14th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, ISROMAC-14, Honolulu, Hawaii, Feb. 2012.

S. Börner, H. Funke, **J. Keinz**, K. Kusterer, D. Kroniger, J. Kitajima, M. Kazari, A. Horikawa “Numerical and Experimental Characterization of Low NOx Micromix Combustion Principle for Industrial Hydrogen Gas Turbine Applications“ in: ASME Turbo Expo 2012, GT2012-69421, Copenhagen, Denmark, June 2012.

J. Keinz, H. Funke, S. Börner, A. Haj Ayed, K. Kusterer, N. Tekin, M. Kazari, J. Kitajima, A. Horikawa, K. Okada “Experimental and Numerical Characterization of the Dry Low NOx Micromix Hydrogen Combustion Principle at Increased Energy Density for Industrial Hydrogen Gas Turbine Applications” in: ASME Turbo Expo 2013, GT2013-94771, San Antonio, Texas, USA, June 2013.

J. Keinz, H. Funke, S. Börner, P. Hendrick, R. Elsing “Testing and Analysis of the Impact on Engine Cycle Parameters and Control System Modifications Using Hydrogen or Methane as Fuel in an Industrial Gas Turbine” in: 5th European Conference for Aeronautics and Space Science, EUCASS 2013, Munich, Germany, July 2013.

J. Oberländer, P. Kirchner, H.-G. Boyen, M. J. Schöning “Detection of hydrogen peroxide vapor by use of manganese(IV) oxide as catalyst for calorimetric gas sensors” in: Engineering of Functional Interfaces 2013. Hasselt University. Hasselt, Belgium 2013.

J. Oberländer, P. Kirchner, S. Reisert, M. J. Schöning “Intelligente Sensor-gestützte Qualitätskontrolle bei Lebensmittelverpackungen im Bereich „Aseptic Food““ in: Size Matters 2013 – Nano auf dem Teller. Saarbrücken, Germany 2013.

J. Oberländer, P. Kirchner, S. Reisert, M. J. Schöning „Smart sensor-based solution for quality control in aseptic food processes“ in: 2nd German-Japanese Symposium, Jülich, Germany 2013.

M. Goßmann, P. Linder, **V. Seifarth**, G. Artmann, M. Epple, & (Temiz) A. Artmann “Measurement of the contractile forces of autonomously beating cardiomyocytes” in: 5. Graduiertentagung 5th Graduate Symposium 15. November 2012 (p. 23).

M. Goßmann, **V. Seifarth**, P. Linder, I. Digel, R. Kettenhofen, G. M. Artmann, & (Temiz) A. Artmann “Simultaneous Control and Measurement of Mechanical Properties of Ultra-thin Tissue Equivalents” in: 4th International Symposium Interface Biology of Implants 2012.

D. Leonhäuser, **V. Seifarth**, K. Strick, C. Fera, N. Gaisa, I. Heschel, J. Grosse “Potential of collagen matrices “Optimaix” as bladder wall substitute – preliminary study in a Göttingen Minipig model” in: 4. Symposium Urologische Forschung der DGU (Vol. 2) (2012). doi:ISBN 978-940017-96-3.

D. Leonhäuser, **V. Seifarth**, K. Strick, C. Fera, N. Huppertz, N. Gaisa, J. Grosse “Blasenwandersatz aus autolog besiedelten Kollagenscaffolds „OPTIMAIX“ - Studie an Göttinger Minipigs“ in: NRWGU (NRW-Gesellschaft für Urologie) Düsseldorf 2013.

V. Seifarth, J. Grosse, M. Goßmann, I. Heschel, W. Zang, & (Temiz) A. Artmann “Tubular collagen matrices for ureteral transplants“ in: 4. Symposium Urologische Forschung der DGU. Der Urologe 2012.

V. Seifarth, D. Schehl, J. Grosse, W. Zang, I. Heschel, G. M. Artmann, & (Temiz) A. Artmann ”Development of a tubular bioreactor system for the generation of biohybrids” in: 5. Graduiertentagung 5th Graduate Symposium 15. November 2012 (p. 39).

R. Frotscher, M. Staat “Effectiveness of the Edge-based Smoothed Finite Element Method Applied to Soft Biological Tissues” in: 8th European Solid Mechanics Conference, Graz, Austria 2012.

R. Frotscher, M. Staat “Application of an Edge-based Smoothed Finite Element Method on geometrically non-linear plates of non-linear material” in: 6th European Congress on Computational Methods in Applied Sciences and Engineering, Vienna, Austria 2012.

Y. Nix, **R. Frotscher**, M. Staat “Implementation of the Edge-based Smoothed Extended Finite Element Method” in: 6th European Congress on Computational Methods in Applied Sciences and Engineering, Vienna, Austria 2012.

R. Frotscher, M. Gossmann, A. Temiz-Artmann, M. Staat “Simulation of cardiac cell-seeded membranes using the edge-based smoothed FEM” in: 1st International Conference "Shell and Membrane Theories in Mechanics and Biology: From Macro- to Nanoscale Structures", Minsk, Belarus 2013.

