LAPPEENRANNAN TEKNILLINEN YLIOPISTO

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

LUT Graduate School

LUT Scientific and Expertise Publications

Raportit ja selvitykset – Reports 45

The compilation of doctoral research at LUT Graduate School 2014

Hanna Värri (Editor in chief)

Sanna-Katriina Asikainen, Mari Kallioinen, Mikko Kuisma, Mika Lohtander, Nina Tervonen, Terhi Virkki-Hatakka (Editors)

ISBN 978-952-265-741-1

ISBN 978-952-265-742-8 (PDF)

ISSN 2243-3384

Table of Contents

FOREWORD

Information is to be shared to result in knowledge and competence both for individuals and organizations. Knowing what your colleagues are doing may also help you to focus to your own research avoiding overlapping but also finding fruitful collaboration. This book of abstracts gives you a brief introduction to research topics carried out by doctoral students at Lappeenranta University of Technology (LUT). Many of the abstracts have also been presented by oral or poster presentations at LUT Graduate Student Conference in December 2014.

This autumn, Lappeenranta University of Technology (LUT) was ranked among 300 best universities in the world, according to the Times Higher Education World University Rankings (THE). According to estimates by UNESCO, there are about 17,000 universities in the world. This puts LUT in the top two percent of the university world on a global scale. LUT has taken giant steps forward in recent years. We've steadily worked our way up through the ranks and are now in the big league. According to President Anneli Pauli, LUT can be compared to a rapidly rising growth company whose youthful vitality and open-mindedness are turning it into an internationally credible player.

THE is one of the world's most prestigious university performance tables, and one of the important areas under assessment is research. This success in the widely recognized university ranking naturally raises the question: What is researched at LUT now? Which disciplines or multidisciplinary research forms the successful coherent whole, the big picture in LUT research? Who will be the future science stars?

To answer these questions, each LUT doctoral student was asked to update his/her research abstract (200 words) and keywords in LUT Research Portal during autumn 2014. These abstracts form a body of this publication representing the compilation of LUT's research. The abstract book is available in electronic and printed form.

I warmly thank all of you, our doctoral students – future science stars, for your contribution to make this book possible.

Jari Hämäläinen

Chairman, Board of LUT graduate school

LGS2014 - The first LUT GRADUATE SCHOOL multidisciplinary CONFERENCE

Working together is one of the most important elements at LUT. On the 11th of December 2014, the first LUT Graduate School conference is held. This is a day to all our doctoral students, researchers and research groups.

Our aim at the LGS2014 event is to create a journey to the future. We will also offer an opportunity to work together, learn from each other´s work and to create new contacts. At the LUT GS 2014 Conference, over 100 young scientists of all disciplines will present their research in oral presentations, posters, and live debate. We hope that you will find new valuable research contacts and interesting viewpoints to Your research area – and of course – enjoy the scientific atmosphere. See you in the next LGS conference!

Lappeenranta, December 11, 2014

LGS2014 organization team:

Terhi Virkki-Hatakka, General chair, LGS 2014
Sanna-Katriina Asikainen, Mari Kallioinen, Mikko Kuisma, Mika Lohtander, Nina Tervonen, Hanna Värri

ABSTRACTS

AbdelWahed Mahmoud

Keywords: *Green Energy and Technology, Water Quality, Geochemistry, Environmental Assessment, Environmental pollution*

Research Water quality is a big issue in the developing countries. In Egypt, for example, major challenges such as population growth, competition on water from the upper Nile basin countries, potential climate change and water quality are threating the water security. The first three challenges are difficult to control. Accordingly, Egypt should keep every drop of water clean to maximize its benefits. This can be achieved through the assessment of water quality throughout the Egyptian Governorates. From this point of view, we present the first assessment study of the surface water quality in the Egyptian Fayoum Governorate (Province). Water samples from irrigation and drainage canals as well as Lake Qarun were collected. Major ions, (semi-)metals, nutrients, salinity and microbiological parameters were examined. The results show high levels of microbiological contaminations in irrigation and drainage waters, which therefore cannot directly be used for drinking or agricultural purposes as they cause a substantial health risk. However, most people use these waters untreated for domestic and agricultural purposes causing water-borne diseases. Also, my PhD study is focusing on geochemical modeling of Lake Qarun (Egypt) based on the predicted climate change and also on the changes of the inflowing water chemistry.

Abdullah Ummi

Keywords: *Green energy and technology, Sustainable value creation, Virtual Reality (VR) technology, off-road vehicle, haptic, userbility*

The target of the research is to develop design methods and practices for designing off-road vehicles by using simulation and virtual reality environments. The latest developments in real-time multi-body simulation and virtual reality environments make it possible to carry out advanced Human-in-the-loop (HIL) simulations of off-road vehicles such as construction, mining, harvesting, agricultural and harbor load handling machines. Test users can drive the virtual machines in realistic virtual work environments carrying out real alike tasks. Because from multi body dynamic models during simulation it is possible to output several variables difficult to measure in real physical machines it is easy to monitor the human machine interaction during processing the works tasks. This progress in design tools makes it possible to utilize them during various steps of the design process. From the early conceptual stages until the finalization these tools can help engineers to design human friendly and life-cycle efficient products. The mobile working machines become more and more intelligent and many functions are handled by automation, while the rest of the functions are controlled by human. This also increases the challenge of R&D because human intelligence meets the machine intelligence and their interaction it is more difficult to handle.

Afanasyeva Svetlana

Keywords: *Green energy and technology, wind energy, optimization, financial risks*

Among renewables wind power is one of the most popular sources of energy. Although wind power has no associated fuel cost, the unpredictability of wind also creates a financial risk.

The goals of the research are establishing a detailed wind farm model taking into account uncertainties of technical and economical parameters, verification and validation of the model, and finding an effective algorithm for optimizing the wind farm configuration. Considerable emphasis has been given to investment risks which supposedly influence decision-making.

Afzalifar Ali

Keywords: *Steam Turbines, Wetness Effects, Numerical Modeling, Nucleation, Droplet Growth*

The effects of wetness on the performance and flow field of steam turbines are theoretically and experimentally acknowledged. Since around 50 years ago, by introduction of nuclear power plant suffering from pronounced problems associated with wetness, many studies have been carried out concerning the wetness effects on the steam turbines. However, yet the level of required engineering accuracy in terms of numerical modeling is far from certain due to extraordinary complexity of the underlying physics.

Firstly, this project is intended to expand the knowledge about the physical sequence described by nucleation and droplet growth occurring in the course of phase transition (wetness formation). The second goal is to apply and develop numerical methods to model the phase transition feasibly close to the theory, regarding the real cases in steam turbines.

Agafonova Oxana

Keywords: *Green energy and technology, CFD, LES, Actuator Line/ Disk Model, Forest, Wind Park*

There is nowadays no need in a long discussion about the importance of the wind park topic. Although, let us emphasize essential points. First, electricity consumption and cost increase every year. Second, in the modern world there is a tendency in saving natural resources and thus in developing alternative sources of energy. There are already several alternative sources which use, for example, sun energy, wind energy etc. However, there are certain known drawbacks. Therefore, there is a high demand of innovative research in order to improve efficiency of the alternative sources of energy. Besides, in the course of such research various yet unknown unsatisfactory features might be detected.

Goals:

1. Analyzing measurements from the forest:

- building of a geometry based on real geography;
- building of a porous model based on porosity measurements in OpenFOAM;
- comparison between obtained results and wind measurements.

2. Modeling of a wind flow in the wind park (complex topography, several forested hills and wind turbines):

- modeling wind turbine using an actuator disk/line model in OpenFOAM;
- using again different RANS and LES models in OpenFOAM;
- using different tools (like OpenFOAM and WAsP).

Ahmadi Zeleti Zeinab

Keywords: *Wind energy, Environmental, Canopy flows, Porous media, Forest morphology, LiDAR point cloud analysis*

Much work had been carried out to implement the effect of canopies into CFD (Computational Fluid Dynamics) simulations. For the sake of reducing the uncertainty associated with the previous models, understanding the actual canopy morphology is very much appreciated for modeling the turbulent wind flow through and above forest. Thus, porous media analogy is used to investigate the most effective forest parameters. Then, high level of canopy structural detailed information derived from high density LiDAR (Light Detection And Ranging) point cloud data is utilized into CFD by conducting LES (Large Eddy Simulation) and various RaNS (Reynolds-averaged Navier-Stokes) models. Furthermore, to provide an extensive validation, in situ measurements (obtained at Skinnarila forest, near the campus of Lappeenranta University of Technology, Finland) are compared with series of CFD simulations. This advanced canopy porous medium model based laser scanning data may allow a more accurate description of complexity of the flow field and the wake recirculation behind the forest.

Ajo Petri

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations, Water treatment, Advanced Oxidation Processes (AOP), Pulsed Corona Discharge (PCD)*

My study focuses on the application of pulsed corona discharge (PCD) in removal of aqueous organic pollutants. The degradation of non-biodegradable organics in water and wastewater treatment gains importance while substances like pharmaceutical residues accumulate in natural waters. The PCD application developed at LUT is more effective, environmentally friendly and energy efficient against recalcitrant compounds than conventional chlorination, ozonation or UV treatment. My aim is to study the interaction of plasma, water and reactor atmosphere in our PCD configuration in order to further develop the system and its operations. To achieve this, I actively look for interdisciplinary possibilities to research and develop a top solution for the removal of non-biodegradable aqueous organics.

Albats Ekaterina

Keywords: *Innovation management, open innovation, university-industry collaboration, National innovation system*

The aim of the research is to specify the needs and interests of the both sides of university-industry relationships in the current and imminent economic situation in order to do not let this relationship suffer, but to strengthen and develop them. This research is focused on detailed analysis of university-industry collaboration in Finland and Russia (North-West region), as well as on cross-border collaboration between companies and higher educational institutions in these two regions. The research is devoted to answering the question 'how to facilitate university-industry collaboration?'. The study results will help in solving a complex of practical issues in global economy:

- to maintain and improve the universities' links with industry, which are the compulsory condition of universities' competitiveness, their ability to nurture highly-qualified human resources and ability to promote the impact of research findings on society;

- to maintain and facilitate the companies' access to the most recent advances of academia and to the highly-qualified human resources;

- to protect and contribute to development of knowledge-based economy and effectiveness of transferring knowledge to economically valuable innovations.

Ali-Marttila Maaren

Keywords: *Sustainable value creation, asset management, value elements, maintenance services, maintenance networks, relationship value*

My doctoral research focuses on value, value creation, and value elements of industrial maintenance services. The goal is to find out what are the value elements of industrial maintenance services and how the relationship between service partners can be improved by collaboratively identifying the value creating elements.

Industrial maintenance can be executed internally, acquired from an original equipment manufacturer or outsourced to a service provider and this concludes in many kind of business relationships. To maximize the total value created in the maintenance relationships it is important to know what the partners value. However, the value of maintenance services is quite complex and constitutes of multiple intangible and tangible elements (e.g. reliability, safety, availability and price). Currently the companies operating in the field are lacking sufficient tools and methods to make the versatile value creating elements concrete. My study aims to tackle this problem. The findings provide a value profile –method, which visualizes and helps to recognize the value creating elements for each partner. By closing the value gap the maintenance service customers and providers can improve their collaboration. More sustainable and value creating service relationships are created.

Almanasrah Mohammad

Keywords: *Membrane Technology, Hemicelluloses, Phenolic compounds, Water Extraction*

Recently, membrane filtration has been found as a potential technology for enable more effective biomass exploitation. This study targeted to recovery of high value-added compounds from two different biomass residues: spruce saw dust and carob kibbles. These compounds can be refined for several bio-based products.

Ultrafiltration (UF) has been studied for fractionation and recovery of galactoglucomannans (GGMs) from spruce hydrolysates. Testing UF membranes with different materials showed higher performance with regenerated celluloses membranes. Depending on membrane cut-off, filtration capacity of these membranes was quite high (100-300 kg/m2 h bar) and fouling tendency was quite low (< 10%). Moreover, production of GGM fractions with high concentrations 200-400 g/L (purity up to 80%) was rather achievable. Based on literature, such fractions could be used in formation of barrier films.

Nanofiltration (NF) and reverse osmosis (RO) was evaluated to valorize aqueous extract of carob kibbles. During NF and RO, filtration capacity of this extract was comparable with in the filtration of such complex liquor. Almost complete retention of bio-active phenolic compounds with relatively lower retention of saccharides makes their fractionation rather achievable. As a conclusion, two enriched streams of phenolic compounds and saccharides suitable for health and food products could be obtained.

Almpanopoulou Argyro

Keywords: *Sustainable value creation*

As business environments become more complex, firms experience rapid changes that stem from pressures such as the constantly changing customers' demands, new technologies and the emergent global competition. Furthermore, companies face considerable structural barriers to agility and competitive performance, such as the highly fragmented nature of business processes across industries, which results in bloated costs, lack of responsiveness to customers, and unexploited opportunities for innovation. Companies, hence, are forced to continually revise and improve their business processes, and since processes form the heart of the advancement procedure, business process improvement (BPI) is becoming one of the most emergent topics for both practitioners and academicians. Thus, there is a growing need to examine BPI practices, not only at firm level, but perhaps more importantly across ecosystems. Additionally, research on value creation in ecosystem level is still in its early phases and the need to understand this phenomenon is recognized both in business and academic forums globally. Motivated by these trends, my study focuses on understanding how BPI affects value creation in ecosystem level, and how different actors in the ecosystem can reinforce each other through appropriate BPI.

Arola Kimmo

Keywords: *Green energy and technology, membrane technology, membrane concentrate management, wastewater treatment*

Availability and quality of fresh water as well as depleting natural resources such as phosphorus are global concerns. Municipal wastewater treatment causes serious environmental challenges due to high concentration of micropollutants in wastewaters and eutrophication due to insufficient treatment. Different membrane filtration technologies are widely utilized globally in various wastewater treatment applications. However the concentrate produced in membrane filtration is often seen as problematic big volume waste stream of which further treatment is challenging and the exploitation potential of these concentrates is often forgotten.

Aim of this doctoral thesis is to develop sustainable municipal wastewater treatment process based on efficient membrane concentrate management. In this process concentrate would be turned as valuable products such as nutrients or recirculated back to processes. Efficient concentration of effluents with shear enhanced membrane filtration, enhancement of recyclability and safety of concentrates with advanced oxidation processes and recovery of phosphorus from concentrated streams are needed in order to create sustainable process that reduces environmental impacts and creates new value. Desired end results of this study are improved quality of discharge waters, phosphorus recovery from concentrates, degradation of micropollutants and recirculation of residual membrane concentrates to achieve zero waste process in a form of membrane concentrate.

Avramenko Anna

Keywords: *Green energy and technology, wind park, computational fluid dynamics, depth-averaged equations, modeling, simulation*

Wind park is considered in a doctoral thesis by means of modeling, simulation and optimisation. First, the use of CFD in the wind park modeling is validated with real measurements. Since accurate 3D modeling is very time-consuming, a fast depth-averaged modeling method is developed for the wind park optimisation process. The so developed fast modeling method is validated with accurate 3D modeling. Even though some of the flow phenomena are lost, the depth-averaged model predicts the velocity and pressure sufficiently well. Optimisation of the wind park will be accomplished with evolutionary algorithms to avoid difficulties in gradient calculations.

Ayabakan Saygin

Keywords: *Ice accretion, numerical ice accretion simulation, wind turbine, wind energy*

Numerical simulation of ice accretion phenomenon applied to wind turbine blades. Via this way resulting adverse effects of cold climate and arctic conditions on wind turbines blades and on wind turbine performance can be studied, and performance loss due to these effects can be estimated in a computational environment.

In this study, potential flow assumption is made to approximate the flow field; therefore, some of the main methods utilized are: two-dimensional panel methods, integral boundary layer methods, and Lagrangian particle tracking.

The main aim of this study has been to simulate rime accretion on wind turbine airfoil cross-sections, while utilizing object-oriented programming techniques by using Python as the programming language. Due to the fact that surface roughness is an important parameter for the boundary layer characterization that influences ice accretion process significantly, attention has been given to the surface roughness effects on boundary layers as well.

Bairoh John

Keywords: -

The study will examine how Small Finnish Renewable Energy Firms (SFREF) are learning while transferring technology in West African countries (WAC). The interest for SFREFs to do business in WACs was triggered by the UN Conference on Environment and Development (UNCED, 1992) goals for global warming and its solutions for developing countries. Technology transfer was a key element in the UNCED agreements (http://sustainabledevelopment.un.org). The current economic downturn in Finland and EU has also prompted companies to look for business elsewhere. Moreover, Finland has expertise in renewable energy and environmental technology. Learning, Internationalization, Globalization and Technology Transfer theories will be used in the study.

There are several methodological approaches available for this study, depending on emphasis of depth vs. width of approach, and type of data used (Yin, 1989). Considering my research questions, a multiple case study is the preferred method. Multiple case studies of firms operating in the same business sector may lead to a theoretical replication (Yin, 1994). My intended audience - besides the scientific community - would be SFREFs; a project undertaken in Finnish renewable energy firms would enable other Finnish firms' managers and consultants to make comparisons and determine if the outcomes are relevant for them.

Belonogova Nadezhda

Keywords: *Green Energy and Technology, residential customer, load control, optimization, smart grid*

The main objective of this research is to forecast a single residential customer's electricity consumption in a smart grid environment. The study focuses on customers with electric heating loads and consists of two main parts. The first part concentrates on forecasting a single customer's consumption in the present operation environment, in other words, without load control actions and local energy resources (micro generation and energy storages). The result is a total electricity consumption profile with an extracted controllable part. The forecasting method uses historical hourly AMR (automatic meter reading) data. An important part of the forecasting model is the control responses of electrical heating loads, in other words modeling of payback power after load reconnection. The second part focuses on the mathematical optimization of the electrical load control under the impact of price signals from different electricity markets such as spot market, balancing market and frequency-controlled reserve market. A direct search algorithm is used to optimize the load control procedure. The contribution of the study is to define a single customer's role and impact on the retailer and the DSO but also on the customer himself in the emerging smart grid environment.

Bin Baharudin Ezral

Keywords: *Multibody, Real-time Simulation, Flexible Body, Model Order Reduction*

In real-time simulations, the operator or existing machines can actively be engaged in the dynamics performance of machines. The interaction between the operator and simulation model provides an opportunity to utilize the real-time simulation in the user training as well as the product development process.

Flexible body dynamics modeling is one of the interesting fields to be explored. There are plenty of computational models available in this field which can be improved and implemented into real-time simulation. Currently, the most accurate approach to analyze the dynamic behavior of this body flexibility is by using finite element method. Large number of degree-of-freedom (DOF) in the model will increase the computational cost. Therefore, in order to reduce the computing time while in the same time can keep the result accuracy in exceptional margin; model order reduction method is one of the ways to be implemented in the real-time simulation.

In this research, computational model, knowledge, and implementation of a coordinate reduction for flexible bodies in real-time simulation are developed. Specifically, the objective of this research is to develop the generic procedure to impose structural flexibility for real-time multibody simulation.

Bogdanov Dmitrii

Keywords: *Green energy and technology, Sustainable energy systems*

Sustainable development of the world economy cannot be reached when a fundamental component is unsustainable. Obviously, the global energy system is an essential component in the world's economy, but the current conventional energy system violates numerous sustainability criteria. This starts locally with dangerous dependence on fossil fuel exporting countries and leads to global risks of unpredictable climate change due to increasing greenhouse gas emissions. Numerous countries, especially in Europe, have begun building new energy systems based on renewable energy resources. However, the process of transformation towards a renewable energy system is full of challenges: different technologies, multiple parameters affecting efficiency and lower inherent predictability of renewable energy sources. This makes efficient and reliable energy system installation problematic. The aim of my doctoral research is to define pathways towards an optimal, sustainable renewable energy system. To reach this essential objective, a flexible and comprehensive model of the energy system including a diverse range of renewable energy resources, storage systems and energy demands must be created. Such a model will allow the determination of optimal energy systems for any geographical, financial or social conditions depicted in desired development scenarios and will assure reliability and sustainability.

Bondarchik Julia

Keywords: *Sustainable value creation, sustainability and sustainable development, assessment and measurement techniques, correlation analysis, mathematical modelling*

Sustainability as a new academic discipline has emerged at the turn of the 21st century. The growing awareness around environmental issues, as well as the rising trend of using the words "sustainable" and "sustainability" can be interpreted as a successful shift towards a positive change. However, rather broad and vague definition of the word "sustainable" leads to public confusion and causes certain scepticism towards green products and sustainability concept itself.

Therefore, there is a need for formal representation of the sustainability science in order to justify the concept and make it measurable and, hence, meaningful. The main aim of my research work is to create a mathematical framework, which would embrace a wide range of mankind activities, besides just the environmental impact on the natural ecosystems: like those associated with economic stability and social integrity. Mathematical modelling can represent a useful tool for better understanding and tracking the sustainable development process, which can amend the future decision-making process.

Buah Eric

Keywords: *CO2-EOR, CO2, enhanced oil recovery, CCUS, Backcasting, Delphi, Ghana, CO2 capture, Oil fields, Finland, Carbon Capture and Storage, CCS*

Oil and gas is one of the most important resources for Sustainable Development. It holds the promise as a vital non-renewable energy resource for meeting global energy demand. However, the petroleum sector is the most difficult sector within which to reduce anthropogenic (i.e., human-emitted) greenhouse gas emissions (GHG) especially carbon dioxide CO2 which fuels climate change. But a body of knowledge explicates that Sustainable Development cannot be achieved if our society is faced with these wicked problems. To this end, Capture and Storage (CCS) in CO2 flood enhanced oil recovery (CO2-EOR) system has emerged as a crucial part of the world's low-carbon options to productively utilize man-made CO2, captured from fossil-fuel power plants and other industrial sources and inject into declining oil fields to increase oil recovery whilst at the same time mitigating climate change. Whilst the technical feasibility of this technology is well understood; the same is not true of it socio-technical challenges that build public confidence on health, safety and environment to enhance it wide-scale deployment in different economies. This is receiving considerable research attention but it is underexplored in developing country's context especially in Africa.

Buzuku Shqipe

Keywords: *Morphological analysis, BPMN, policy measures, wastewater treatment*

Purpose - The purpose of the PhD Thesis is to create a platform for the decision-making process in municipal wastewater treatment strategy, supporting the requirements of principles sustainable development. The research work is focused on the development of methods for the effective formulation of the policies to be applied in conceptual design of wastewater treatment plants, as well as analysis of the consistency and transparency of process of policy building for wastewater treatment in the context of the specific organization.

Methods - The designed methods and tools are used as following:

Morphological analysis (MA) matrix, for formulation and identification of policy measures for the location and operation of wastewater treatment facilities. Business Process Modeling and Notation (BPMN) for representing policy measures of wastewater treatment plant in a diagram that enables reorganization and adoption of these measures, to facilitate and support decision-making process.

Results

Use of MA allows the decision-making process of identification and selection of appropriate policy measures to be structured and accelerated in a multidimensional matrix. Use of BPMN enables reorganization and adoption of these measures, to facilitate and support decision-making process.

Child Michael

Keywords: *Green energy and technology, Sustainable energy systems, Power-to-gas, Energy storage*

Modelling and analyzing future energy systems and markets is challenging due to radical changes needed to tackle climate change. At the same time, global demand for energy service is increasing. However, all dimensions of sustainability need to be regarded, something that may create barriers to development. Especially challenging is the modelling and analysis of those energy systems which include large amounts of variable renewable energy generation in the system. Therefore, new models need to be created to better analyze the economics, barriers, operational issues, etc. of those systems. The focus of my doctoral thesis is the transition of the Finnish energy system towards long-term sustainability. This will involve modelling an energy system which includes large amounts of variable renewable energy generation, new energy storage options with synthetic natural gas, new energy demand patterns and demand response, etc. The effects on the power system at an operational time scale will be analyzed by integrating and further developing existing energy system and market models. A special focus will be power-to-gas technology. Moreover, renewable power methane can be stored for the mid- to long-term and reused in the energy system in several ways, with synergetic benefits to the energy system.

Dabiri Mohammad

Keywords: *Fatigue, Fracture, FEM, CPFEM*

The main area of my research is related to the fatigue assessment of welded components made of Ultra High Strength Steels (UHSS). This assessment covers the analyses from microstructural point of view to the macro scale where the microstructure does not have a big influence on the components failure. The concepts of fatigue and fracture will be applied through the experiments and numerical simulations. Methods, such as crystal plasticity finite element modeling, continuum finite element analysis, and stress/strain based approaches will be used.

Demesa Abayneh

Keywords: *Green Technology, Wet Oxidation, Carboxylic Acids, Biomass Conversion, Waste Utilization*

The objective of the current research is to study and develop a process where forest industry wastes are used for production of carboxylic acids. These chemicals are currently produced from fossil sources increasing the consumption of fossil raw materials. The conversion of organic matters to valuable chemicals can be done by partial oxidation of the organic molecules in wet oxidation process at elevated temperature and pressure. The produced carboxylic acids are then separated from the aqueous stream and purified to products. Separation might be based on extraction and solvent recovery, or possibly on membrane technology. From scientific viewpoint, the goal is to generate new knowledge and novel technology: (i) chemistry and kinetics of wet oxidation of organic matter, including catalysis (ii) development of novel hybrid separation methods, such as reactive extraction, membrane extraction and combined oxidation and membrane separation. From practical viewpoint, the study has both social and environmental benefits since it reduces the waste discharges to the environment, increases the efficiency of the usage of biomass in pulp and paper industry and increases the energy efficiency of chemical industry in global terms by reducing the amount of fossil raw materials used for chemical production.

De Smet Dieter

Keywords: *Sustainable Value Creation, Green Energy and Technology, Financial Services, Innovation Management*

Innovation in financial services research has attracted research attention in the form of classifications and taxonomies. Various perspectives were illustrated and dispersed results were obtained, indicating that this area is still in need of more research. Financial services invest significantly in innovation activities (Eurostat) and has many distinctive features that need more research, as mentioned by Frame and White (2004) and recent research agenda (Mention and Torkkeli, 2012).

Deviatkin Ivan

Keywords: *Green Energy and Technology, International Hub of Russian Relations, Deinking sludge utilization, Material Recovery, Life Cycle Assessment*

My research is related to the utilization of deinking sludge which is a waste, or more and more referred to as a by-product of tissue paper manufacturing mills that utilize recovered fiber in its production process. Disposal of such material in landfills undoubtedly negatively affects the environment, and is not seen as a viable disposal option in the future what is supported by the legislative changes.

There are many technologies known that enable effective deinking sludge utilization as a raw material, however, there is no consensus about the choice of the most environmentally-friendly material recovery possibility, as well as the most economic one.

The objectives of my research are to evaluate economic aspects of alternative deinking sludge utilization possibilities and their environmental performance applying systems assessment tools. For the economic analysis, cost-benefit analysis is to be applied, whereas life cycle assessment is seen as the most suitable tool for the environmental assessment.

Once being finished, all domains of sustainable development are expected to be positively influenced by the outcome of the study: environment through decreased consumption of ordinary raw materials and reduced emissions, society through improved quality of the environment, and economy through avoided costs of substituted raw material.

Dubey Shashi

Keywords:-

Carbon is a versatile adsorbent that is heavily used in the removal of various inorganic and organic pollutants from aqueous solutions. Also, a variety of metal nanomaterials are reported as an excellent catalyst for water contamination processes. Novel nanocomposites materials will be synthesized, characterized and explored for their application in water purification. Experiments will be carried out for the synthesis of nanocomposites materials using chemical and biological synthetic approach. Mainly, carbon and metal based nanocomposites will be synthesized and application by adsorption and catalysis will be studied. The synthesized nanocomposites material will be confirmed for their shape and composition using different techniques such as scanning electron microscopy, transmission electron microscopy, X-ray diffraction, surface area analyser, and infra-red spectroscopic method and utilized for the purification of water.

Filianin Kirill

Keywords: *Sustainable value creation, copper production, data analysis*

Hydrometallurgical copper production is a complex industrial operation requiring advanced analysis and control of the production stages, namely, solvent extraction (SX) and electrowinning (EW). On-line X-ray Fluorescence (XRF) analysis provides real-time assay data for monitoring and control of liquid streams in hydrometallurgical plant.

Frequent measurements of product steams' quality create a data overload that becomes more and more difficult to handle. Advanced mathematical tools are in great demand for control and optimization of SX-EW plants, as well as for more efficient treatment of process analytical data.

Various chemometric multivariate techniques such as Principal Component Analysis (PCA) and Partial Least Squares (PLS) allow both compression of huge data sets and extraction of valuable information, describing major trends in the data. Application of these techniques to spectral data from industrial XRF on-line analyzers provides qualitative and quantitative analysis of main elements as well as interesting trace elements in process streams. Once a PCA or PLS model is developed, it can be combined with tools and techniques from univariate statistical process control (SPC) to form multivariate statistical process control (MSPC) tools. It allows development of control strategies for flexible and sustainable copper production.

Frimodig Lotta

Keywords: *Accelerators, new business creation, high-growth companies, green companies*

The aim of doctoral research is to clarify how accelerators can support high and rapid growth of green companies. Startup accelerators are relatively new phenomenon, which has its roots in the venture capital industry. On the other hand, there have been some kinds of new venture acceleration before startup accelerators. Accelerators can be defined as venture-to- capital (V2C) actors that bridge the competence and equity gaps of startups. Moreover, growth companies are needed to sustain economic welfare but green and clean technologies are needed for sustainable development of natural resources and natural capital. The rapid growth of green companies (e.g. cleantech, green tech) might have great positive economic and environmental consequences.

Gerami Tehrani Mohammad

Keywords: *Machine Dynamics, Mechanical Vibration, Torsional Vibration, Electromechanical Systems, Electric Vehicle, Hybrid Powertrain, Control Design*

The convenience of electric drive applications is reforming the conventional power sources to electric mode. Although the electric drives are clean, efficient and powerful, they have restrictions in dimension and feeding power supply. Generally, exploiting the mechanical energy out of the electric machines, demands a mechanical integration that considers both electrical and mechanical characteristic of system. The need of an efficient hybrid design senses when the specific performances are requested in compact systems.

According to the various utilization of hybrid systems, either mobile or stationary, designers are faced with new challenges in design and control of electromechanically driven complexes. Trying to develop a more efficient design guide line for mechatronic system architecture in order to fill the gap between electrical and mechanical engineers is the objective of this research. The dynamic behavior of a mechanism affects the performance of the electric drives while the electrical system parameters are determinant in mechanical components performance, efficiency and life cycle.

Developing accurate simulation models and approaches for integrated hybrid electromechanical systems including the control system, electric drive and mechanics as well as establishing new design guidelines for integrated hybrid electric drives are the layout of my research.

Gradov Dmitry

Keywords: *Computational Fluid Dynamics, Particle Image Velocimetry, Chemical reaction modelling, Scale-up*

Main idea of the current research is adoption of Computation Fluid Dynamics (CFD) tools for metallurgical unit design and optimization. Particular interest lies in modelling of batch stirred reactor for hydrometallurgical gold extraction. Batch process is modelled by CFD to capture primary phase flow field and secondary phases (air bubbles and solids) distribution. Baffled tank with Rushton turbine is an object of study. Multiphase modelling results are validated by means of Particle Image Velocimetry (PIV). PIV technique is capable to provide average velocity flow field of both single and multiphase flows. CFD for engineering application mostly explores Reynolds-averaged Navier-Stokes two equation models (RANS) which means that PIV validation suits current needs. When mixing is described successfully chemistry models can be coupled to get comprehensive model of batch reactor. Auxiliary work is currently going dedicated to modelling of flow caused by ultra sound inducing. Media of study are Newtonian and non-Newtonian liquids. Applied ultra sound produced no visible cavitation therefore flow description could be performed by RANS models. The output of the auxiliary work is expected to be a range of constants of RANS turbulence formulation in order to tune simple reactor systems with ultra sound agitation for experimental data fitting.

Hajikhani Arash

Keywords: *LGS14, Sustainable value creation, Social Network Analysis, Content Analysis, Text Analytic, Innovation Management, Innovation Measurement*

The research focuses on understanding the evolution path of innovation (as a socioeconomical phenomenon) sciences and its consequences to economic growth. Furthermore the attempt is to propose indicators using novel data in order to evaluate innovation activity trend more accurately. The study will benefit from varied sources of data, such as bibliometrics data and data on social media in order to investigate the effects of innovation as such in society. Natural Language Processing techniques and on top of that Sentiment analysis will be utilized for understanding the big unstructured data from social media. The results will be useful for policy makers and firm decision makers for obtaining more accurate perspective of their innovation policy's performance and regarding that shaping the policies accordingly.

Han Mei

Keywords: *Green energy and technology, Fluid mechanics, Fluid particle dynamic behaviors, Computational Fluid Dynamics, Multiphase reactors*

The objective of the study is to improve the hydrodynamics and then achieve mass and heat transfer intensification for two-phase flow which is encountered widely in chemical industries, bioprocesses as well as in wastewater treatment. The hydrodynamics in two-phase flow is still far from understood-well due to the complicated fluid mechanics and the limitation of testing techniques. It inhibits the design, scale-up and optimization of multiphase reactors and thus delays the applications and development of industrial processes. Within this study, the hydrodynamics and the mass transfer of two-phase flow are investigated with the visualization testing (PIV/LIF) and CFD simulation methods. Special interests focus on the fluid particle dynamic behaviors that play important roles and are related closely to the mixing, mass and heat transfer as well as the reaction rate. Contributions of this work are made to design, scale-up and optimizing of multiphase reactors together with the selection of operating conditions.

Han Bing

Keywords: *Reactive crystallization, precipitation, mass transfer, solubility*

As a solid-liquid separation technology, crystallization is a much more difficult and complicate process compared to other chemical unit operations. Crystal properties, quality and particle size of the product depend on operational conditions. Various crystallization processes such as reactive crystallization and anti-solvent crystallization are studied in the present research work. The target is to fully understand the fundamental and utilization of crystallization, and find out a proper method to control particle size distribution, especially for three phase system. Gas-liquid mass transfer of absorption in the presence of solid particles in a stirred tank is investigated in order to know how different-sized particles interact with gas bubbles. By using experimental and modern analytical methods, precipitation kinetics, mechanism and mass transfer of magnesium carbonate hydrates from a reaction of magnesium hydroxide and CO2 were systematically investigated. It can give greater insight on gas-liquid-solid reaction principle and mechanism from this heterogeneous crystallization. And new research approach developed can provide theoretical guidance and useful reference to promote development of gas-liquid reactive crystallization. Moreover, solubility prediction model by Pitzer thermodynamic model is investigated based on solubility measurements of potassium dihydrogen phosphate in non-electronic solutions.

Hanski Jyri

Keywords: *Sustainable asset management, asset management, sustainability, strategy*

Sustainable management of assets is one of the key means to improve the sustainability of manufacturing companies and thereby, the sustainability of the whole society. The research aims at finding out ways to improve the sustainability of current asset management strategies taking a special interest in manufacturing companies. The research is practice-oriented and case-based, however, the results can be generalised to other companies operating or owning a fleet of engineering assets. The research draws upon the new asset management standard ISO 5500x (2014). Information collection, analysis and utilization related to assets play an important role in improving the sustainability of an asset management system, and improvement in these activities has a great sustainability and business potential. At societal and industrial level, the research aims at increasing consciousness of sustainable asset management and improving the effectiveness of resource and energy use, thus improving the competitiveness of companies and sustainability of the society.

Hasan Mehdi

Keywords: *Eutectic Freeze crystallization, Natural freezing, Heat transfer, Mass transfer*.

Finland is a country of cold climate with numerous metal mining sites. Wastewater of these metal mining industries can be treated by freeze crystallization operating under the eutectic point (temperature). It would be very possible to reach the eutectic temperature by ambient condition during winter. Furthermore, higher yield and purity of separated salts could add extra financial value. All of these factors make Eutectic Freeze Crystallization a revolutionary technology to treat wastewater of metal mining industries in Finland.

Havukainen Jouni

Keywords: *Waste Management, Life cycle assessment, Biogas production, Distributed energy systems*

The main goal of dissertation work is to estimate the regional renewable energy potential from integrated biodegradable waste treatment, calculate greenhouse gas emissions from biogas production and analyze energy performance of biogas production. In integrated biodegradable waste treatment, different biodegradable waste fractions are utilized together and possibly also with other biodegradable masses, such as energy crops.

This research focuses on the other hand the problem of managing the biodegradable waste and on the other hand the ever increasing demand of renewable energy. Biodegradable waste management should be done so that the treatment is environmentally friendly and is energy efficient.

Other research topics include distributed energy systems, waste management in general and life cycle assessment of different systems.

Heikkinen Janne

Keywords: *Green energy and technology, Vibration, Subcritical vibration, Multibody dynamics, Simulation*

Rotating electric generators can be seen as the backbone of the energy production. Within the latest decades, permanent magnet applications have been widely used because of their reliability and efficiency when compared with traditional induction generators. The dynamics of permanent magnet generators have been studied extensively, and their electromagnetic characteristics have been thoroughly investigated. However, relatively few dynamics studies accounting for electromagnetic forces have been carried out, and electromagnetic forces can produce surprising and significant dynamic effects. My study introduces models that can be used to predict better the full range of dynamic behaviors of the rotating machinery. The excitations that cause vibrations in the system arise from the electromagnetic forces and manufacturing inaccuracies. The resulting models are tools capable of simulating various fault situations, which makes it possible to assess relative criticality. Through simulation, various fault conditions can be better understood and avoided. The rotational speed of the machines is considered usually as the excitation frequency of the machine. However, manufacturing and assembly tolerances cause some imperfections to the system that leads to excitations which frequencies may be multiples of rotational speed. These frequencies and their effect to the resonances during the usage are studied in details.

Henttu Ville

Keywords: *Green energy and technology, International hub of Russian relations, transportation, logistics, rail transport, dry port*

My research interest focuses on transportation regarding mainly rail transport and dry port concept. In dry port concept, a seaport is connected by rail with an intermodal terminal, which is located in the hinterland of the seaport. I am researching, whether cost and environmental benefits could be achieved by implementing dry port network in Finland. Furthermore, the amount and locations of dry ports in Finland is of my research interest. In addition, I research, could there be advantages of connecting Finnish hypothetical dry port network with major rail transport corridor. This corridor could be utilized to transport freight between Finland and e.g. Central Europe.

Herold Kristiina

Keywords: *Sustainable value creation, Word-of-Mouth, Complex Services, Information processing, consumer behavior*

Services are stated to have a central role in economic growth, and social influences such as Word-of-Mouth (WOM) are known to play an important part in their success, extant research has even suggested that WOM is the ultimate success factor for services. People around us are known to be powerful persuasive sources of information affecting our behavior. However, relatively little is known about the psychological mechanisms and the effectiveness of WOM in consumer decision making. Thus, my current research focuses on how consumers process information through WOM in a complex service environment, by adapting dual-processing models of persuasion. I am aiming to form a deeper understanding of how consumers utilize WOM information through source effects and evaluation difficulty, but also through a longitudinal perspective taking into account different phases of consumer choice and rejecting behavior. Taken together, the results will both deepen the understanding of behavioral processes intervening WOM, as well as provide insights into designing more powerful WOM marketing campaigns for complex services. Understanding the processes of WOM will further advance knowledge in how services could be developed from an information search perspective.

Hujala Elina

Keywords: *Green energy and technology, NPP thermal-hydraulics, interfacial area transport theory*

Local states of coolant flow play major roles during the normal operation and possible emergency conditions of a nuclear power plant (NPP). Although the thermal hydraulics of NPPs has been a popular research area, there is still demand for more uniform and generally applicable flow and heat transfer models. One part of that need is the reliable boundary surface modelling of liquid-vapour two-phase flow. The aim of this research is to create a mathematical model to define barrier layer of two-phase flow by using interfacial area transport theory. Interfacial area transport is a mathematical way to model a barrier layer between two different phases. It has been used to model two-phase flows of NPPs, but it is rarely measured in experimental research of NPP thermal hydraulics or used in improvement of system codes, albeit it could be very profitable in the both. With a functioning model, it could be possible to replace the simplified models in system codes, which would improve the quality of simulations, and improve also CFD interface modelling. It should also improve the analysis of the results of the NPP thermal hydraulics experiments and upgrade the safety research of light water reactors.