M. Bäcker, **S. Schusser**, M. Leinhos, A. Poghossian, M.J. Schöning “Chip-based real-time degradation monitoring of biopolymers” in: Biomedica Summit 2013. Aachen, Germany 2013.

S. Schusser, A. Poghossian, M. Leinhos, P. Wagner, M. J. Schöning “Characterization of Biodegradable Polymers with Capacitive Field-effect Sensors” in: 14th International Meeting on Chemical Sensors - IMCS 2012. Wunstorf, Germany: AMA Service GmbH (2012), S. 1035–1037.

S. Schusser, A. Poghossian, P. Wagner, M. J. Schöning “BioMiMedics - Determination of polymer degradation by a semiconductor-based sensor system” in: Sebastian Schusser und Michael-Josef Schöning (Hg.): 4th Graduate Symposium 2011. Sebastian Schusser, Christiane Vaeßen, Michael-Josef Schöning. Aachen, Germany: Sebastian Schusser, Christiane Vaeßen, Michael-Josef Schöning, S. 57.

S. Schusser, A. Poghossian, P. Wagner, M. J. Schöning “Determination of polymer degradation by a semiconductor-based sensor system” in: Engineering of Functional Interfaces 2011. Johannes Keppler University. Linz, Austria 2011.

S. Schusser, M. Bäcker, M. Leinhos, A. Poghossian, P. Wagner, M. J. Schöning “Chip-based degradation monitoring of biodegradable polymers” in: Biomedica 2012.

S. Schusser, M. Bäcker, M. Leinhosm, A. Poghossian, P. Wagner, M. J. Schöning “Impedance spectroscopy - an approach for on-line degradation monitoring of biopolymers” in: Engineering of Functional Interfaces 2012. Zweibrücken, Germany 2012.

S. Schusser, M. Bäcker, M. Leinhos, A. Poghossian, P. Wagner, M. J. Schöning “Improving degradation studies of biopolymers: A chip-based sensor concept for online degradation monitoring” in: 9th International Symposium on Electrochemical Micro & Nanosystem Technologies. Linz, Austria 2012.

S. Schusser, M. Bäcker, M. Leinhos, A. Poghossian, P. Wagner, M. J. Schöning “Polymertesting-Chip - Sensorkonzept zur in situ-Überwachung der Degradationskinetik von biodegradierbaren Polymeren“ in: Deutsches Biosensor Symposium. Wildau Germany 2013.

S. Schusser, M. Leinhos, A. Poghossian, P. Wagner, M. J. Schöning “Biopolymer-degradation monitoring by chip-based impedance spectroscopy technique” in: Humboldt Kolleg - Nanoscale Science and Technologie 2012. Hammamet, Tunesia 2012.

S. Schusser, P. Wagner, M. J. Schöning “Development of a LAPS-based biosensor system for water quality monitoring” in: 3rd Graduate Symposium, FH Aachen. FH-Aachen. Aachen, Germany 2010, S. 65.

T. Baumann, **C. Boura**, J. Eckstein, J. Dabrowski, J. Göttsche, S. Schmitz, S. Zunft “PROPERTIES OF BULK MATERIALS FOR HIGH-TEMPERATURE AIR-SAND HEAT EXCHANGERS“ in: ISES Solar world congress Kassel, m. Kassel 2011.

T. Baumann, **C. Boura**, J. Eckstein, J. Felinks, J. Göttsche, S. Schmitz, S. Zunft “AIR-SAND HEAT EXCHANGER“ in: IRES EuroSolar 2011. Berlin.

T. Baumann, **C. Boura**, J. Göttsche, B. Hoffschmidt, B. O. Connell, S. Schmitz, S. Zunft “Air / Sand Heat Exchanger Design and Materials for Solar Thermal Power Plant Applications” in: Solar PACES. Perpignan: Solar Paces 2010.

T. Baumann, **C. Boura**, J. Göttsche, B. Hoffschmidt, S. Schmitz, S. Zunft “Air-Sand Heat Exchanger. Materials And Flow Properties” in: Solar PACES, m. Granada, Spain: SolarPaces 2011.

C. Boura, J. Eckstein, J. Felinks, J. Göttsche, B. Hoffschmidt "3-D CFD simulation of an Air-Sand Heat Exchanger" in: Solar Paces. Granada: Solar Paces 2011.

C. Boura, S. Schmitz, J. Dabrowski, J. Eckstein, J. Göttsche, B. Hoffschmidt, "Poster" in: Sonnenkolloquium 13 Köln DLR 2011.

J. Hoefling, **J. Schirra**, A. Spohr & D. Schaefer "Induced drag computation with wake model schemes for highly non-planar lifting systems" in: Deutscher Luft- und Raumfahrtkongress 2013, 10-12 September, Stuttgart, Germany.

J. Schirra, J. Watmuff "Euler-Based induced drag estimation for highly non-planar lifting systems during conceptional design" in: Deutscher Luft- und Raumfahrtkongress 2013, 10-12 September, Stuttgart, Germany.