Huotari Pontus

Keywords: *Sustainable value creation, Innovation Management, Strategic Management, Agent-Based Modeling and Simulation*

Nowadays, diffusion of a competing innovation is more commonly dependent on complementary innovations. This is especially true in multi-sided and platform-based markets, such as smartphone or video-game console markets, which are thriving these days. Explaining and forecasting diffusion in these markets is beyond the scope of traditional diffusion models, which basically neglect competition and complementarities. It is highly important to develop diffusion models for multi-sided and platform-based markets, so that diffusion dynamics can be explained and forecasted, allowing firms to manage them. Thus, the objective of my study is to advance our accuracy in explaining and forecasting the diffusion of competing innovations that rely on complementary innovations. The main research question is: how do competing innovations diffuse in multi-sided and platform-based markets? To answer this question, advanced explanatory and predictive diffusion models are developed. A modeling and simulation method called “agent-based modeling” is utilized, because it is especially suitable to modeling and simulating micro-level dynamics of social phenomena such as diffusion. The study focuses on ICT markets, which are usually organized around competing platforms that rely on complementarities (e.g. iOS vs. Android).

Hupponen Mari

Keywords: *Green energy and technology, Sustainable value creation, Municipal solid waste management, Life cycle assessment, Greenhouse gas, Public procurement*

The ongoing trend in the public sector is to make more sustainable procurements in order to take into account the impacts throughout the entire life cycle of the procurements. Despite the trend, the only deciding factor can still be the sum of costs. The research is related to the greenhouse gas emissions (CO2, CH4 and N2O) of municipal solid waste management. The aim is to answer how greenhouse gas emissions should be taken into account in the planning and decision making of waste management. The aim is also to guide the public procurement of the waste management towards more environmentally friendly procurements. The idea is to recognize the main processes that are affecting the results by doing life cycle assessments. The life cycle of waste begins from the moment the waste is produced and continues until the waste is utilized or landfilled. Avoided emissions resulting from recycling and energy recovery are also included. The GaBi life cycle modelling software is used as a modelling tool. The research focuses on different waste fractions, e.g. source separated mixed municipal solid waste, biowaste, cardboard, glass and metal. Different case areas and scenarios are used to evaluate the global warming potentials.

Hyvönen Irma

Keywords: *Leadership, innovation, renewal, knowledge management, intellectual capital*

Information technology and digitalization of services mean that even a local government organization has to be flexible, innovative and renew its processes, practices, services and insights instead of maintaining the status quo of the activities.

The aim of the present dissertation is to explore, understand, and exploit the phenomenon of organizational innovativeness or innovation in the local governmental organization context. The focus is on the complex real life phenomenon of the local government innovation process. The local government organization consists of the city-, state- and private-owned organization system of the same field. The leadership of the innovation process gives a holistic view of the activities in the field and society.

In the research literature there is a gap of the leadership of the local government organization innovation process. The main research question: How does the leadership impact the innovation process within the local government organization? Methodologically the study is qualitative research analysed and triangulated with sound research literature seen from the knowledge management, strategic management and intellectual capital perspectives.

Ikäheimonen Tuuli

Keywords: *Sustainable Value Creation, Board of Directors, Family Business, Family Business Governance, Succession*

My research interest is directed toward the family business board of directors. Especially I'm interested in to clarify how the board participates in family business governance, and how the board develops along with the firm's and family's development. Both boards and governance have increased their attractiveness as a research topic lately, but e.g. family business governance studies are criticized for ignoring the multifaceted needs of companies. This ignorance has led to inconsistent findings, and also the relevance for the practitioner is more difficult to prove. Because of this, many authors have called research observing the context and contingencies affecting the governance and board of directors. I implement my study as qualitative case research, using the longitudinal process approach as it provides the opportunity to examine development in context.

The study benefits both family business owners, board members and business advisors as it clarifies the board position in the family business governance; suggest new kind of tasks for the board and increase the knowledge about the board's development.

Inkinen Henri

Keywords: *Knowledge management, Intellectual capital, Sustainable value creation*

The recent estimations explicate that firms' intellectual assets clearly outweigh the tangible value. The World Bank reported in 2005 that intellectual assets accounted as much as 77% of the total wealth globally. However, the recent publications by e.g. Perrez-Arrau et al. (2014) and Heisig (2014) found out that the key research gap in the field is the better understanding of the relationship between knowledge management (KM) and business performance. Thus, the importance of intangible assets is generally well-recognized but the empirical evidence on the firm performance enhancing influence remains to be rather vague.

My research focuses on how intangibles i.e. intellectual capital (IC) influence firm performance. The special interest is in KM practices, i.e. the organizational and managerial practices which are aimed at leveraging on the intellectual assets in order to achieve improved firm performance. Therefore, my research tries to tackle the following question: "How do the possession of IC assets and the utilization of KM practices influence firm performance?" The results of my research are valuable for the surrounding society and especially for the firm-level decision makers, as they gain novel information on the organizational and managerial practices that are highly relevant for transforming IC into improved business performance.

Jaatinen Pekko

Keywords: *High-speed, Active magnetic bearings, AMB, rotordynamics, bearingless motors*

Active magnetic bearings provide frictionless suspension for the high-speed motor applications. Traditional active magnetic bearings system consists of several active parts. These parts are a motor, two radial magnetic bearings and an axial bearing. This kind of structure increases the rotor axial length and complicates the overall system structure. Amount of the active parts can be reduced by combining motoring and suspension action into same stator. This method combines motor control and suspension control. Additional benefit is reduced axial length of the rotor. This increases the critical bending modes of the rotor. Research target is the scalability and the limitation of the industrial size bearingless motors. Main research interest is a robust control of the bearingless motors.

Janhunen Sari

Keywords: *Green energy and technology, Social acceptance, Wind power, Landscape, Wind turbine sound*

Background of this dissertation work comes from confrontations: wind energy is one of the renewable energy sources with national targets in Finland. At the same time the harmful environmental impacts are needed to asses. Finnish people do accept wind power at general level and consumers are willing to buy green electricity, but the wind farm projects meet opposition and market share of wind power is still low. The main research question is: how is social acceptance of wind power defined in Finland?

The question is studied from two main perspectives. Firstly, the role of relationship between people and environment is analysed. The attitudes are studied among local residents and second home owners in a rural environment. Also, the differences in attitudes between residents in rural and urban wind farm projects are studied. Secondly, environmental impacts of wind power may cause experienced disturbances. These experiences are often related to landscape change or wind turbine noise. This dissertation work is asking where people do accept wind turbines. One target is to describe human experience of wind turbine sound. The data is collected both at the cases in planning phase and near constructed wind farms.

Jukka Minna

Keywords: *Buyer-supplier relationships, Russo-Finnish, Sino-Western, trustworthiness*

My research contributes to the research on intercultural B2B buyer-supplier relationships. The main objective of the study is to find out how managers coming from different cultures such as China, Russia and Finland perceive their partner's trustworthiness and create mutual trust in business relationships.

Trust is an essential relational element, yet past research cannot explain how individuals and organizations across cultures perceive trustworthiness and what they expect from trustworthy business relationships. Much of the research on trust across cultures takes the western conceptualization of trust as granted and may not be able to capture the contextual meaning of trust as perceived by individuals across cultures.

Novelty in my research is based on utilizing the Repertory Grid method in the research on trust in intercultural context.

My preliminary findings indicate that the repertory method reveals new knowledge of the type and relative importance of trustworthiness dimensions across cultures.

The research will contribute to scientific discussion by providing a more nuanced cultural understanding of the perceived quality and related trustworthiness in business relationships as well as how trust should be purposefully built in cross-cultural business relationships. New knowledge will also have practical relevance for Sino-Finnish and Russo-Finnish business relationship development.

Juntto Reko

Keywords: *Sustainable value creation, green IT, open data and open innovation*

Collaborative collection and publishing of open data and datasets by public authorities are a current trend on the web. The research main question is that what are the impacts that open data will bring to these public authorities and to the stakeholder's that are developing the public IT systems. The research will explore that what kind of data is beneficial to open and what could be the advantages of it, new services, innovations and products possibilities based on it.

Public and private organizations are currently wondering, what data to open, how to publish open data, what are the benefits of that and which open data platform to use. This research can give support and solutions to that.

Juntunen Raimo

Keywords: *Green energy and technology, Control systems design, Multilevel inverter, Grid inveverter, Grid filter*

Design of parallel connected filters for high power inverters. High power inverters use low switching frequencies and thus require high order filters, such as LCL-filter, to ensure that grid codes for current harmonics and voltage quality are met. Unfortunately LCL-filters have resonances, which can cause the control system to go unstable if resonances are not damped properly. Parallel connection of LCL-filters results in shifted and additional resonances, which can lead into poorer or better damping and more complex control design. Also optimization of the filter becomes more complex multidimensional problem. Paralleled filters can have common or individual components, which introduces more degrees of freedom and grants more possibilities to realize adequate current harmonic attenuation at grid interface. Proper knowledge of the filter resonances in parallel filter systems allows designing the filter in such way that system is kept stable without creating more losses. Proper filter design ensures a stable and energy efficient system for green power generation and grid integration.

Järvi Henna

Keywords: *sustainable value creation, value creation, value co-creation, value co-destruction, consumer behavior*

Value creation has been one of the hot topics in management literature for the past 20 years but still our understanding of value is limited. In the recent years two new concepts of value co-creation and value co-destruction have emerged into value research taking the collaborative approach into value creation. However we still fail to understand what value co-creation and value co-destruction really mean and what are the roles of consumers and companies in these situations. Inspired by this discussion my doctoral dissertation focuses on understanding how value co-creation and value co-destruction differ from one another and especially, what is the role of consumer engagement in both phenomena. Additionally I am studying how companies need to take trends and changes happening in consumer market into account. We have seen how different consumer food trends and new sports have impacted companies and how they have introduced new products and services into market trying to answer to this market need. Analyzing this and introducing the concept of crowdsourcing might give us more understanding of the discussion between consumer market and companies.

Järvisalo Heikki

Keywords: *Green energy and technology, active gate driver, voltage transition rate control, switching delay time minimization*

The advances in semiconductor technology have reduced the switching times of semiconductor switches, such as IGBTs, to the order of tens of nanoseconds at best. The faster switching times mean a higher voltage transition rate, and a too high voltage transition rate can have harmful side-effects; in inverter-fed electric drives, one of the reasons for cable reflection caused harmful overvoltages is too high voltage transition rate in the inverter output. Hence it is feasible to study a gate driver, which can modify the performance of the semiconductor switch to get the optimal switching performance depending on the application. The switching characteristics of most interest are voltage transition rate, switching time delay, current transition rate, voltage overshoot and switching losses. The gate driver should also be as cost-efficient and simple as possible.

Kaijanen Laura

Keywords: *Green energy and technology, Separation concepts, Chemical metrology, Analytical chemistry, Biorefining*

This dissertation focuses on the analytics for the products from the renewable resources, especially the validation and development of capillary electrophoretic methods.

The aim of the study is to develop and validate CE methods for the monitoring of the process streams of bioprocesses. One of the aims is to evaluate suitability of the method for the identification and quantification of the compounds, focusing mainly in the wood-based materials. The aim is also to find new applications for the side streams of the separation processes of biorefining.

In this research, the suitability and applicability of the methods for monitoring of biorefining in forest industry are studied. The bases of validation procedures are adapted from the traditional analytical methods. In the evaluation of suitability also real process samples are analyzed, which emphasizes the purpose of validation. The suitability for industrial applications is also discussed from the environmental point of view.

The procedure of in-house validation is studied at general level of metrology from both scientific and industrial point of views. E.g. selectivity, specificity, linearity, and limits for detection and quantitation are evaluated. Also the requirements for the equipment in the industrial environment are discussed.

Kaipia Tero

Keywords: *Green energy and technology, low-voltage direct-current, electricity distribution, distribution system planning, system engineering, standardization development, optimization methodologies, life-cycle analysis, economic feasibility analysis*

The main fields of interest are systems engineering and grid planning questions related with low-voltage direct-current (LVDC) power distribution systems. The main objectives of the research are the formulation of the related optimisation problems, the definition of the applicable solution methods and principles, and the analysis of the role of the LVDC systems in the future power systems. Central themes are techno-economic optimisation, analysis of feasible use cases and applications, electrical safety questions, control architectures and development of standardisation. The special emphasis is on the LVDC systems for utility networks and versatile microgrid solutions, however, the main goal is to develop generic planning methodologies suitable for all applications and both system engineering and network planning. In addition, microgrids related business models for electricity markets are addressed. The adoption of LVDC systems is supported by the favourable price development of power electronics, the significant increase in the transmission capacity of the low-voltage grids, and the improved grid service quality for the end-customers. The smart functionalities of the embedded converters provide means to meet the stringent demands imposed on the cost efficiency and service quality of electricity distribution. The LVDC distribution provides new opportunities for grid management and electricity trade.

Kan Yelena

Keywords: *Optical metrology, Non-linear optics, CARS spectroscopy, background elimination*

Coherent Anti-Stokes Raman scattering (CARS) is one of the successfully approved, label-free and powerful technique utilized in nonlinear spectroscopy. However, the non-resonant processes, accompanying CARS signal generation, prevent the direct extraction of chemically specific quantitative information. Maximum entropy (ME) method enables phase retrieval from original CARS spectra and thus makes possible defining imaginary part of third-order nonlinear susceptibility responsible for 'fingerprint' molecular vibrations signal. Examination of various background eliminating procedures is required for reliable determination of true phases from ME phases. We apply ME method along with wavelet transform or asymmetric least squares smoothing to experimental CARS spectra. Resulted data are analyzed to reveal main advantages and limitations of the algorithms.

Kapustina Viktoriia

Keywords: *Sustainable value creation, International hub of Russian relations, Waste management, environmental performance, systems analysis, waste oil*

My research focuses on the analysis of waste oil management systems. Waste oil is defined as mineral or synthetic lubricant oil, that is lost during the use, but the rest becomes waste after losing its properties and getting contaminated. Waste oil is classified as a hazardous waste in most countries. Improper waste handling leads to aquatic life damage and contamination of the soil. Therefore, development of proper waste oil management is crucial for the protection of the environment and human health. Waste oil management systems include processes such as generation, collection, recycling, and disposal and result in various environmental, economic, social, and regulatory impacts which complicate the waste management analysis. In my research, the waste oil management systems are analysed using a system approach to reveal the interconnections between the components of the system and its connection to the other systems. This helps to understand how the waste management system's performance can be improved. The performance of the system is examined from the environmental point of view by the life cycle assessment tool.

Karell Ville

Keywords: *Sustainable value creation, investment analysis, equity investing*

The objective of my research is to provide further insight to pricing anomalies by developing innovative methods for the identification of undervalued stocks. The research is based on empirical testing of discriminatory power of several methods on separating undervalued stocks from fairly-priced or overvalued ones in both Finnish and U.S. stock markets. There are two distinct methodological approaches which are used in the research. The first method is based on adjusted valuation measures, where the adjustment of traditional valuation ratios (i.e., earnings yield (E/P), book-to-price (B/P), sales-to-price (S/P), cash flow-to-price (CF/P), and EBIT(DA)/EV) considers also additional dimensions that are firm size, industry, and financial leverage. The second methodological innovation is based on the application of the Operational Research (i.e., DEA, AHP, and TOPSIS) that permits the usage of composite value measures as classification criteria, as well as, the combining of those with the price momentum indicator. Hence, the research provides new evidence of added-value of combining value and momentum strategies. The research is relevant not only to academics but also to practitioners since the findings can be used as a basis of investment strategies in equity markets.

Karppanen Janne

Keywords: *Green Energy and Technology*

The research concentrates on the utilization of low voltage direct current (LVDC) in public electricity distribution. The favourable technological and price development of the power electronics has enabled the use of DC also in distribution. The main benefits of the LVDC distribution are the possibilities to increase transmission capacity and quality of supply compared to the traditional AC distribution. In addition, LVDC distribution system provides a versatile platform for implementing various Smart Grid functionalities which are indisputable part of the future distribution. Suitable application targets for the LVDC distribution can be found globally ranging from rural to urban areas and thus the operational environments differ greatly. To be able to obtain feasible solutions in techno-economic sense it is necessary to develop methodology for the planning of the LVDC systems which is also the main research objective. For now, due to the novelty of the concept the LVDC related practises are partially incomplete or lacking.

Karttunen Jussi

Keywords: *Green Energy and Technology, Electric drives, Power electronics, Control engineering*

The aim of my research is to improve control methods for multiphase electric machines. Multiphase machines have become a subject of significant interest over the last two decades. The increased attention among researchers and industry to machines with more than three phases results from the possibility to achieve notable improvements in various aspects of performance compared with the use of conventional three-phase electric machine drives. Features such as higher efficiency and greatly improved reliability make multiphase machines particularly advantageous alternative, for example, in wind power systems and electric vehicles. However, while increasing the phase number of the electric machine provides significant benefits, it also complicates the internal dynamics of the system which causes challenging problems. Because of these problems, multiphase machines are difficult to control and consequently good performance is hard to achieve. Current state-of-the-art fails to solve these performance issues. Thus, improvements in control methods are much needed. Through deep understanding of the electromagnetic behavior of the multiphase machines, advanced control methods can be developed. These methods allow the full benefits of multiphase machine drives to be utilized even in demanding applications. As a practical implication, the results of the research help to build better wind power systems.

Kauppinen Otso-Pekka

Keywords: *Green energy and Technology, Nuclear safety, system code, TRACE, PWR PACTEL*

Thermal hydraulic studies are an essential part of the safety analysis of nuclear reactors. Because of the complicated thermal hydraulic behavior of a nuclear power plant, several advanced computational tools, such as thermal hydraulic system codes, have been devel-oped. These tools along with test facilities play an important role in the design, licensing and operation of nuclear power plants.

These system codes need constant validation for the reliability verification of the calcula-tions. Despite of huge amounts of resources invested to the code development, the results are still affected by errors.

In this thesis the objective is to analyze the thermal hydraulic behavior of the PWR PACTEL facility, an integrated test facility in LUT to model pressure water reactors with vertical inverted U-tube type steam generators, and to study the TRACE system code (developed by the U.S. Nuclear Regulatory Commission) behavior in the PWR PACTEL geometry. Data from several PWR PACTEL experiments with different kind of transients will be used to test the modeling capability of the TRACE system code and to improve, maintain and update the system code nodalization of the PWR PACTEL facility. The TRACE system code nodalization could be use in the experiment planning and the results analyzing.

Kazarnikov Alexey

Keywords: *Sustainable value creation, pattern formation, bifurcation theory, asymptotic methods, nonlinear functional analysis*

The main purpose of the current research is analytical and numerical investigation of pattern formation processes in reaction-diffusion systems. In nature, patterns are visible regularities of form. Reaction-diffusion systems, initially introduced by Alan Turing in his classical paper “The chemical basis of morphogenesis” (1952) have found a wide range of applications in mathematical biology, chemistry, physics, physiology and other branches of science. The mechanisms of pattern formation are still not completely understood now, however a lot of mathematical models have been developed for quantitative and qualitative description of pattern formation.

Quite often, the processes of pattern formation are modeled by partial differential equations. Our attention is given to spatially distributed FitzHugh-Nagumo system, which describes nerve impulse propagation. In the case if no spatial dependence is assumed, FitzHugh-Nagumo model becomes a generalized version of classical Van-der-Pol oscillator.

The efforts are given to the analysis of time dependent and stationary solutions, bifurcations and long-time dynamics of the equations. Various analytical approaches from bifurcation theory, asymptotic methods, nonlinear functional analysis and numerical methods are used. We are performing numerical experiments in order to confirm our theoretical findings as well as in order to obtain new information about the system.

Keskisaari Anna

Keywords: *Green energy and technology, waste, recycling, WPC*

This research focuses on using recycled raw materials as a part of wood-plastic composite (WPC). The main aim of this research is to find out widely available waste streams in different fields and use them in wood-plastic composite manufacturing. Wood-plastic composites are made from different materials, mainly reinforcing wood fibers, plastic as a matrix and different fillers and additives. So far research in this area has focused on recycled fibers and plastics, but there are a wide range of other recycled materials which are suitable for WPC. This research gives new information about potential materials for wood-fiber composites. Different materials provide different properties in WPC. In this research, material properties are studied, to get properties of WPC as suitable as possible for the intended application. Research in this area improves waste recycling by creating a new application for waste and creates new WPC materials with new features.

Kesse Martin

Keywords: *Advanced Welding Technology, TIPTIG*

Industries like the automobile, aeronautic, construction and maritime transportation industries are always seeking means to maximize profit in their commercial activities. One way that these industries could reduce costs is through the use of lighter materials in their products. In this regard, non-ferrous metals like aluminum offer a lower-weight alternative to steel that can possibly increase fuel efficiency. However, producing welded constructions from non-ferrous metals like aluminum alloys is more challenging than when using steel. The objective therefore is to investigate the difficulties associated with the welding of non-ferrous metals using newly developed TIG-associated welding processes such as TOPTIG, TIPTIG and laser-TIG hybrid welding. Secondly, the study investigates how TIG-associated welding processes can be effectively used in the welding of non-ferrous metals and thus accelerates their usage in industry. Exploration of these objectives requires an approach that includes experimental study on the various research questions in order to ascertain the benefits associated with the use of TIG-associated welding processes (TOPTIG/TIPTIG) and also improve on existing findings. The research consists of two areas: a literature review and experimental methods to seek insight into TIG-associated welding and to verify previous findings.

Knutas Antti

Keywords: *Green energy and technology, cscl, computer-supported collaborative learning, social network analysis, information networks, rfid*

Collaborative learning, or cooperative activity of students working together towards a specific learning goal with the teacher as a facilitator, has become an increasingly important topic in education. This collaborative approach to education has been shown to develop critical thinking, deepen the level of understanding, and increase shared understanding of the material. Computer-supported collaborative learning (CSCL) facilitates this collaboration by using computer-mediated communication tools to either enable new communication methods between students or to extend the range of communication beyond a single classroom.

The extension of collaboration with CSCL allows increased knowledge building between a wider range of participants, flexible teaching structures independent of place or time, better monitoring of student understanding by instructors, and improved student productivity and satisfaction.

Our proposal is to arrange a gamification model around rewarding student collaboration, like helping solve posted problems or collaborating on difficult or additional tasks across groups, instead of tying the rewards to achieving the learning goals. Our hypothesis is that this model of gamification, when applied to a CSCL systems, provides an initial extrinsic motivation for students to start using the system, giving them time to realize the educational benefits to their studies and subsequently increasing internal motivation and engagement.

Kompanets Victoria

Keywords: *University-industry collaboration, university-business cooperation, international higher education, joint and double degree programmes, university partnership*

In the era of economic austerity and recession innovative breakthroughs are required to overcome the current challenges. Such radical improvements can be done by well-educated and open-minded skilled professionals from all-over the world. University can be a source for accumulation, education and provision of the most talented people to society, but only with the help of business world. Knowledge about international university-business cooperation (UBC) in the field of education is rather fragmented and needs to be more developed. Therefore, the research aims to discover and theorize new approaches and models of international university-business collaboration in the field of education and contextualize this knowledge in relation to Russia. The question of enhancing partnership between higher education providers and business in the field of international education in a more sustainable way is studied in the following dimensions: 1) What are the values for companies and academics in cooperation and how those can be matched? 2) What factors affect international university-business cooperation (UBC) in the field of education? How institutional infrastructure influences UBC? 3) How to structure university-business cooperation in a more beneficial way for both parties?

Kunttu Anna

Keywords: *Sustainable value creation, social entrepreneurship, sustainable entrepreneurship, entrepreneurial opportunities, entrepreneurial intentions*

The doctoral research focuses on social and sustainable entrepreneurship among young adults. The main research question examines the role of values, social networks and education in turning entrepreneurial intentions into behavior among young adults in the context of social and sustainable entrepreneurship. As Europe is facing increasing youth unemployment, turning entrepreneurial intentions into actual behavior could have significant impact on the financial development of the EU. Generation Y (born 1979-1994) has been suggested to be more entrepreneurial than past generations, and in order to utilize their tendency, information regarding the antecedents of entrepreneurial behavior is a must. Moreover, the generation Y has been proposed to value environment and focus on problems in the surrounding society, which in turn highlights the need to introduce other forms of entrepreneurship alongside the conventional entrepreneurship. Engaging young adults into social and sustainable entrepreneurship, and revealing the underlying factors, which impact the intention-behavior connection, could help to solve the most troublesome issues in Europe related to environmental development and society. Moreover, examination of the role of education, could shed light on issues especially in the higher education, which seems to focus on the conventional entrepreneurship, and provide only little knowledge about other entrepreneurial opportunities.

Kuokkanen Anna

Keywords: *Sustainable value creation; sustainable food system; complex systems; system innovation; positive change*

Industrial food system has become extremely wasteful and energy-intensive at the time when more people are suffering from food shortages and valuable resources are becoming scarcer. In Finland the unsustainability of food system is manifested by dead zones in the Baltic Sea and overuse of nitrogen and phosphorus resources. However, food presents a complex system and sustainability issue can be considered a wicked problem, such for which there are no simple solutions. Transition of food system, including closing the nitrogen and phosphorus loops, is urgently needed. However, transition of such complex system requires escaping lock-in and path-dependcies at all parts of food value chain. This means understanding system´s feedback loops and bottlenecks in existing structures and practices, and interaction between institutions, civil society, environment and technology. Therefore, ultimately the goal is to outline framework to escape lock-in and instigate emergent change for sustainability.

Kuparinen Katja

Keywords: *Sustainable energy systems, Biomass conversion, Biomass to energy, BTL, SNG*

Research focuses on sustainable biomass conversion for energy purposes. Biomass conversion methods, such as gasification, torrefaction, and pyrolysis increase the possibilities of biomass use in various applications. Conversion promotes fossil fuel replacement with renewables in industry, energy production, and transportation sectors. Conversion products can be gaseous, liquid, or solid, and in addition to energy use, they can be refined further into more valuable products, such as chemicals. For example in pulp and paper industry there are several possibilities to use conversion methods both in order to replace fossil fuels and utilize biomass-based byproducts, and to create new business lines based on conversion products.

Kurvinen Emil

Keywords: *Machine design, rotordynamics, electric machines, multibody dynamics*

Main research interests are in the electrical machines. The common applications for these machines are traction motors, gas compressors, blowers and turbines. The research includes mechanical design and dynamical behavior under varied operation speeds. Different types of supports and attachments for the rotating part are also considered. Demand for higher rotation speeds, which often leads to better efficiency, requires advanced bearing solutions compared to the conventional rolling element bearings such as fluid film bearings or magnetic bearings. The dynamical behavior is required also to study in order to avoid unwanted vibrations in the rotating part during operation. The research leads to more efficient machines where the electrical energy is transferred to mechanical energy with minimal amount of wasted energy and vice versa.

Kähkönen Tommi

Keywords: *Enterprise Systems, Enterprise Resource Planning, Integration, Organizational Issues*

Enterprise Resource Planning (ERP) system is a software solution that automates the core business processes of an enterprise, promising many business benefits. However, implementing these systems in organizations is challenging, it has been estimated that 90% of ERP implementations fail to fulfill the intended goals. An ERP system cannot itself fulfil all the integration needs of a company. It has to be integrated with numerous different systems, not only with those that are inside the company but also with the external systems of business partners and customers. Thus, integration remains as a continuous challenge during the life cycle of an ERP system. Integration is a socio-technical challenge that requires the collaboration and cooperation of many stakeholders and organizations involved. My research focuses on organizational issues of ERP system integration during the life cycle of the system, how different stakeholders contribute to it, how it evolves during the life cycle and how integration issues can be effectively solved. The ERP development of three large and global organizations is examined by Grounded Theory as the main research method. The results of this research help managers in integration governance and decision making, to avoid the increased complexity and costs in complex organizational settings.

Kärkkäinen Tommi

Keywords: *Green Energy and Technology, Electronics, Power Electronics, Reliability, Semiconductor components*

Power electronics are everywhere. Numerous systems including industrial drives, electric generators, the power grid, transportation and consumer goods contain a power electronic converter of some sort. The unexpected failure of a converter causes interruption to service, loss of productivity and profit, and in some cases a risk of injury or death.

An early warning of failures would help the operators to cope with the issues, but a widely accepted condition monitoring and early warning method does not exist. Can acoustic measurements be used to predict the failures of the semiconductor components in these systems? The failure mechanisms caused by aging of the components usually include cracking, breaking or other physical damage to the package of the component. Such damage can reasonably be expected to cause an acoustic phenomenon, and detecting the phenomenon should be able to provide an early warning of failure.

If successful, the research results will allow better availability of systems utilizing power electronics. This means that factories, renewable energy plants, electric transportation etc. will function with better reliability, and with lower maintenance costs. Early warning methods may also prevent death and injury if they allow safety critical processes to be stopped preventatively before they fail.

Lahdenperä Esko

Keywords: *Fluid flow, modeling, unit operations, novel unit design, additive layer manufacturing, crystallization, liquid-liquid systems, multiphase systems*

Chemical industry is looking for processes and equipment which increase material and energy efficiency and decrease environmental load. This is accomplished by applying principles of process intensification which by novel methods and new designs leads to smaller, cleaner and material and energy efficient technology.

The main research question in this study is to examine how CFD modeling and additive layer manufacturing can be combined in development of energy efficient units for chemical engineering processes. Solution for the research question is searched by building models for mass transfer processes where either energy usage or/and material recoveries are key points in order to search better solution in view of sustainability. CFD modeling is used to provide basis for experimental runs where new designs produced by additive layer manufacturing and process conditions are tested. As a result the optimal conditions and unit geometry are to be found. As candidate processes are selected crystallization and liquid-liquid dispersions because of their wide usage and increasing importance in chemical industry.

As a result study provides new concepts and guidelines in optimization of existing equipment and design of novel equipment to satisfy requirement of sustainable engineering.

Lahtela Ville

Keywords: *Sustainable value creation, wood, material, modification*

Ville Lahtela's research work focuses on wood modification using environmentally sound substances and methods. The main aim of research is to study the impact of modification substances on various properties of solid wood, e.g. mechanical, weathering, and fire resistance properties, and thereby overall usability. Performing the modification by environmentally nontoxic substances, the modified wood-products are recyclable at the end of life cycle. The wood-products markets are limited and it needs new innovative products. Research into wood modification can remove barriers to new applications for products made from solid wood.

Lahti Jussi

Keywords: *Membrane filtration, black liquor, lignin, hydroxy acid*

Kraft black liquor, side product of the kraft pulping process, is nowadays mainly burned to recover inorganic cooking chemicals and to produce energy. However, ligneous compounds and hydroxy acids, which are present in black liquor, would be valuable raw material for instance for renewable fuels and materials replacing oil based chemicals. In addition, the separation of lignin from black liquor would reduce the load of the recovery boiler and enable increasing of the capacity of a pulp mill.

Applicability of precipitation and ultrafiltration for separation of lignin from kraft black liquor has been studied since the 70's. Nevertheless, commercial applications are still rare and knowledge of how to improve separation efficiency is still needed. This study produces novel information on the separation phenomena, which can be utilized in the fractionation of hydroxy acids and lignin from black liquor. In addition, the effect of process conditions and raw materials on separation phenomena and stability of polymeric membranes under extreme conditions prevailing in black liquor treatment are studied to evaluate feasibility on commercial membranes for this application. The results of this study give valuable contribution for the development of wood-based biorefineries.

Laine Igor

Keywords: *Sustainable Value Creation, International Hub of Russian Relations, international entrepreneurship, international new ventures, internationalization, institutional perspective*

International new ventures being exposed to liabilities of newness, smallness and foreignness find themselves to be disadvantaged comparing to more established local firms. Regardless of this statement, there is a growing population of INVs in various industries all over the world. Traditional IB theories could not provide us with substantial answer to this emergent phenomenon so far, thus giving us opportunity to employ new perspectives while researching this area. To my mind the best approach to describe the existence and behavior of INV is a combination of resource-based, industry and institutional perspectives, while giving a central role to entrepreneur in charge.

Lampinen Matti

Keywords: *Green energy and technology, Process development, Process intensification, Multiphase processes, Hydrometallurgy*

Development of hydrometallurgical processes for sustainable production of metals from primary and secondary sources. Process development with experimental methods, modeling and simulation. Creating information and knowledge for process development requirements.

Laukkanen Minttu

Keywords: *Sustainable value creation, Business model, Sustainability, Value network, Future*

Business model innovations are recognised as a key to the creation of sustainable business. Although the question of how companies can transform their business models to become more sustainable is highly relevant for the society and management, it is poorly understood, and the adoption of the strategies by firms has been slow. The goal of my research is to understand how the transition towards more sustainable business models will be achieved. The objective is to increase understanding about how to build competitiveness in business models through sustainability and to recognise new exceptional sustainability opportunities for firms. The research increases understanding on sustainable business model innovation by examining the favourable conditions and mechanisms through which sustainability could be effectively built in business models. The research will have practical implications for managers aiming to change their business models to be more sustainable by shedding light on the role of the network collaboration on sustainable value creation and capturing, and by developing supportive tools for sustainable business model development.

Layus Pavel

Keywords: *Arctic, Offshore and shipbuilding, Submerged arc welding, Material science*

Nowadays, arctic engineering is on the rise and a lot of offshore platforms and ice-going vessels are being produced. Most of the applications in the arctic area relate to oil and gas industry, and the forecasts show that in the future arctic area might also play an important role for sustainable technology, such as wind farms. Additionally, there are increasing logistics activity in the arctic, and with possible extend of utilization of Northern route the demand for arctic technology cannot be overestimated. Despite the high demand and a large number of the arctic structures produced, numerous challenges in material selection and welding exist. My research focuses on acquiring a better understating on arctic conditions and how they are affecting the requirements for steels and welding processes. From one hand it is important to control the chemical composition of steels as well as its manufacturing process, and from the other hand the proper selection of welding process and its parameters playing a major role in the success of an engineering application. Significant part of my work is a study on high-deposition submerged arc welding modifications for shipbuilding, which was done as a joint work with Russian colleagues from CRISM Prometey (St.Petersburg).

Lipiäinen Niko

Keywords: *Sustainable value creation, Value assessment, Value capture*

My research interest focuses on the dimensions of value creation and value capture. The main goal is help companies to understand how they can assess created value to customers and capture it to themselves. Better understanding of customer needs and what would be valuable for customers, will help reshaping of suppliers' business models and offering. As important from suppliers' point of view is efficient delivery of value propositions, so they can capture maximum share of created value to themselves. By doing right things and increasing productivity, the companies will support an evolvement process of the surrounding society too.

Luostarinen Lauri

Keywords: *Green energy and technology, Mobile working machines, Real-time simulation, Virtual Reality, Human effect on the efficiency of the machine*

Studying the effects of human operators on the efficiency of mobile working machines using real-time simulator and virtual reality. Using real-time simulator and virtual reality the effects of operators on the machine can be assessed effectively and in low-cost. Good understanding of the interactions between the machine and operator enables better optimisation of machines.

Hardware-in-the-loop simulation of hybrid electro-hydraulic power transmission components of mobile working machines. HIL simulation is cost effective method to test suitability of novel power transmission components for different working machines.

Machado De Oliveira Carvalho Mariana

Keywords: *Green energy and technology, Sustainable value creation, Biomass gasification, natural gas, metallurgical industry.*

The metallurgical industry consumes high amounts of energy, including non-renewable sources, such as natural gas. Due to fossil fuels scarcity and increasing concerns regarding sustainability and global warming, at least partial substitution by renewable energy seems inevitable. Regarding natural gas substitution, one of the most promising technologies is biomass gasification followed (or not) by methanation reaction. In this process, charcoal and other suitable biomasses can be thermally converted into product gas, which mainly contains H2, CO, CO2 and CH4. If a fuel with properties similar to natural gas is required, bio-synthetic natural gas (bio-SNG) can be obtained by e.g. catalytic hydrogenation of carbon oxides.

The utilization of product gas and bio-SNG in metallurgical industry is evaluated, focusing on the main environmental and economic benefits as well as possible impacts such renewable fuel could have in the processes. This study aims at answering the following questions: Is it viable to utilize biomass gasification to substitute natural gas in the metallurgical industry? Under what conditions this substitution is possible? What are the technical, economic, environmental and social impacts involved?

Malkamäki Matti

Keywords: *Green energy and technology, Gas turbine, Microturbine, Off-spec performance, Operation simulation, Gas turbine efficiency, Partial load efficiency*

The energy service in the world is changing. New alternatives of energy generation and transfer become more competitive all the time. Decentralization of the energy generation is already essential part of the power generation genre and continues to grow as new technologies make smaller and more efficient units possible.

This research investigates methods to produce electricity with small, less than 1 MW, gas turbines with efficiency found in several hundred megawatt industrial installations. The benefits in high-speed technology combined with advancements in numerical fluid dynamics provide high unit efficiencies with broad operating ranges. In the research a new type of modular simulation model will be developed and tested against the output of the real world results of a two-spool gas turbine in off-spec conditions.

The results of the study will give better understanding of the turbine's off-spec design operation, control needs and possibilities. The results may be implemented also to various operating conditions and plant applications, where the benefits of the new knowledge can immediately be applied.

Mamelkina Maria

Keywords: *Green technology, Electrochemistry, solid-liquid separation, mine waters treatment, anions removal*

Water discharge standards are becoming tighter and stricter resulting in the situation where different water streams in mining operations need to be treated by the most efficient techniques. Mine waters contain a large amount of anionic contaminants (fluoride, phosphate, sulphate, cyanide, nitrate, etc.) that lead to water pollution, cause various problems related to process equipment and stable operation of the processes.

Water treatment methods, such as adsorption, ion-exchange and membrane technologies, have been studied previously for removing excessive anions from aqueous solutions. However, with the rising trend in elemination of secondary pollution and chemicals consumption, more attention has been given to electrochemical methods. Electrochemical methods (electrocoagulation, electro-oxidation, electroreduction, etc.) often require pre-treatment of waters in order to operate in an optimal way. Additionally, some post-treatment operations (sedimentation, flotation, flocculation, filtration) are always required for the separation of components generated during the electrochemical processes.

The research main objective is to determine correlations between the operating variables of electrochemical techniques and the performance of pre- and post-treatment operations. Finally, the technologies that would enable the process waters recycling and hazardous contaminants removal will be evaluated in terms of energy and material efficiencies as well as economics.

Matthews Sami

Keywords: *Green energy and technology, WPC pressing forming cutting*

My research is about finding production parameters that allow dual process Wood Plastic Composite prototype production line to work in an optimal way for mass production in mind. Research has special attention to cutting and forming of WPC material. In addition temperature control, tolerances of tools and assembly review play major role in this research. Research involves experimenting with prototype WPC line and refinement of measured data into generalizable results for similar process lines in industry. In addition to process testing new material formability and cut tests are also conducted.

Research can have effect on amount of construction material ending to landfills because with WPC it is possible to utilize this waste and with correct process parameters this process can be made more economical.

Mattsson Aleksi

Keywords: *Green energy and technology, Low voltage DC distribution, power conversion, energy efficiency*

My research is focused on the optimization of the lifetime cost of the power conversion stages that are used in public low voltage direct current distribution (LVDC). Using DC in low voltage distribution increases the power transmission capacity of the network compared to AC distribution and also provides several interesting possibilities to the controllability, connectivity, and monitoring (i.e. Smart Grid functionalities) of the network due to utilization of power electronic converters. Even at the early stage of development, potential target areas for DC distribution have been identified. However, a wider implementation of the technology is still limited by efficiency of the converters that are required in order to operate the network. The primary focus of my research is to optimize the design of the DC to AC conversion stage in terms of lifetime cost and therefore, further increase the feasibility of the LVDC distribution. Lifetime cost is defined as the running cost of the system and therefore, the design of the conversion stages become an optimization problem that addresses the balance between the investment cost and the cost of the losses.

Metso Lasse

Keywords: *Sustainable value creation, networks, asset management, value creation, life cycle services*

Knowledge management in the field of industrial maintenance.

The beginning of the research is to identify and categorize problems in knowledge management of industrial maintenance. When problems are known it is possible to develop successful industrial maintenance. Various organizational structures as well as different arrangements in industrial maintenance increase the meaning of the management of information processes. Information is missing or it is not up to date. Maintenance Information systems are not properly used. Instructions are not followed. That kind of issues can easily be avoid by focusing to manage knowledge in industrial maintenance.

Mielonen Katriina

Keywords: *Green energy and technology, inkjet printing, multilayering, print quality, packaging technology*

Ink jet printers have been used especially in the Small Office and Home Office market (SOHO), but during recent years entering the production printing market such as packaging, label, transpromo and graphical printing. However, the lack of suitable low cost substrates for inkjet is one of the challenges and reasons why these printers are not yet more widely used. The composition of ink has developed, but there is still need for specialty paper. Improved source efficiency and sustainability are of essential importance to provide a more environmental friendly solution both in terms of recycling, less raw material usage, and reduced logistic.