A. Spohr, **J. Schirra**, J. Hoefling, & A. Schedl "Wing Weight estimation methodology for highly non-planar lifting systems during conceptual design" in: Deutscher Luft- und Raumfahrtkongress 2013, 10-12 September, Stuttgart, Germany.

C. Huck, M. Bäcker, F. Kramer, A. Poghossian, W. Zander, J. Schubert, V. Buniatyan, P. Wagner, M. J. Schöning "Capacitively-coupled contactless electrolyte-conductivity sensor based on high-k materials" in: Engineering of Functional Interfaces 2013, Hasselt, Belgium, p.56.

C. Huck, J. Schiffels, C. N. Herrera, T. Selmer, A. Poghossian, P. Wagner, M. J. Schöning "Bestimmung methanogener Substrate zur Überwachung biologischer Prozesse im Biogasfermenter" in: 8. Deutsches Biosensor Symposium 2013, Wildau, Germany, p.121.

C. Huck, A. Poghossian, P. Wagner, M. J. Schöning "Investigation of a bi-functional sensor chip for the detection of dissolved hydrogen in biogas reactors" In: 5th Graduate Symposium 2012, Jülich, Germany, p. 25.

C. Huck, C. N. Herrera, J. Schiffels, M. Schelden, T. Selmer, A. Poghossian, M. J. Schöning "Gaining insight into the metabolic activity of Escherichia coli using a capacitive field-effect sensor" in: Engineering of Functional Interfaces 2012. Zweibrücken, Germany, p.42.

C. Huck, A. Poghossian, P. Wagner, M. J. Schöning "Combined amperometric/field-effect sensor for the detection of dissolved hydrogen in biogas reactors" in: 14th International Meeting on Chemical Sensors – IMCS 2012, Nuremberg, Germany, pp. 1028-1031.

C. Huck, M. Bäcker, A. Poghossian, P. Wagner, M. J. Schöning "Bifunktionaler Sensorchip für den Nachweis von Gelöstwasserstoff" in: 10. Dresdner Sensor-Symposium 2011, ISBN 978-3-942710-53-4, Dresden, Germany, pp. 325-328.

C. Huck, P. Jolly, P. Wagner, A. Poghossian, M. J. Schöning "One-chip integrated dual amperometric/field-effect sensor for the detection of dissolved hydrogen" in: Procedia Engineering 25 (2011) pp. 1161-1164.

C. Huck, I. Kerroumi, A. Poghossian, P. Wagner, M. J. Schöning "Measurement of dissolved hydrogen in a liquid-to-gas transfer setup utilizing PTFE membranes" in: 4th Graduate Symposium 2011, Jülich, Germany, p. 33.

C. Huck, P. Wagner, A. Poghossian, M. J. Schöning "Investigation of an one-chip integrated dual amperometric/field-effect sensor for the detection of dissolved hydrogen" in: Engineering of Functional Interfaces 2011, Linz, Austria.

C. Huck, A. Poghossian, P. Wagner, M. J. Schöning "Entwicklung eines Sensors zur Messung von gelöstem Wasserstoff für die anaerobe Biogasüberwachung" in: 7. Deutsches Biosensor Symposium 2011, Heilbad Heiligenstadt, Germany, pp. 50-51.

C. Huck, A. Poghossian, P. Wagner, M. J. Schöning "Investigation of a dissolved H2 sensor for applications in anaerobic biogas monitoring" in: 3rd Graduate Symposium 2010, Aachen, Germany, p. 37.

C. Huck, A. Poghossian, P. Wagner, M. J. Schöning "Investigation of a dissolved hydrogen chip sensor for applications for anaerobic biogas monitoring" in: Engineering of Functional Interfaces 2010, Marburg, Germany, p. 48.

Impressum / *Imprint*

Tagung des Forschernachwuchses der FH Aachen
20. November 2013

Veranstalter | ***Organizer***
FH Aachen | Dezernat V
Innovationstransfer
Kalverbenden 6 | 52066 Aachen

Redaktion | ***Editorial*** | J. Kreyer, D. Stollenwerk, M.J. Schöning

Gestaltung und Satz | ***Design and typesetting***
Susanne Hellebrand, Stabsstelle für Presse-, Öffentlichkeitsarbeit und Marketing

Die Stabsstelle bietet einen umfassenden Service bei der Gestaltung und Produktion von Printmedien im neuen Corporate Design der Hochschule. Sprechen Sie uns an!
T +49. 241. 6009 51064

Druck | ***Print*** | Printproduction, Aachen

Auflage | ***Circulation*** | 100 Exemplare

Bildnachweis | ***Picture Credits*** | Die Bilder und Grafiken wurden jeweils von den Autoren der Exposés selbst bereitgestellt.
Foto Deckblatt | FH Aachen, www.lichtographie.de

Aachen, November 2013

Zertifikat seit 2009
audit familiengerechte
hochschule

HAWtech
HochschulAllianz für
Angewandte Wissenschaften