The paper surface composition has a significant impact on print quality and it has been demonstrated in previous works that surface modification of the paper can significantly reduce the required ink amount and make print more durable and more environmental friendly. However, the current paper surface development is usually limited to the manufacturing technology and unfortunately this is also affecting the fundamental research on ink-substrate interaction. The objective of this research is to develop a new multilayering coating concept in order to investigate different thin coatings and in order to gain more understanding about ink-fiber based substrate interaction.

Montonen Henri

Keywords: *Green energy and technology, Control systems, Modeling, Virtual simulation, Mechatronic control*

My research concentrates on the intelligent control of a mechanical system powered by an electric drive. The mechanical system can be, for example, a hybrid vehicle or an electric crane. Common to these systems is that they consist of mechanical structures, electrical drives, gears, hydraulics, sensors, and embedded systems. The dynamic response of this system consists of the sum of the subsystems. This makes system analysis difficult when using methods of control engineering.

Additionally, these systems contain un-linearity, which is caused, for example, by mechanical clearances and anti-windup –properties of integrating controllers. In addition, environmental disturbances (wind, terrain, load) add challenges for control design. The control algorithm is executed in an embedded environment, which normally has more limited resources than a modern computer. As a result the designed control algorithms need to be light in terms of calculation.

The aim of the research is to model electrically driven mechanical systems and to develop intelligent control for such systems. The control program is executed in the inverter and the program utilizes the rotational speed and torque estimates of the motor calculated by the inverter. This decreases the need for external sensors.

Multaharju Sirpa

Keywords: *Sustainable value creation, Responsibility, Risk Management, Competitive advantage, Logistics*

My research interest is responsibility value creation through sustainability risk management in a logistics context. Sustainability refers not only to stability but also liability, i.e., responsibility. Sustainability risk is quite a new risk area that is set to become one of the most critical risk areas of this century. Sustainability risk management is two dimensional and covers both environmental and social performance. The social aspect here refers to fair and equal labour treatment.

The research has two purposes: Firstly, to investigate through empirical measures exactly what the impact of a company's sustainability risk management capability is on sustained competitive advantage. Secondly, to develop a measurement tool to evaluate sustainability risks of logistics service providers.

Responsibility value creation through risk management in logistics suggests that the processes of value creation are assumed to be not only efficient and effective but also capable of managing risks arising from internal or outsourced logistics practices which possibly are not acting responsible manner. Sustainability risk management capability creates value both for a company itself and customers by mitigating risks that certain undesirable consequences could occur caused by poor environmental practices or unethical and unequal labour treatment, e.g., lack or non compliance of labor standards.

Murashko Kirill

Keywords: *Energy technology, electrochemical energy sources, thermal models, batteries*

This research work is directed on study of the operation and creation of the model for most modern and most popular in our time lithium ion batteries. The main attention is done on study of the lithium ion battery thermal behavior during its operation, creation of the protection systems from a temperature runaway and for development of the suitable ways for the batteries integration in heavy working machines, HEVs, EVs and mobile machines.

Mvola Belinga Eric

Keywords: *Sustainable value creation, adaptive control, higher performance, higher productivity, weld quality*

In order to meet a growing demand for reliable product, with a reasonable production cost, manufacturing schedule need to be reduced by increasing productivity, eliminating rework and flaw. Welding contribute significantly to the manufacturing industry, however any flaw in a weld weaken the infrastructure and result to dramatic incidents.

The aim is to carry out a critical analysis of the various techniques of adaptive control of gas metal arc welding, categorize and identify their advantages and limitations; then suggest an advanced technique that would provide higher productivity, speed and quality. The method is based on literature review and empirical experiments whose data will be analyzed to determine the control-ability of the welding machine power output, shielding gas unit and driven system performance and weld quality of steels.

The expected result establishes a relationship between: welding parameters, real-time adjustment and the significance improvement in productivity, stability and the quality of welds. Moreover, the result offers perspectives on quality control in real time and adjustment of welding parameters. The implications of enhanced adaptive control of GMAW is diversify use in the manufacturing or repair industry and make the welding machine smarter, easy to be carried and provide flawless weld joint.

Mändmaa Sirli

Keywords: *Students, financial literacy, personal finance, financial services*

The globalization has led to new and broader opportunities for both businesses and individuals. The use of these opportunities requires a certain skill, including financial knowledge. Financial literacy helps to orientate in financial services and make deliberate decisions. If people do not have sufficient knowledge for making financial decisions, there can be consequences for the individuals themselves and the economy as a whole.

Several studies through the world have shown that the level of financial literacy needs improvement. According to international journal databases no earlier comparative studies of Finnish and Estonian students' financial literacy exist.

The goal of this research is to analyse the level of financial literacy of students studying in higher education institutions in Estonia and Finland and to propose ways of improving it. This survey investigates students personal financial literacy; the relationship between the literacy and students' characteristics; and impact of the literacy on students' opinions and decisions. The sample size is planned to consist of 2,000 undergraduate, graduate and integrated study students. Data collecting method is questionnaire survey, standardized questionnaires with open and multiple-choice questions. For analysing the responses, the analyse of variance will be used and the differences are further analysed using logistic regression models.

Nakari Olli

Keywords: *Green energy and technology, membrane separation, nanofiltration, ionic liquid, purification of IL*

The aim of my research (or thesis) is separation and purification of ionic liquids (ILs) from different kind of solutions. Ionic liquids are salts solutions, which are usually liquids at room temperature and in wide temperature range. One important property of some ionic liquids is that they can dissolve cellulose or wood. Cellulose can be precipitated from these solutions by a suitable non-solvent. Depending on how cellulose is precipitated the final product can be regenerated fiber for textile industry or film to be used as a barrier in packages. But because ionic liquids are expensive solvents, efficient recycle process for ionic liquids is needed.

The main technology used for separation and purification of ionic liquids in my research is membrane separation. Nanofiltration is potential separation method to remove impurities from solutions. These impurities can be hemicelluloses and lignin compounds. Reverse osmosis is utilized for separation ionic liquids from solvents. The solution not need necessarily to be water solution, so new opportunities is discovered with solvents such as methanol, ethanol or isopropanol in IL solutions. The main interest of this research is on phenomena that effect on separation e. g. osmotic pressure, viscosity of solution, temperature, membrane properties and solution concentration.

Naukkarinen Tomi

Keywords: *Green energy and Technology, Sustainable value creation, International hub of Russian relations, Fluid Dynamics, Multiphase, DEM*

Aim of the study is introduce computational fluid dynamics to filtration technology in this university. CFD can be used in many ways in the filtration technology. In this study main focus is selected to hybrid membranes and liquid fluidized beds. Hybrid membrane are one way to separate heavy metals from drinking water. Controlling of the resin bed in the hybrid membrane is the key factor to achieve working hybrid membrane. CFD is also profitable way to study fluidized beds because the behave of the fluidized beds lays problems to measurements. The approach of the CFD is Euler-Lagrangian. Fluid is modeled in the Euler frame and particles in the Lagrangian frame. In the spirit of the open data open source programs; OPENFOAM® and LIGGGHTS, are selected to use.

Nevalainen Minna

Keywords: *Green energy and technology, Membrane filtration*

Metal and mine industries consume huge quantities of water and chemicals in their processes. Today, the used process waters from mines and concentrating mills end up being waste and the recycling of the water is very limited. By recycling the used process water, the mines and concentrating mills could minimize their detrimental impact to environment and also reduce their production costs. The companies could also recover valuable metals from the waste water streams and increase their profit. Water recycling could be achieved with nanofiltration, because it enables separation of monovalent ions from multivalent ions in acidic conditions. It is even possible that the monovalent ions concentrate to the permeate stream. The aim of the study is to understand the separation phenomena in nanofiltration at acidic conditions. The novel information created in this study enables greener and more cost-effective mining industry operations.

Nevstrueva Daria

Keywords: *Green energy and technology, membrane, cellulose, ionic liquids*

Cellulose is the most abundant Earth polymer and has a long history in membrane preparation. Importance of this polymer can be explained with unique properties specific for cellulose and highly required in membrane preparation. Cellulose is hydrophilic, biodegradable, renewable and low cost material. However a transformation of this polymer into a membrane requires usage of various solvent systems. And almost all existing and widely used ways of cellulose dissolution can be considered as toxic and harmful for the environment. So, all listed above may be regarded as a drawbacks preventing full scale utilization of cellulose in the area of membrane preparation. Therefore, work in the Laboratory of Membrane Technology is focused on creation, characterization and testing of novel cellulose ultrafiltration membranes prepared with a new type of green solvent-ionic liquid. Ionic liquids are the new class of organic solvents, which are non-flammable, recyclable, chemically and thermally stable chemicals. It is already proved, that at least few of them are good solvents for cellulose.

Nikolaeva Marina

Keywords: *Wood-plastic composites, fire resistance, flammability, cone calorimetry, retardants*

Wood-plastic composites (WPC) are a new class of materials that merge the best features of wood and plastic. Good reaction-to-fire properties are necessary for many applications of WPCs. These properties are important especially for applications in the residential construction (mostly for decking, siding, roof tiles and window frames), transportation and furniture industries. For many applications in these fields, the fire performance of the material has to be known and in some cases improved. Enhancement of the flame resistance properties of WPCs in response to safety requirements has become a very important area of study.

Despite the fact that there is significant information in the literature concerning the fire retardancy of wood and plastics separately, the fire performance of wood-plastic composites is poorly studied and understood.

Nikula Simo

Keywords: *Green energy and technology, physics, engine plasticity, bulletphysics*

Target of this work is to find out suitable methods for handling of plasticity in bulletphysics. Handling of plasticity basically means that objects involved may absorb kinetic energy and break. As physics engines have not been traditional area of research for structural engineering, very common impact test was selected to be used as primary scenario.

Nokka Jarkko

Keywords: *Green energy and technology, Electrical Drives, Hardware-in-the-Loop, Hybridization, NRMM*

My research focuses on hybridization of non-road mobile machinery (NRMM). By nature these machines have high dynamics in their drive cycles and these dynamics cause significant losses in terms of fuel efficiency. By transforming the traditional diesel-powered driveline into diesel-electric one the dynamical behaviour of the machine is compensated by the electrical drive and the energy storage and the diesel acts merely as a part of a genset. This way the system operates constantly at higher efficiency and the diesel engine can me dimensioned mo match the average power requirement instead of the maximum.

Nuutinen Pasi

Keywords: *Green energy and technology, LVDC distribution, customer-end inverter, smart grid*

By replacing suitable medium-voltage (MV) AC branch lines and 400-V low-voltage AC lines in some parts of the network, the low-voltage DC (LVDC) network provides a cost-effective way to develop distribution networks. At every electricity end-user connected to the LVDC network, the AC supply is provided by a customer-end inverter (CEI). Further, application of power electronics to the LVDC enables constant customer-end voltage quality control, and smart grid functions, such as communications, customer-end load control, and intelligent network management.

The main scope of the study is to set design and operation requirements for customer-end inverter and analyse inverter structures suitable to for this application. When the CEI alone is supplying the end-user, it is responsible for voltage quality, protection, and other functionalities in customer-end network. The study discusses functionalities that are required for proper and reliable power supply. Also, the rectifier structures, operation, and required functionalities are covered. Because of the power electronic converters responsible of DC network and customer-end supply, common-mode and radio frequency electromagnetic interferences are covered.

As a result, analysis of the power electronics in LVDC distribution is carried out. The theoretical analysis is backed up with results gathered from a practical research setup, implemented in an actual distribution network.

Oinonen Minna

Keywords: *Sustainable value creation, co-development, customer involvement, customer participation, value co-creation*

The doctoral research focuses on customer involvement in the co-development of products, services and solutions in business-to-business markets. It is widely acknowledged that companies should involve customers in their new product and service development processes to better answer customer needs but at the same time it is argued that such involvement destroys companies' possibilities to develop radical innovations and reach commercial success. The doctoral research increases understanding on successful customer involvement and management practices for supplier-customer co-development. The findings provide a framework of supplier-customer co-development process which integrates both supplier's and customer's perspectives for the process. The study reveals customer roles and factors that affect customer involvement in co-development. Furthermore, the research provides strategies for understanding customer needs and developing more customer-oriented solutions taking into account the fact that intensive co-development is not always beneficial. For companies, the research provides best practices for acquiring information on customer needs and managing co-development processes.

Oleksiienko Olga

Keywords: *Green Energy and Technology, sol-gel synthesis, adsorption, material characterization, water treatment*

Titanosilicates are known as the most promising inorganic adsorbents for the water purification from long–lived radionuclides, such as caesium, strontium, uranium and transuranic elements. It can be explained due to their high selectivity and stability over a wide range of pH, and high immutability at temperature variations and resistance to ionizing radiation. Recently, we synthesized titanosilicates by sol-gel method, which allows controlling the pore structure, crystallinity, form of material and its final price.

The aim of my study is to investigate the influence of different parameters on physico-chemical properties of titanosilicates obtained by sol-gel method, in order to find the optimal synthesis conditions. Effectiveness of titanosilicates as sorbents will be compared with powder analogues, which are already known, but cannot be widely applied due to powder form of material. The another goal of this work is to study the effectiveness of synthesized material in aqueous modelling solutions under different temperatures and with real radionuclide polluted water. Finally, in order to understand the mechanism of uptake process and medium influence on selectivity, the physico-chemical properties of materials after so.

Oleynikov Anton

Keywords*: Electric Motors and Drives, Electromagnetics, FEM, 6-phase electrical machine, Green energy and Technology, Sustainable value creation, International hub of Russian relations*

The research will consider modelling, analysing and optimizing a 6-phase electrical machine of non-standard design with 3 D magnetic flux path using numerical methods and techniques. Such components as coils, permanent magnets, power source controller will be studied and optimized by material properties, dimensions and work regimes.

One of the most important aspects is to figure out and evaluate the advantages and limitations of flat coil windings comparing to standard windings, to study the influence of chosen materials on the resulting efficiency of an electrical machine. The most spread type of stranded coils is the one wrapped with ordinary wires, it is well-known and easy to configure, but using of flat wires can be more reliable and efficient for powerful electrical machines.

Every electrical machine has particular limitation of rotational speed due to efficiency of electrical components and mechanical factors. The complex research of magnet saturation, magnetic flux direction change and building power, momentum and efficiency curves taking into account the whole information obtained from independent component analysis in different configurations will give final results for improvement of the studied prototype.

Ovaska Sami-Seppo

Keywords: *Green energy and technology, papermaking, coating, barriers, food packages*

Together with changed consumer habits, global packaging market is growing continuously. The demand for sustainable packaging materials, partly driven by legislation, to reduce waste has increased the efforts to replace plastics in food packages with biodegradable alternatives, such as paperboard. Proper packaging material also retards the spoiling of foodstuff, which, in turn, decreases the loss of food.

In case of bakery goods, fast food and convenience meals, one of the most important barrier properties of packaging materials is good grease resistance. Conventionally, grease resistance can be obtained by coating the paperboard with plastic which provides a physical barrier against oils and greases. Another possibility is inhibiting the wetting of fibers by applying fluorocompounds. Neither of these alternatives is trouble-free, since the use of oil-based plastics should be reduced and the bioaccumulation of fluorocompounds is a potential health risk.

The purpose of the research work is to develop safe, bio-based barrier coatings for paperboard and characterize their absorption and wetting behavior with such real-life test liquids as vegetable oils in various conditions that correspond to reality. Particularly the effects of temperature must be studied carefully because the packaging material is exposed to heat several times in converting processes and end-user applications.

Panova Iuliia

Keywords: *Sustainable Value Creation, Container Traffic, Russian Railways, Dry Ports, Public-Private Partnerships*

The main research question of the study concerns the justification of the participation of JSC 'Russian Railways' (JSC RZD) in the formation of the dry ports. In order to pursue this goal, the analysis of the role of railways within Eurasian market has been provided, showing that the economic growth of China's north-western "landlocked" provinces potentially can benefit from forwarding cargo via main Russian backbone, Trans-Siberian Railway. Additionally, European companies may partly redirect the flow to land routes from the sea transport, which will be disrupted by the Sulphur Directive since 2015. Therefore, the participation of Russia in the formation of overland international supply chains requires exporting of the high quality transport services and minimized logistics costs. For that to happen (e.g. maintain the required service level over the long distances), the construction of terminal and warehousing infrastructure along the transport corridors, especially on the approaches to the seaport, is backed by the concept of dry ports. The financial burden of the dry ports' infrastructure development within the system of the large multinational company, like Integrated Transport Logistic Company, can be mitigated through the public-private partnerships of forwarding firms, railway, and seaport operators in the Russian Federation, Europe, and Asia.

Patala Samuli

Keywords: *Decision-making logic, sustainability, value propositions, inter-organizational networks*

My research focuses on organizational decision-making logics for investments in green technologies. Decision-making in organizations can be viewed as being governed by logic of consequences, based on rational utility calculation or logic of appropriateness, based on actors' appropriate behavior and norms. These logics are studied in three separate studies. The first study focuses on interactions between supplier and customers to form value propositions for sustainable technologies. The second study focuses on the role of inter-organizational networks for increasing environmental sustainability. The third study focuses on organizational-level decision-making for sustainable investments. The topics are studied through a combination of qualitative case studies, quantitative life cycle assessment, and analyses of investment decision processes.

The preliminary findings include a process framework for developing value propositions for sustainable technologies and a typology of the inter-organizational network forms that can advance sustainability. The implications of this research are important for academics and managers alike. The understanding of decision-making logics is a fundamental but under-researched topic in organizational research. Suppliers of green technologies gain increased understanding of the buying behavior of their customers firms and how they can communicate the value of their offerings. Policy-makers gain new understanding on facilitating cooperation between firms for advancing sustainability.

Peltola Petteri

Keywords: *Green energy and technology, carbon capture and storage, high-temperature solid looping processes, fluidized bed technology, energy conversion processes*

Analysis and modelling of energy conversion processes, focusing especially on sustainable systems with near-zero emissions. Developing multiphysical models to investigate novel CCS (carbon capture and storage) technologies for carbon dioxide-free energy production on industrial scale. Utilizing comprehensive modelling and simulation tools for a better understanding of the processes involved, and using this knowledge for the design, optimization, and scale-up of reliable, economical, and environmentally sound energy systems.

Peltonen Hanna

Keywords: *International hub of Russian relations, Russia, entrepreneurship, SMEs, business environment*

The role of Russia in the global economy has varied extensively during the past decade or so. The aim of my research is to study the linking role of institutions, business environment and behavior and performance of Russian enterprises which they are lacking. This tries to find the role of the general business environment and how it actually plays in the performance of the Russian enterprise sector. A keyword is also company's size - testing for the effect of the business environment on performance between small, medium and large Russian firms, and compare the results to the more traditional perspective of the largest perceived business obstacles.

Pham Thuy

Keywords: *Ultrasound, electrokinetics, soil remediation, persistent organic pollutants*

The research investigated the coupling effect of the combination of the two techniques, electrokinetics and ultrasonication, in persistent organic pollutant removal from contaminated low permeability clayey soil (with kaolin as a model medium). Experiments were conducted in various conditions (moisture, frequency, power, duration time, initial concentration) to examine the effects of these parameters on the treatment process. Experimental results showed that ultrasonication has a potential to remove POPs, although the removal efficiencies were not high with short duration time. Experiments were conducted to compare the performances among electrokinetic process alone and electrokinetic processes combined with surfactant addition and mainly with ultrasonication, in designed cylinders (with filtercloth separating central part and electrolyte parts) and in open pans. Combined electrokinetic and ultrasonic treatment did prove positive coupling effect compared to each single process alone, though the level of enhancement is not very significant. The assistance of ultrasound in electrokinetic remediation can help reduce POPs from clayey soil by improving the mobility of hydrophobic organic compounds and degrading these contaminants through pyrolysis and oxidation. Ultrasonication also sustains higher current and increases electroosmotic flow.

PokhrelChhabin

Keywords: *Sustainable value creation, disruptive innovations, R&D strategies, process industries*

The aim of the research work is to develop R&D strategies for disruptive innovations in process industries. The strategies developed as result of this work would help to plan future R&D work for development of new product or process with intention of disruption in process industry field.

Popovic Tamara

Keywords: *Social sustainability, quantitative indicators, wastewater treatment, process industry, indicator interdependence.*

The growing role of sustainability is more and more visible in planning, design and operation of technical and social systems. The environmental and resources related issues are studied very intensively. However, the third element, social sustainability, is analyzed relatively rare and in qualitative manner. It is mainly due to the difficulties related to the quantification of various aspects of social sustainability. This research is addressing social sustainability in process industries. One of the important problems of process industries is water management and especially wastewater treatment. Therefore, the social sustainability issues related to the emerging needs for appropriate wastewater management motivate this research. The major research issueis formulated as development of the quantitative measures of social sustainability able to capture its various aspects and visualize the network of their interdependences.

The developed measures should enable the relative assessment of the social sustainability of various wastewater treatment processes. The analysis of the network of social sustainability indicators will facilitate the identification of the nature and type of their relations. It will result in determination of system centrality and mechanism of information flow in the decision making processes addressing social sustainability.

Proskurina Svetlana

Keywords: *International trade of biomass, bioenergy products.*

In the next decades the biomass and bioenergy market are expected will sustainably grow due to increasing prices of fossil fuels, concerns regarding the security of supply, the aim to diversify fuel supplies, high costs of carbon emissions and subsequent strong political willingness to support bioenergy and other renewable energy sources. Research focuses the international trade of biomass and bioenergy products, which will continue to have a significant impact on the bioenergy development in the world. I am interested in a wood pellets and other biofuels, which are made through gasification, torrefaction and pyrolysis, its markets and applications.

Pulkkinen Aki

Keywords: *Green energy and technology, Surface science, DFT*

Processes on solid surfaces play an important role in technological applications. Adsorption on surfaces is a critical step in several processes, including heterogeneous catalysis and semiconductor device fabrication.

In terms of fundamental surface science, it is essential to understand the interactions of adsorbates with surfaces. This can be achieved theoretically using computational methods, and experimentally by electron diffraction methods. These methods together provide a powerful tool to explain processes at surfaces on an atomic level.

We study surface systems using ab initio computational methods based on the Kohn-Sham formulation of the density functional theory (DFT) within the generalized gradient approximation and the projector augmented wave method, as implemented in the Vienna Ab-initio Simulation Package (VASP).

Our group combines DFT calculations with low-energy electron diffraction (LEED) simulations and measurements, allowing us to compare the theoretical DFT results to experimental LEED data.

Puranen Johanna

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations, Evaporation crystallization, Pharmaceuticals, Polymorph screening*

Evaporation crystallization is a widely used method especially in the pharmaceutical industry. The evaporation crystallization process is very sensitive and careful control of process conditions is required to obtain the desired crystal product.

My study is focusing on the evaporation kinetics of the solvents and the influence of the evaporation rate of the solvent on the crystal formation and crystal structure (polymorph screening) of a pharmaceutical model compound. For example Raman spectroscopy, X-ray Powder diffraction and optical microscopy are used for the crystal analysis.

Ranaei Samira

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations*

The dissertation considers the impact of technology forecasting in innovation process within the context of emerging technologies. The idea is seeking for methods for exploiting information about emerging technologies to inform the technology managers. The main issue for investors in industries is the uncertainty exist in the future, and technology prediction methods are assumed to decrease the uncertainty level by collection and analysis of information. As businesses are making decisions under tremendous competitive pressures, they seek better information. The main hypothesis would be based on using different technology prediction techniques in industry level to assess the significant value that could be created. Moreover, the research includes discerning technological trends in the realm of renewable energy sector using patent databases, R&D literature, scientific publications and expert review. The expected results can assist either industry managers or scientists in their decision making process.

Rantalankila Mikko

Keywords: *Green energy and technology, ultraviolet, LED, water treatment*

“Pure water is a human right", was stated UN's general assembly few years back. Every human should have access to pure water and decent sanitation. Novel water treatment technologies are in a key position for achieving these goals even in developing nations. In developed world people are spending increasing times indoors and are exposed to number of chemicals and microorganisms.

Ultraviolet light is a well-known and effective disinfection method and it can also be utilized in photocatalytic treatment. Traditional technique to produce UV light using mercury lamp has its issues in energy efficiency and environment friendliness. New UV LED components are a promising alternative to traditional products due to their good properties. My interest is within proving the suitability of LED components in treatment processes and finding out the potential commerciality of such products that utilize LED components.

Ratava Juho

Keywords: *Sustainable value creation, adaptive control, expert systems, fuzzy systems, machining*

Increasing the efficiency of machining, especially turning, by applying A.I. and expert systems technology into adaptive turning control. The objective is an intelligent machining system capable of emulating the behaviour of a human machinist. Instead of maintaining constant cutting conditions or logging raw physical data (e.g. cutting force magnitude), such a machining system is able to optimize cutting parameters on the fly, giving human-understandable information of the cutting process or training a less experienced human machinist. This will potentially make manufacturing less dependent on (cheap) human labour and instead make manufacturing preferable in countries with cheap energy closer to markets (e.g. Finland).

Richter Chris

Keywords: *Green energy and technology, Sustainable value creation, Shareconomy, Smart Cities, Crowdcreation, Crowdfunding*

My dissertation will be named „Digital entrepreneur“ and it takes a closer look on Shareconomy and Smart Cities. Both aspects are observed with a straight focus an SME, entrepreneurship and innovation.

Shareconomies (e.g. flats, cars, music or knowledge) change the world of consume dramatically, the former point of view of just owing goods is replaced by the trend to share goods. This is based on the “war of spaces” and “war of resources”, but leads to a different, more sustainable use of goods, and even a social change through cooperation, exchange or community work.

Smart cities is a aspect of the mega trend big data. “Internet of things” is another term of combining devices in a smart way to save resources, energy, costs and lead to a better, more liveable city or community.

My work focuses on business opportunities for SME and analyzes strengths, weaknesses, chances and risks. My work is based on the classic methods of science: starting with several articles with detailed literature reviews, followed by articles coined by qualitative analyzes with entrepreneurs and finished up with articles based on quantitative empirical work.

Rimppi Heli

Keywords: *Green energy and technology, Sustainable value creation, System analysis, LCA, Environmental management*

Product life cycles and companies as operators of the life cycle unit processes interact with different levels of the operational environment through material and immaterial flows, impact networks, expectations and requirements. Sustainable development of product systems requires awareness and management of the interactions, where companies have a key role. Efficiency measures which lead to profits in the short term are easily justifiable. However, the ability to indicate added value which application of sustainability measures in a production process creates for different stakeholders is important to ensure long-term viability of business. The aim is to study company approaches to sustainability in different activity levels (passive, reactive, active and proactive) with regard to awareness, strategies and actions related to the interactions in the product system. The research increases understanding of the multi-dimensional nature of sustainability, contributes to sustainability management practices and provides companies approaches to identifying new opportunities to develop product life cycles towards a better state of sustainability.

Rinkinen Satu

Keywords: *Sustainable value creation, innovation policy, innovation system*

Regional innovation policy aims at strengthening regional innovation systems and their competitiveness both nationally and internationally. Regions are increasingly encouraged to specialise to selected fields of expertise but at the same time the birth and evolution of new fields of expertise should be enabled. The gradual change from cluster-based innovation activities towards more innovation ecosystem-based activities sets new challenges also to innovation policies and their implementation. The aim of the dissertation research is to examine at which extent do the regional innovation policy objectives meet the national objectives, how regional development objectives and regional specialisation are made visible at strategy level, and do the different policy levels (regional, national, supranational) communicate with each other. The aim is to examine the policy discussion of different strategy levels utilising e.g. regional strategy documents, national innovation policy programme documents, interviews, case studies and previous research literature. The used research methods are mainly qualitative. The research results provide new knowledge about the development, present state and possible future developments of regional innovation policies. The results can be utilised e.g. when planning innovation policies and developing regional innovation systems.

Rissanen Tommi

Keywords: *Sustainable value creation, business model innovation, lean startups, business model experimentation, internal startups*

Primary research interest is to understand how business model experimentation can be used as a method of business model innovation in different industries and in companies of different sizes. I also study the practices large companies can learn from startups in using experimentation as a tool for business model innovation, how the size of the company affects the usability of experimentation in business model innovation and the differences that can be found in using experimentation as a tool for business model innovation between static and dynamic industries.

Romanenko Aleksei

Keywords: *motor, bearing, fault, diagnostics*

Inverter-induced high-frequency bearing currents are a common root cause of bearing failures in frequency converter-fed motors and generators. Bearing faults are typically identified by vibration measurements. In our work, we experimentally submit bearings to electric discharge machining (EDM) bearing currents, use different means to measure the electrical stress placed on the bearings, measure the resulting vibration signal, and apply signal processing for feature extraction. The final goal of the research is to develop a method of diagnosing bearing failure early on so it can be replaced before causing damage to the machine.

Rotich Nicolus

Keywords: *Green Energy and Technology, mechanical separation, minerals processing, computational engineering, systems modelling*

Particle classification has continuously played a critical role in modern-day industrial processes. In fact, granular materials and powders account for over 50% of the raw materials used in the chemical industry alone. Common as it is, powders have been a complex material for several decades that some enthusiasts have referred to it as a fourth state of matter between solid and gaseous states. Particulate classification aims at distinguishing and/or separating a set of particles that are unique by virtue of some pre-determined criterion. Construction industries, foods, mining, pharmaceutical, power generation (e.g. coal and biomass-based plants), waste management and many other industries dealing with particulate matter, more often than not, require classification and sorting of the particles in terms of size, specific gravity, grain loading, shape, chemical composition, bulk density, resistivity, friability, wettability, cohesiveness, resilience, etc. prior to utilization in downstream unit operations or in final use. Like most industrial processes, particle classification is currently hindered by a number of challenges ranging from environmental problems, to intensive energy requirements needed to drive 'phase' separation. Many unit operations are currently high contributors of carbon, atmospheric dust and other fugitive emissions that are detrimental to both human health and the environment. Minimal energy vibration, and gravity classification is considered in this study.

Salampasis Dimitrios

Keywords: *Sustainable value creation, open innovation, trust, HRM, financial services*

This PhD research by employing a qualitative and multidisciplinary research approach in terms of talking across discipline lines and different backgrounds, explores the multifaceted people's side, crystallized within the locus of a trust-embedded approach of open innovation in the financial industry; a sector which is surprisingly neglected by innovation studies despite its importance for the worldwide economy. It develops a concise, concrete, dynamic and comprehensive conceptual model which (a) investigates the trust embedded aspect of open innovation, (b) re-defines the framework of the human dimension of open innovation (c) empowers the integrative role of human resource management and (d) creates the prerequisites and the mindset to observe the emerging shift towards the building of human enterprises in the financial industry through the adoption of open innovation practices. The research outcomes address cutting-edge topical issues of the role of intraorganizational trust, encapsulated within a dynamic interplay between organizational and individual level, in relation to open innovation adoption and how human resource management practices amplify dedicated skills, competences, values and incentives, cultivating a collective open innovation organizational environment.

Sandman Johanna

Keywords: *Sustainable value creation, innovation, KIBS, intellectual capital, IPR, technological development*

The aim of the research is to find factors that contribute to the efficient utilization of knowledge. The potential to apply the outcome of the research relate to advancing the activities of innovative networks and related actors, to the development of business and operational models, and to the process of making innovative solutions available in the market. The research considers the role of knowledge intensive business services in the development of welfare and innovational activity.

The research aims to answer the following questions:

1. What is the role of KIBS and how is the role changing?

2. Which factors are important for the future development of technologies and innovational activities?

3. What kind of role entrepreneurship and business networks play in the operations of knowledge intensive business services sector, in the innovational activity, and in the process of bringing new solutions to the market?

4. Which issues act as efficiency promoting factors from the knowledge usage point of view?

The research contemplates technological trends and topics that can be considered meaningful from the perspective of innovational activity in general, including intellectual capital, IPR, networking, business opportunities, economics, automation, globalization, and value chains.

Saukkonen Esa

Keywords: *Green energy and technology, forest biorefining, hemicellulose extraction, paper, pulp*

The global trends to move from fossil to bio-based products, and general attitudes to sustainability by brand owners and customers has impelled companies in the pulp and paper industry to seek added-value creation potential from forest biorefining operations. Such operations could enable new sustainable bio-based materials to be introduced into markets. Consequently, it has been proposed to integrate a large number of potential forest biorefinery processes with existing unit processes in pulp and paper mills. For example, the hemicellulose removal concept plays an important role in the integrated forest biorefinery scenario, where the target is the co-production of hemicellulose-extracted pulp and hemicellulose-based chemicals or fuels.

The objective of this work is to study the effects of partial recovery of wood hemicelluloses on kraft pulp properties. The work consists of hemicellulose extraction (1) by a softwood chip pretreatment process prior to kraft pulping, (2) by alkaline extraction from bleached birch kraft pulp, and (3) by enzymatic treatment, xylanase treatment in particular, of bleached birch kraft pulp. This research provides new insights on the opportunities to utilize hemicellulose-extracted fibers for modern papermaking purposes and sheds light on the possibilities to create more valuable and innovative end products from these specialty fibers.

Savolainen Jyrki

Keywords: *Sustainable value creation, Real Options, Investment analysis, Mining*

This project studies investment analysis methods usable in the ex-ante evaluation of mining investments, especially in Finland. Mining investments are large industrial investments with long lifetimes that are made under uncertainty and vague information about the future. This research creates new insights into Finnish mining investments and studies and enhances the applicable methods used in profitability evaluation of mining investments in general. The project is cross disciplinary between corporate finance and mathematics.

The objective of this research is to study how the profitability analysis of mining projects is presently modeled and how the presently existing models could be enhanced. Research into selected Finnish mining projects from between the years 2000 and 2013 is done. The Treatment of uncertainty and the use of real options within the framework of mining projects is in the core of this research.

This project contributes to mining companies considering alternative operating policies of the operational mines; exploration firms or mining companies considering a development of a given mineral resources; financial analysts concerned with the valuations of the above mentioned corporations and policy makers, who are concerned with the social costs cyclical industries.

Semken Scott

Keywords: *Green energy and technology, sustainable value creation, liquid-cooled, low-speed, electrical machine, wind turbine*

We have been applying a holistic approach to wind turbine generator design that considers wind energy markets and the economics of wind power, system reliability, electromagnetic behaviors and design, thermal design and performance, mechanical architecture and behaviors, and performance modeling. The approach has led to the development of a liquid-cooled, direct-drive, permanent-magnet, synchronous generator with helical, double-layer, non-overlapping, windings formed from a copper conductor with a coaxial internal coolant conduit. The generator is only half the size of existing direct-drive wind turbine generator architectures and promises to be both reliable and cost effective. The smaller size and mass results in lower build, transportation, and installation costs.

To complement the unique new generator architecture, a concept is being developed for a novel lightweight wheel structure intended for rotor and stator use in large low-speed wind turbine generators. It uses a slanted spoke and rim architecture to provide maximum static structural performance with minimum weight. A unique attribute of the structure is its use of layered sheet steel elements to form the spokes and rim. Friction between layers establishes structural integrity. The interaction between layers and the resulting increase in damping normal to the stack offers improved dynamic performance.

Seppänen Kaisa

Keywords: *Sustainable value creation, Service process management, Customer management, Customer input management*

The doctoral research focuses on customer-service process interfaces and service process design in healthcare context. In the center of the research are customer inputs in service processes. It has been noticed in the field of service research that customers and the inputs their produce have a significant meaning in service processes and there is a growing academic interest towards the customer's role in services. Both the service literature and practice stress the need for managing services and service customers, but there is still lack of deeper knowledge about the characteristics of customer input management. This research offers new openings about the characteristics of customer inputs and their management.

It lays a foundation for exploring and developing methods for the management of customer inputs, which can be utilized by service managers when aiming at services with better productivity and quality. These contributions are especially relevant in the public and healthcare sector, where a constant lack of resources demands the development of new solutions, e.g., for the optimal utilization of customer inputs.

Seppänen Päivimaria

Keywords: *Arts in social and health services, institutionalization, intergration, multiprofessionality, empowerment, knowing*

The aim of my dissertation is institutionalizing arts in social and health care services. The research focus is to study what kind of multiprofessional combinations there are where art is included in social and health care occupations and how it could be noticed and deployed. There can be employees with two or more professions; they have changed careers because of different reasons and have many skills and knowledge obtained and learned in schools, at work and in life. In this study, they are called as multiprofessional employees: they have wider readiness and more versatile know-how than those employees with one profession.

It is important to notice multiprofessionality because there is a need for new kind of aspects to strengthen client orientation at social and health care. Also there is a need for practice-based innovations. Arts can be a rehabilitative method and it can rise up unknown knowing among employees and personel. Art can be used in buildings, the space can be made interactive by using arts. Art is empowering, it increases wellbeing and awakens people to see and notice things differently.

Sermyagina Ekaterina

Keywords: *Renewable energy, Bioenergy, Biomass treatment technologies, torrefaction, hydrothermal carbonization, gasification, modelling*

Various techniques that help to improve biomass properties for energy utilization. Such processes, as hydrothermal carbonization, torrefaction, and gasification allow converting biomass fuels into more valuable product in terms of further energy conversion. The influence of biomass characteristics on these processes efficiency is the other aspect of big interest

Shakhanova Marina

Keywords: *Green energy and technology, Solid-liquid separation, Filter Cloth, Permeability, Pore size distribution.*

Cloth filter media are fundamental for all filtration processes, which are applied in a wide range of industries. Cloth manufacturers typically provide only the air permeability values for their cloths but this parameter might not be suitable for describing the separation performance of the cloths in real solid/liquid separation processes where the fluid is not air. Filter media characteristics such as the liquid permeability and the pore size distribution remain poorly defined, although these features directly determine the cloth performance. Furthermore, theories describing cake formation and the resistance of the filter medium have been developed but have not really been connected with theories for permeability. The aim of this work is to investigate different filter medium characteristics and determine their effect on separation performance in solid/liquid separation. Increased knowledge could be used to improve the filtration properties of the cloths and to make the filtration process in terms of capacity and the quality of the final product. Pore size distribution, air and liquid permeability were investigated and dependencies between these parameters have been analyzed. The analysis of results showed that an accurate description of the cloth filter media performance cannot be limited to the use of only one parameter.

Shemyakin Vladimir

Keywords: *techno-mathematics, differential evolution, stochastic optimization, chaotic systems*

My research interest is focused on the estimation of parameters of chaotic and stochastic systems. There are specific models, for example numerical weather prediction systems, where such research is of particular importance due to their value to the society. Although several approaches to handle such systems are already exist and utilized, I try alternative methods in order to improve replace the current ones or make them work more efficiently. As a particular example of my present work I can give the Differential Evolution approach which is currently being tested and modified to work within stochastic and chaotic problems framework. My future research direction lies in the field of development of complex methods for estimation of highly computational cost systems by integration of different approaches.

Siitonen Jani

Keywords: *Green energy and technology, Preparative chromatography, Membrane filtration, Process design, Process integration*

Separation unit operations are typically the most energy consuming steps in the chemical industry. The challenges regarding depletion of natural resources and climate change emphasize the need for developing more energy-efficient and environment-friendly separation processes. The most promising approaches to intensify conventional separation processes are integration of two or more separation units into hybrid schemes and recycling of energy and material streams. My research is focused on hybrid separation concepts that are based on preparative recycling chromatography and membrane filtration. The main objective is to improve process performance in terms of economy, productivity, yield, purity of the product, and/or chemical consumption. The key tasks are to develop theoretical tools, shortcut methods, and heuristic rules for early stage evaluation and preliminary optimization of different process alternatives and to analyse robustness of the proposed concepts. Both theoretical methods and numerical simulation tools are employed. The developed methods can be applied for a wide variety of industrial scale separation problems, for example, in the pharmaceutical, fine chemical, and food industries.

Sikanen Eerik

Keywords: *rotordynamics*

The main objective in doctoral research is to develop a computationally fast rotordynamics simulation tool using 3D solid elements. Simulation tool needs to be able to support multiple bearings models including active magnetic bearings (AMBs). An automatic meshing algorithm that reduces effectively unneeded degrees of freedom is needed. Nowadays, commercial solutions provide only beam element or axisymmetric modelling method without any support for AMBs. The need for 3D rotordynamics simulation tool arises when the rotor under investigation includes non-circular shapes or the rotor consist of multiple parts that need to be describes using different kind of contact models such as shrink fit contacts. By means of implementing a new computational method calculation times can be shortened significantly.

Sillanpää Teemu

Keywords: *Green energy and technology, active magnetic bearings, sensorless, self-sensing*

Research of the position sensing feedback loop in AMB applications to achieve novel and lower cost methods for sensing the rotor position with and without using dedicated position sensors, through real time identification and intelligent signal processing of the measurement data.

Active magnetic bearing is a complicated mechatronic system where rotor is levitated with electromagnets. Contactless rotor operation enables high rotational speeds. This is useful in many high-speed applications where traditional bearings cannot be used due the lack of the mechanical strength. Because magnetic bearings are naturally unstable system, electromagnets need to be controlled actively.

Several position measurement sensors are needed to determine the rotor position. Knowledge of the rotor position is fed to the controller where control signal is calculated for the electromagnets to keep the rotor in the reference position. Controller requires several inputs and outputs to control this kind of system. The commercial position sensors used in the position feedback loop are expensive and increase the cost of the whole AMB-system, decreasing the adoption of the technology in the industry.

Sinkkonen Tiina

Keywords: *Sustainable value creation, Life-cycle, Network, Maintenance, Value*

Industrial maintenance outsourcings have changed the basis of maintenance decision making in many companies. When multiple different organizations (e.g. a customer, a service provider and an equipment provider) must collaborate to ensure the availability of production equipment, the decisions cannot be based on the tacit knowledge of individual maintenance experts, as has often been the case in in-house maintenance. Instead, a new kind of transparency is required from the companies operating in maintenance networks, not to mention cost-awareness, which is an essential part of service pricing, contract formulation and maintenance performance measurement. The main focus of my doctoral thesis is to create life-cycle model that helps in planning maintenance operations. This general item level life-cycle model takes into account the point of view of all maintenance network members, it makes planning the future scenarios of maintenance operations together possible, and it provides a practical tool for daily use to reach cost and time savings in the whole network.

Sipilä Jenni

Keywords: *sustainable value creation, consumer behavior, emotion, ambivalence*

Most of us face daily decisions involving a conflict between our short-term and long-term goals: whether to have dessert after lunch, whether to exercise today, or whether to stay at home studying or to go out. It is increasingly understood that emotions are a central driver of our behavior and decision-making. Hence, my research deals with goal-related choices from the perspective of emotional ambivalence, defined as the experience of multiple emotional states either simultaneously or sequentially. My research takes a longitudinal approach to the maintenance of goal-directed behaviors, by tracking these small choices and the related emotional ambivalence over a period of time. The societal implications of my research span to any commercial or public institutions dealing with goal-directed services, including health clubs and public health care. I have additionally been working on the role of emotions in organizational online buying decisions using facial expression and eye tracking methods. This research has implications for B2B organizations, whose sales have potential to increase as the result of a stronger focus on emotions. I believe in the power of emotions in all areas of human behavior and decision-making, and based on current trends, I anticipate emotions to have an increasingly greater role in research and management.

Skriko Tuomas

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations, Welding quality, Fatigue strength of welded structures*

It is widely known that welding can decrease the fatigue strength of welded joints more or less in a similar way, independent of the steel grade, if normal workshop quality is applied during production. However, better fatigue properties of welded joints can be reached either by using optimal welding parameters or by using weld post-processes. Post-treatments can improve the fatigue strength of welded joints significantly, especially in the case of high-strength steel. However, the effectiveness of the process depends on the amount of treatment needed to improve the structure and also on the type of load (R-value) to which the structure is subjected. In all cases, post-treatment increases manufacturing costs in terms of investigation, extra work, and longer lead time in production. If the same fatigue strength can be obtained by proper welding parameters, these additional costs can be avoided. The use of high- and ultra-high-strength steel is expected to increase significantly in the near future and there is, therefore, a considerable need to improve the welding process in order to obtain benefit from the high strength of the base material. This presumes profound understanding of the material parameters and the welding techniques both theoretically and practically.

Sokolov Alexander

Keywords: *Green energy and technology, advanced oxidation processes, pulsed corona discharge, lignin, pharmaceuticals*

My research is concentrated on Pulsed Corona Discharge (PCD) technology and its implementation for water treatment and modification of various products. The method has hydroxyl-radical and ozone as the main oxidants species effective in oxidation of organic molecules. Lignin modification for its utilization in valuable products by oxidation at maximum cost efficiency, and study of PCD in pharmaceutical compounds abatement in water bodies are the main lines of research at that moment. PCD proved itself as competitive water treatment method surpassing the closest competitor such as ozonation. Such antibiotics as amoxicillin, doxycycline, sulfametizol as well as meglumine acridonacetate are easily oxidized by PCD with relatively small energy consumption.

Lignin is one of the most abundant natural polymers and it is a potential raw material for various products including phenolic substances and aromatic aldehydes (vanillin, syringaldehyde, vanilic acid, syringic acid). My study considers the hypothesis that modification of lignin with PCD oxidation at ambient conditions may appear feasible and beneficial method of lignin modification by its economic performance and environmental safety. The positive tendency in aldehydes formation was observed during PCD treatment.

The degradation of others compounds, such as phenol, humic acids, ibuprofen, paracetamol, β-estradiol were also studied.

Spodniak Petr

Keywords: *Green energy and technology, Nordic electricity market, power exchange, electricity pricing, financial markets*

Network industries, of which electricity markets are a fundamental part, are currently undergoing structural reforms due to regulatory, technological, social and economic changes. In order to achieve the goals of sustainable, secure, reliable, and efficient electricity markets, we need to understand the interaction between the physical and immaterial worlds. The focus of my dissertation is to identify and understand the factors that facilitate and impede the sustainable transition of the European electricity markets. The socio-technical shifts are studied on a concrete examples and actors, such as adoption of smart grid technologies (smart meters), renewable energy diffusion (wind power), and financial and physical market design issues. The work embraces theories from innovation, organization, financial, and economics sciences and empirically applies them to relevant problems. The work aims to theoretically contribute to the debates on institutional change illustrated on a market with non-storable good. Policy implications stemming from the individual papers aim to facilitate the path towards sustainable and common European energy market.

Srithammavut Waroonkarn

Keywords: *Green energy and technology, Process development, Computational work, Modelling*

Modern methodology for process development is, as its best, based on parallel experimental and computational work. Mechanistic models, describing the phenomena of the processes, have an important role in such methodology. Experimental work usually starts in laboratory, in which the target is usually to study the phenomena which do not depend on the scale, e.g. chemical kinetics and dependencies between parameters. Experimental plan and model are conducted based on the levels of knowledge. A number of experiments decrease due to the more understanding of system, consequently the role of model is different. Three different approaches of models are used in this study. For well-defined system, in which the phenomena, variables and dependencies between variables are known, the model is built in order to estimate the model parameters. In case of known phenomena and affecting variables, the model is used to find the dependency between the variables. For the system in which only the phenomena is known, experimentation together with an empirical model are used to find out the variables affecting the system and dependency of these variables. The primary goal of this research is to study and develop model-based methodology for process development. The secondary goal of the research is to study these processes and the phenomena appearing in them.

Stade Sam

Keywords: *Membrane technology, UTDR, fouling, compaction*

Fouling is limiting the use of membranes in many industrial applications and its management would significantly improve the feasibility of membrane processes. With high technology microelectronics and sensors membrane fouling can be studied in real time. This gives better understanding how fouling mechanisms occur in different separation processes and lead to more efficient way to manage fouling. We have already successfully built ultrasonic time-domain reflectometry (UTDR) in co-operation with the Laboratory of Physics and Microelectronics. These micro sensors can measure thickness and density of the fouling layer. We have integrated these micro sensors in our membrane module in a novel way which improves the measurements accuracy significantly. The data achieved with this monitoring system enables real-time control of the process parameters to minimize the fouling of the membranes and the energy usage in membrane filtration. In addition the real-time UTDR measurements are applied to study membrane compaction and how compaction could be utilised in modification of membrane properties.

Stoklasa Jan

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations, MCDM, fuzzy modelling, linguistic modelling, operations research*

My research focuses on fuzzy and linguistic models for decision support. These models include multiple criteria decision making and evaluation tools (both crisp and fuzzy), but stress the importance of a linguistic level of description. The relationship between the linguistic level of the models and the mathematical one and possibilities of presenting understandable outputs from mathematical models are being studied as well as the issue of responsibility for decisions. Well-built linguistic decision support models can provide decision makers (e.g. managers, diagnosticians) with a sufficient amount of easily interpretable information, which is one of the most important prerequisites for informed decision making.

Application areas of these models include disaster management (focus on medical rescue services), HR management, economics, business, but also education or psychology and arts. Recently, I have been involved in the development of evaluation methodologies and mathematical models for tertiary education institutions in the Czech Republic. For one of these applications in tertiary education institutions management an evaluation model for academic faculty evaluation was developed and it is currently being used or implemented on several universities in the Czech Republic. Another one included the design of an evaluation model for creative work outcomes of Czech art Colleges (arts evaluation).

Strand Elsi

Keywords: *Ultrafiltration, wood extract, hemicelluloses, lignin*

One objective of forest biorefineries is to utilize currently less efficiently exploited wood-derived compounds in profitable ways. Ultrafiltration is a potential method to recover hemicelluloses from wood extracts. However, membrane fouling is a serious issue especially in recovery of hemicelluloses with medium molecular mass, since the material of current commercial tight ultrafiltration membranes is mainly hydrophobic, which is not favourable for wood extracts with hydrophobic foulants. A solution for the fouling problem could be removal or degradation of the foulants, by e.g. adsorption or oxidation, prior to ultrafiltration. Pretreaments remove, not only different compounds, but also different sized compounds from the wood extract. This study establish the impact of changes in the wood extract composition caused by pretreamtent on filtration capacity. A practical pretreatment would not only improve the filtration performance but also increase the purity of the produced hemicellulose fraction. The information obtained from this study can be utilized in development of separation processes used in forest biorefineries.

Suhola Timo

Keywords: *Social identity, group effect, Sensemaking, Dialogue*

Suhola's deep interest points to phenomena of collaborative working, and the obstacles which deteriorate productive collaboration. Scholar sees that one crucial underlying phenomenon, which blocks fluent cooperation originates to the construct of social identity that defines one's social set of mind: the ways she/he perceives different episodes and environments; ways on reasoning, and the means she/he behave on varying situations. Basic idea is that individuals intend to locate themselves to certain social groups and thereby absorb group's distinctive mental and visible characteristics, such that separates it from other groups. Event above strengthens the group's cohesion, raises common self-esteem, generates team spirit, and brings feeling of safe to the group members.

Phenomenon above is natural social psychological necessity. It's disadvantage, however, is that different groups, for example officials in social and health care and/or educational sector, are not efficiently enough able to create common social reality. They also often fail to create common goals that overlap organizational borders. The aim in Suhola's studies is to explore carefully the origin of barriers mentioned above. Frameworks of Sensemaking ja dialogue are used in explaining and/or creating the possibilities to give birth to shared understanding. In the big picture this process take place in the practical contexts of collaborative and innovative environments, which are driven by the participants involved particular case.

Suikkanen Heikki

Keywords: *Green energy and technology, Nuclear energy, Generation IV reactors, Gas cooled reactors, Numerical modelling*

Innovative gas cooled reactors like the pebble bed reactor (PBR) and the gas cooled fast reactor (GFR) can produce high temperature steam and thus offer high efficiency and new application areas for nuclear energy. In addition, PBRs have specific safety features while GFRs breed fissile isotopes and burn actinides. Some of the remaining technical challenges related to these reactors are tackled with numerical simulations.

A multi-physics code system is developed for the modelling of the PBR core consisting of a randomly packed bed of spherical fuel elements cooled by a helium gas flow. The packing and dynamic behaviour of the pebble bed is investigated with discrete element simulations. The results are utilised in the coolant flow and heat transfer analyses with computational fluid dynamics (CFD) and in Monte Carlo reactor physics calculations. Novel methods are developed for coupling the calculation methods together to obtain an accurate prediction of the state of the reactor.

Optimisation between heat transfer efficiency and pressure losses in a GFR core design consisting of fuel rods cooled by helium gas is investigated using CFD simulations. Fuel rod geometry with ribs enhancing convective heat transfer from surfaces is calculated and the results are compared with experimental measurements.

Sääksjärvi Eija

Keywords: *Sustainable value creation, International hub of Russian relations, Chemometrics, Environmental modelling, Environmental protection*

The objective of my research work is to continue my previous studies for the origin and distribution of waste waters in the southern Lake Saimaa. I am using public available water quality data collected during several decades. The national database OIVA is not utilized sufficiently in environmental modelling in order to produce information for decision making in environmental protection. As a research tool I am using Chemometrics which may be regarded as the application of statistical and mathematical methods using modern information and communication technology. These tools are Principal Component Analysis (PCA) and Parallel Factor Analysis (PARAFAC) which are used to solve interactions of measured variables and pollution sources in a complex water ecosystem. The aim is also to identify changes in the condition of waterways and to find the most important parameters affected on the changes. The results help to direct preventive actions to improve the water condition in waterways. The research area is Lake Saimaa and its recipient water systems River Vuoksi, Lake Ladoga and the Gulf of Finland. The advantage of the modelling is find answers what has happened in complex water systems. The results and the methods can be used globally.

Talasek Tomas

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations, Multiple criteria decision making, Fuzzy rule based systems, Fuzzy classification, Fuzzy data analysis*

My research focuses on the study and development of new mathematical models of complex real life situations – particularly such that inherently involve classification under fuzzy conditions. From the mathematical point of view a special attention is directed to the (linguistic) fuzzy rule based systems and their applications, including proper ways of fuzzy inference and presentation of results (the issues of interpretability, understandability and other issues relevant for proper use of these models in practice are considered as well) are in the focus of my research.

Classification problems and the respective mathematical models are studied in the broadest sense – the algorithms used for assigning objects into classes, the descriptions of classes and even the values of the characteristics of objects to be classified are allowed to be fuzzy. Since many multiple criteria decision making or evaluation tasks can be approached from the classification perspective as well, the results of my research can find use in many areas of human activity. Among these possible application areas diagnostics (clinical and psychological), decision support and similar fields including disaster management deserve mentioning the most. To achieve higher impact, my research also involves software implementations of the classification algorithms and the newly developed mathematical methods.

Talonpoika Anna-Maria

Keywords: *Sustainable value creation, Asset management, Working capital management*

My research interests include capital, capacity and cost management. I have specified on financial working capital management. Financial working capital is part of net working capital which can be defined as capital that is required to perform business operations. My doctoral thesis is focusing on defining and measuring financial working capital. The management strategies of financial working capital are also studied. Financial working capital implies the liquidity conditions of the company. The measure, created in the research, presents the cycle time of financial working capital in days. The easy and informative measure can easily be adapted to financial management in companies. The research will therefore benefit business practitioners and also bring academics new insights about the liquidity conditions of companies.

Tamminen Jussi

Keywords: *Green energy and technology, Liquid-liquid extraction, metals, Process intensification, Modelling*

Process intensification of liquid–liquid extraction of metals is studied in present work. Conventional processes use large equipments and relatively gentle mixing in order to prevent reagent losses. Copper extraction with hydroxyoxime type reagent is intensified by using high impeller speeds and shear rates in small in-line reactor. Phase separation after mixing is intensified using continuous centrifuge. Resulting copper extraction rates are over 50–fold larger, when compared to batch reactor with more conventional mixing. Experimental results were modelled by using developed mathematical model for metal solvent extraction. Ideal CSTR was found to be good approximation of flow of in-line reactor. Model includes necessary aqueous and organic phase speciation equilibria. Kinetic constant of extraction is calculated using model.

Extraction experiments with organophosphorus and carboxylic acid type reagents were made with feed solutions, which contain several metals. Model developed for copper extraction can be extended also to these systems.

Intensified extraction can be applied to reagents with slower extraction kinetics. Smaller equipment size means that less reagents needed in process, which leads to either costs savings or possibility to use non-conventional reagents. Such reagents may be too expensive or impractical to use in conventional processes.

Telkkä Joonas

Keywords: *Green energy and technology, nuclear safety, thermal hydraulics, particle image velocimetry, wire mesh sensors*

Experimental thermal hydraulics is needed to increase knowledge on functioning of nuclear power plants (NPP) and thus to enhance the safety of NPPs. Test facilities at LUT nuclear safety research laboratory are used either to ensure the functioning of safety systems of NPPs or to gain data for the validation of the computer codes. These codes are used to analyze the safety features of light water reactors. In the doctoral research advanced measurement techniques are used to acquire more information on thermal hydraulics of NPPs. Among these are particle image velocimetry (PIV) and wire mesh sensors (WMS).

Particle image velocimetry is a flow visualization technique, which allows for capturing velocity information of flow fields. PIV is based on illuminating of small tracer particles added to the flow with a laser apparatus. The movement of these illuminated particles is recorded with a camera system and converted into velocity information with a data acquisition system.

Wire mesh sensors are used to gain information on multiphase flows. WMS is based on the difference of multiphase flow phases regarding an electrical property, i.e. conductivity or permittivity/capacitance. WMS can be used to determine void fraction distributions, bubble size distributions and velocity distributions of multiphase flows.

Teplov Roman

Keywords: *Green energy and technology, Sustainable value creation, International hub of Russian relations, SME, Entrepreneurship, Innovation, Electronic commerce*

Open Innovation concept as a combination of collaborative practices is widely considered as a beneficial strategy for companies. Open innovation being properly applied results into increase of speed of innovation process and certain cost reduction. At the same time majority of studies on Open Innovation focused on large companies. The question of Open Innovation applicability for SMEs remains therefore understudied. It is clear that small firms are by nature deeply embedded in their network, however limitation in the resources and lack of structured organizational processes may hamper joint activities with other parties. The questions are consequently how SMEs can benefit from Open Innovation, what are the necessary steps to perform and what are the capabilities to acquire, what are the hazards of Open Innovation for SMEs, how firms can avoid them.

Tervonen Nina

Keywords: *Sustainable value creation, Sustainable business, sustainable innovations, value development, value measurement, value management*

The goal of my research is to understand the value of sustainable solutions and create ways to follow-up and manage this value over multidimensional networks. Sustainability is argued to be a key in future innovations and firms' business development. In finding the balance between innovation actions, business and environmental goals and social demands, value management plays a crucial role. The perspectives of sustainability, social equity, economical accountabilities and care for the ecosystem all have an effect on value which is experienced by stakeholders in different phases of a value chain. The value varies between stakeholders and following the sustainability principles may also bring forth the value-destroying elements such as increasing costs. To optimize the value without forgetting the sustainability issues can be thus very difficult task. The measurement actions of sustainability are evolving, but firms' are lacking the understanding of the importance and weighting of different sustainability dimension measures and data utilization. By improving the management and measurement actions of sustainable business, the research takes a step towards the optimization of sustainability value. Practically, the research helps firms in finding balance between their innovation, business and environmental goals and moving towards more valuable solutions.

Tiainen Jonna

Keywords: *Green energy and technology, micro-scale compressors, centrifugal compressors, low Reynolds number flow, efficiency*

The research concentrates on micro-scale centrifugal compressors. The typical features of the micro-scale compressors are low size, very low mass flows, and high rotational speeds. Micro-scale centrifugal compressors can be used to replace larger positive displacement devices or larger centrifugal compressors operating at lower rotational speeds for example in refrigeration processes, in small gas turbines or in domestic heat pumps. The use of micro-scale compressors instead of larger devices would result in significant savings in both size and weight. However, the reduction in compressor size can lead to quite large decrease in performance. At micro-scale, the viscous loss increases due to the low Reynolds number and the tip leakage loss increases due to the increase of the relative tip clearance. The aims of the research are to study the theoretical and numerical models describing the low Reynolds number flow in compressor passages and develop novel and innovative means to control flow stability and boundary layer interactions, which would increase the efficiency of micro-scale compressors.

Tikhonova Victoria

Keywords: *Human resource management/Competence development and management; competence, innovativeness, human resource management instruments, magazine publishing industry*

At the time of moving from resource-based economy to knowledge-based economy innovations became an important topic of discussion for various actors of economic environment. Enterprises are the main source of innovation. But their innovation activity is impossible without firms' main resource – people. Individual employees and work teams possess different kinds of competences, that are essential in achieving competitive advantage and strategic success for the company.

This paper focuses on the analysis of the role of Human Resource Management instruments in linking competences with innovative outcomes of enterprises, that have to adapt to changes in external business environment?

Magazine Publishing Industry was chosen, as it is experiencing radical change nowadays in terms of transferring to the digital format of presenting the magazine content to customers, and creates an interesting context for the research. The nature of the research question defines the choice of qualitative research method. The results of the study will be valuable both for the theoretical field (the research allows to look at HRM issue from a different perspective) and practical field (managers of organisations, employees).

Tikka Ville

Keywords: *Electric vehicle, Smart charging, Green Energy and Technology*

Large scale electrification of transportation is about to start in Finland in the following decades. Electrification of the traffic is likely to cause increased electricity demand, thus also novel charging methods need to be developed. The electric grids are facing changes in demand structure. Development of the distribution grids is a long-term process, thus what comes to planning of the distribution grids the decisions needs be made proactively. Distribution business is capita intensive in nature and component lifetimes are measured in decades.

The main contribution of the research is to define the main properties of the EV charging load that are relevant in the planning process. Secondly, the purpose is to develop methodology for analysing charging behaviour and estimating the grid effects and challenges posed to planning activities. Thirdly calculation and analysis methodology is tested on an actual distribution grid data in order to validate and demonstrate developed methodology.

Tirkkonen Katariina

Keywords: *Green energy and technology, membrane filtration, ceramic membranes, bleaching effluents*

Ceramic membranes are at the moment on the verge of scaling up in module surface area. This will lower their price and make them more appealing an option to polymeric membranes in purifying the bleaching effluents of a kraft pulp mill to be reused as process water. The possibility to use ceramic membranes in the treatment of bleaching effluents would be beneficial, because they are likely to tolerate better the prevailing conditions and can be expected to have a longer operational lifetime compared to polymeric membranes.

The optimal use of ceramic membranes in the treatment of complex bleaching effluents requires a thorough understanding of the dominating separation mechanisms. This research aims to produce an improved understanding on these mechanisms by testing titanium dioxide membranes in the treatment of both model solutions and authentic acidic and alkaline bleaching effluents. The information produced can then be used both in developing new effluent recycling processes in pulp mills, and in the development of separation processes for recovery of valuable compounds in modern wood-based biorefineries.

Toghyanirizi Amir

Keywords: *Machining and Sheet Metal Processing, Production of Wood Plastic Composite, Sustainability, Tooling Design, Product design*

Establishing Key tooling Parameters for generating wood plastic composite (WPC) products based on the requirements of production process, material properties and final product demands will be focusing criteria for my research. This procedure permits use of a wide range of materials and mixtures of materials. The flexibility of the production line makes it possible to produce a variety of consumer products using diverse sequences of processes such as cutting, pressing and bending. This procedure starts from the extrusion process which is carried out with an extrusion tool that is linked with the extrusion device. Modification of the thickness or shape may be performed by various methods such as pressing, or additive manufacturing methods. The method and the device may use to fabricate products of any kind and any shape. The aim of this study is to find and develop new procedure of producing sustainable fiber composite products from the perspective of DFMA (Design for Manufacturing and Assembly). In this procedure Product and production tools design will affect by changing the material properties and applications which needs to focus on as an undeniable segments of the research.

Toivanen Jenni

Keywords: *Sustainable value creation, Welding technology, Welding network, Welding quality, Welding production*

It is generally accepted that business is becoming global and competition is intense with specific demands. Welding, as an established technology, is commonly an undervalued action of the manufacturing function in the manufacturing chain when observing opportunities to enhance productivity and profitability. Welding manufacturing has enormous prospects to develop network behavior with appropriate relationships, competences and functions and therefore affect enhancing competitiveness and profitable manufacturing. However, there is lack of empirical studies and particular field of welding networks and this requires specific research. There is a need for elucidate the potential of welding quality data in whole network context, and how to use that information for accelerate the networking with welding demands and potentially improve welding quality and profitability in welding network. Research work concerns welding manufacturing functions and welding production demands in global welding networks.

Torvinen Pekka

Keywords: *Sustainable value creation, international hub of Russian relations, technology management, technology transfer, emerging markets, networks*

Author's research focus is on the challenges of enterprises competitiveness and performance in emerging markets. Research aims to identify the factors which create the competitive advantages for the companies by examining the innovation activities, capabilities, and technology management strategies of the firms. The research focuses especially on Russian manufacturing industry.

Open technology management strategies can create sustained competitive advantages for emerging market firms. However, this requires firms to develop internal capabilities to be able to search and exploit external technologies and commercialize developed technologies. Access and involvement in competitive global value networks able firms to exploit open business strategies and exchange technologies to improve the firm performance and to become internationally competitive.

Firms in emerging markets are forced to manage the challenging set by the constantly changing business environment and institutional weaknesses. The market position of many emerging market firms, especially in Russia, has become difficult due to foreign multinationals and more competitive imports. Russia has highly educated workforce and vast markets but the firms have not been able to exploit these benefits to achieve competitive parity.

Tukiainen Teemu

Keywords: *Bacteriorhodopsin, molecular computing, photoelectric response modeling, differential photoelectric response*

Bacteriorhodopsin (BR) is a light-sensitive biomolecule found in the purple membrane of the archaean Halobacterium salinarium. Due to its exceptional durability, BR has been proposed for a variety of technical applications. At LUT, the main research focus has been on dry bacteriorhodopsin thick films. The electrical and optical properties of the films have been studied and they have been used to construct photosensors and a color-sensitive camera. The origin and mechanism of the photovoltage generation in these sensors is not fully understood. In order to study the origins of the measured photovoltage, we have developed both a simulation environment, and in collaboration with researchers on electronics, better measurement electronics for the research. The simulation environment provides a tool to test different models for the BR photocycle and the electronics. The possibility to design a novel imaging sensor incorporating different types of BR in a layered structure is also studied. This type of sensor provides higher spatial resolution, and due to the active nature of the biomaterial, it is possible to change the properties of the sensor during the image capture. This is expected to improve the controllability and increase the signal-to-noise ratio of the sensor in different applications.

Tuominen Niko

Keywords: *Sustainable value creation, high strength steel joints*

The joint are the most important part of structures, because they usually define the capacity of the structure and require most effort in design and fabrication. The joint must be easy to fabricate and the capacity in terms of load carrying and deformation must be adequate. However, the safety of the structure is most important subject, when the joints are designed for high demand applications. The industrial applications require design information and instructions for fabrication which are currently lacking for UHSS.

The project is connected to BSA project 2 (Design beyond present codes) and the main industrial partners will be SSAB and companies using the tubular structures. Additionally, the work is linked RUOSTE-project, which is a RFCS-funded project and will exceed the European design code for steel structures (Eurocode 3) to cover the steel grades up to 1000 MPa.

The demand for capacity, lightness, economy and safety of welded structures is increasing in future. On site of laboratory testing a sophisticated simulation is needed which takes into account all essential effects on the deformation and load carrying capacities of the joint and for that the material parameters are needed for simulation in order to replace the expensive experimental tests.

Tuunanen Jussi

Keywords: *Green energy and technology, electricity distribution business, load forecasting*

The future energy system may include new types of power production, energy end-use and energy technologies. The future technologies, such as electric vehicles and micro generation, will have significant effects on the electricity use. In addition, smart meters will revolutionize information of the customers' electricity usage. The changes in the energy system will have also impacts on the electricity distribution. Some technologies will increase and some other technologies may decrease the electrical energy transmitted through the distribution network. For instance, customers' micro generation may produce more electricity than customers are able to consume. The research concentrates on technical and economic issues in the electricity distribution business. The main focus is on investigating what kinds of changes are taking place in the electricity distribution environment, how the future energy consumption and powers in electricity distribution networks can be forecasted, and what their effects are on the electricity distribution business in long term. The aim is to develop new load forecasting process to forecast changes in energy and power volumes in electricity distribution networks. The motivation for the research comes from the changing operating environment, which will have various impacts on the electricity consumption and the distribution business.

Tynninen Leena

Keywords: *Sustainable value creation, Customer, Profitability management, Asset management, Higher education*

Most firms aim to be more customer-focused, profitable and want to create value or shared value for their customers. At the same time digital era is changing the business models and the amount of data is increasing rapidly. These changes create new possibilities to connect customer data and financial data as well as to seek better understanding of the factors affecting revenues and cost in customer profitability. What kind of factors adding value for the customer in the short and long run? How can we combine the knowledge from marketing and cost management to know our customers and to make them visible for managers in various decision-making situations? My research interest contributes to the development of more sophisticated models for customer accounting. Customer can be seen an asset.

Uusitalo Ulla-Maija

Keywords: *Knowledge creation, practice-based perspective, ethnography, interdisciplinarity*

It is the purpose of my PhD research to gain a better understanding of interdisciplinary knowledge creation by observing it as grounded in site-specific work practice within the context of higher education, namely the Aalto Design Factory of Aalto University. As research approach a practice-based perspective is taken, where the focus is on gaining a "sense of the doing", and observing the specificities of participant behaviour and meaning in site-specific work-practices of knowledge creation. I place a special focus on the role of individuals engaging in these practices, that is their differing aesthetic judgements, sensible knowledge and experiences of these practices. In addition I take into account the sociomateriality and spatiality of the practices, as the physical space of Aalto Design Factory is one of its salient features. My research employs organizational ethnographic research methods in the form of on-site fieldwork, generating field diaries, observations, semi-structured interviews and additional secondary sources and materials.

Uzhegov Nikita

Keywords: *Green Energy and Technology, Electrical drives, Electromagnetism, High-speed electrical machines*

High-speed electrical machines are nowadays used in a number of industrial applications. The key benefits of these machines are high power density, small footprint as well as high system overall efficiency. These factors are attracting the manufacturers producing, for instance, gas compression applications, air blowers, vacuum pumps, turbines, machine tools, and machine tool spindle drives.

My research is concentrated mostly on the electromagnetic design of the HS Induction Motors and Permanent Magnet Synchronous Machines as these two machine types are widely used in the industrial applications. My field of expertise lays in the electromagnetics, nevertheless, the basic knowledge of the mechanics and thermal engineering are required.

To sum up, my research is concentrated on the multi-faceted studying of the high-speed electrical machines. It is includes the analytical and numerical design, the topology selection based on the customer requirements, the material properties investigation, a development of the calculation tools, the prototypes measurements and the research results publishing.

The research helps to improve the existing drive train systems, increase their efficiency and reduce the amount of wasted energy.

Valtonen Petri

Keywords: *Demand Response, smart grids, electricity retailer, Distributed Energy Resources*

The development of smart grids may be an agent for the next major changes in the electricity business. Smart grids, although offering many new opportunities, also create new risks. This research examines possible impacts of the development of smart grids on the electricity retail business, develops a methodology for electricity retailer short-term profit optimization in a future smart grid environment. The methodology is also used to evaluate the economic potential offered by the market-based demand response put in practice by an electricity retailer.

It is found that smart grids offer new functionalities, of which particularly the DR based applications provides great potential for retailers to improve their profitability in short-term markets. Moreover, in a large scale the market-based demand response promoted by electricity retailers can benefits the power system and electricity markets in many ways. It can, for instance, help to maintain the power balance between production and consumption, decrease price peaks in electricity markets and reduce the need for typically rather expensive and high CO2-emissions providing peak-power capacity.

Vanhala Erno

Keywords: *Sustainable value creation, computer games, business models, software industry*

I am interested in software business, business models, open source and gaming industry. My research is focusing on how computer game organizations utilize business model concept. This includes also issues such as human resources, revenue streams and customers. I am mesmerized by the whole transition from physical products and business to digital ones.

Vasileva Evgeniia

Keywords: *Electricity markets, capacity market, renewable energy, energy policy*

European and US have deregulated markets designs which are commonly used as a model for other countries electricity markets. Further developments of existing markets remain an open question, since factors that affect the market operation are specific for different countries. These factors, such as fuel availability, economic sustainability of the country and environmental and energy policies, have strong impact on decision making of regulatory institutions. With growth of energy efficiency issues and environmental agenda, many innovative solutions (smart-grid, renewable energy) take place in the modern power industry. Their integration in the market often is a problem to solve, in addition to existing. The main objective is analysis of how independent generation or innovation can enter into existing and operating market, which has specific drawbacks and incentives. The methodology to assess the acceptability of solutions to implement the certain innovation should be discovered as a result. This result is relevant, from academic approach, to understand how to implement something new in formed operating market and also, from business approach, to evaluate competitiveness of different business related solutions.

Vasilyev Fedor

Keywords: *Sustainable value creation, Solvent extraction, Liquid-liquid extraction, Reactive extraction, Modeling, Simulation, Mixer, Settler*

Solvent extraction followed by electrowinning (SX-EW) process is used for hydrometallurgical production of high purity copper. Constantly changing quality of raw materials, their increasing complexity and requirement for recovery of valuable impurities make control of the process operation and prediction of product quality a challenging task. The state-of-art of copper SX-EW process includes mostly unit-process control loops utilizing simplified models of process phenomena. Oversimplifications in describing the process chemistry and lack of accurate information about the state of the process restrain the development of model based control of the process. Advanced analysis of interactions within the process is required. The objective of this research is efficiency improvement of the copper SX-EW process by devising an integrated process model based on deep understanding of process chemistry and accurate information about the state of the process, using advanced mathematical tools. A rigorous mathematical model based on physical chemistry of phenomena involved in mixing and settling of process phases in solvent extraction will be developed. The model will be able to predict the process behavior for a wide range of raw material qualities. The model will be used for simulation, control and optimization of copper SX-EW plant enabling flexible and sustainable process operation.

Vehmaanperä Paula

Keywords: *Dissolution, iron oxides, acid mixtures, kinetic modeling*

Dissolution of iron oxides has been extensively studied in single acid systems but studies with mixtures of acids are few. Kinetics and thermodynamics of dissolution of iron oxides are in general not agreed on. The objective here is to investigate the dissolution mechanisms of magnetite and hematite in acidic environments by adding oxalic acid in sulfuric or nitric acid. This can contribute to more efficient and environmentally friendly processes. The work is based on performing thermodynamic and kinetic experiments at different temperatures and acid ratios. So far the results have shown that the solubility of magnetite and hematite improves by adding oxalic acid in sulfuric acid. The temperature has an effect on the equilibrium kinetics, but higher temperatures do not automatically result in significantly higher solubility. The Kabai model has been found most suitable in describing the dissolution kinetics of magnetite and hematite in mixtures of oxalic and sulfuric acid. A solid specific constant a of the Kabai model has been found to vary for the different acid ratios for magnetite and hematite dissolution, which has not been reported by Kabai. The reason for the variation might indicate changes in the solid phase during the dissolution process.

Vepsäläinen Ari

Keywords: *Green Energy and Technology, Energy, Combustion technology, CFD, mass and heat transfer*

PhD research, ‘Heterogeneous mass transfer in fluidized beds by computational fluid dynamics’, is fundamental phenomenon research of fluidized bed combustion technology by means of CFD, and represents the first such-research presented in the literature.

In the very recent years, the multiphase CFD modeling of complex gas and solid flow dynamics existing in the fluidized beds has been developed by research efforts to be a reliable modeling tool for small-scale equipments. Taking advantage of this, the PhD research benchmarks the heterogeneous mass transfer coefficients predicted by fine-grid Eulerian CFD simulations against empirical data presented in the scientific literature. The obtained mass transfer coefficients provide an enhanced prediction accuracy of the fluidized bed process performance, and have practical relevance in various engineering design, reactor scale-up and process research tasks. Additionally, the research provided great amount of new process-specific knowledge, such as a strong mass transfer control over heterogeneous reaction rate, a dominance of interphase mass transfer in the fine-particle fluidized beds and a strong chemical kinetic dependence of the average gas-bed mass transfer.

The results prove that CFD modeling provides a very cost-efficient and reliable choice for traditional laboratory- and pilot-scale experiments of fluidized bed processes for the academic and industrial needs.

Vostatek Pavel

Keywords: *Sustainable value creation, fundus photography, image processing, content based image retrieval*

Segmentation and content-based image retrieval of retinal images.

Modern retinal imaging modalities enable efficient diagnosis, monitoring and documentation of various conditions by imaging the retina. It is possible to produce quantitative information of the signs of eye diseases such as age-related macular degeneration, diabetic retinopathy and glaucoma. When the disease screening programs grow wider and more representative, computer aided diagnosis based on automatic and semi-automatic segmentation tools are required in reducing the workload of medical experts.

The main focus of the research is on the application of content-based image retrieval (CBIR) to retinal images. CBIR is a relatively novel method in image processing designed to search for images from a database using only image information. The method is being exploited in retinal image analysis mainly for disease detection, but the possibility to find similar images from a database enables adapting further processing of unseen images, and the use of possible prior information based on the already seen images and additional information connected to them. The image feature extraction, segmentation and machine learning methods developed during the research serve as a basis for developing a retinal statistical atlas.

Väntsi Olli

Keywords: *Fiber composites, recycling, construction & demolition waste*

Research interests include fiber composites and utilization of recycled raw materials in them.

Research is focused on construction and demolition waste, it being the largest waste stream in the world by volume. Currently major part of construction and demolition waste ends up in landfills. Environmental laws and regulations implemented in many countries are becoming stricter and in order to meet the requirements, new ways of recycling construction and demolition waste must be found.

Fiber composite provide a possible way utilize some of materials originating from construction and demolition waste stream, such as plastics, wood and different mineral materials.

Multiple benefits can be achieved by increasing the use of recycled materials: reduced amount of waste is deposited to landfills which lessens the negative environmental effects related to landfills, the shortage of land for waste disposal and the rising landfilling costs increase the attractiveness of re-using materials and natural resources are conserved when waste materials are used to replace virgin raw materials.

Yli-Huumo Jesse

Keywords: *Technical debt, Software project management, Software development lifecycle, software quality assurance*

Increasing competition within software industry is forcing companies to develop their products faster to market in order to acquire customers. Balancing the idea of releasing poor-quality software early or high-quality after dead-line is challenging for companies. Taking shortcuts and workarounds in development can give companies the needed speed to release their product in time. However, if these shortcuts are never paid back, they might show up as omitted quality and extra costs in the future. This research is studying the challenges between development and deadlines that can also be called as 'technical debt'. We are interested on the causes of the technical debt to the software development lifecycle and the effects occurring from it. Moreover, the focus in on evaluation and management strategies regarding controlling and reducing technical debt. Our goal is to create a theoretical model about the evaluation and management of technical debt in software development lifecycle. We use grounded theory method for creating a theoretical model through several case studies and field interviews with professionals from both technical and business background. As a result of the research, we will have a theoretical model of technical debt evaluation and management that can be applied to practice for improving companies internal and external processes that will help to create high-quality products on time and on budget.

Ylä-Kujala Antti

Keywords: *Sustainable value creation, Asset management, Industrial maintenance networks, Open-book accounting, Model implementation*

International competition has tightened in most industries resulting in continuous outsourcing of companies' non-critical activities, such as industrial maintenance, and eventually to the formation of company networks. The establishment of these networks has generated a great deal of managerial challenges, e.g. a need for increasing information openness from a company to another in such a way that collaboration is deepened and value is created for all participants. The main research question of my doctoral thesis is "How does the adoption of open-book accounting practice benefit asset management-wise companies that operate in industrial maintenance networks?" Therefore, the two primary aims of my research are demonstrating the benefits of open-book accounting utilization, i.e. increasing information transparency among the interdependent industrial maintenance companies, and consistently addressing the question of implementing inter-organizational asset management models. The benefits of emphasizing openness are illustrated with two inter-organizational models that are called "the FAM-model" (Flexible Asset Management) and "the life-cycle model for maintenance service management". Further, the potential practical issues in implementing these models inter-organizationally are highlighted by creating a theoretical implementation framework. The maximization of total maintenance network value with the FAM-model and the life-cycle model is also mathematically proven as a part of the research.

Zhukov Vladimir

Keywords: *Gold, leaching, modeling, sustainability*

The main focus of the research is investigation of gold leaching from ore and concentrate by ammoniacal thiosulphate method. The classical cyanidation process of gold leaching needs to be substituted for many reasons. The alternative "thiosulphate" leaching process for gold and other noble metals from various ores is under a thorough investigation at the moment.

The major advantages are safety and protection of environment. The method is at the stage of laboratory and pilot study, and experimental data are vital – the gold leaching kinetics, influence of the process key parameters.

The most important actions are to get information by experimentation about:

1) Kinetics of the process. How the kinetics is affected by conditions in the reactor, temperature and concentration of reagents.

2) Reagent consumption. How the reagent concentration is affected by the conditions in the reactor.

3) Gold recovery efficiency. How gold can be recovered from the leached solution. What is the efficiency of gold recovery?

The problems of reaction modeling and possible reactor modeling are under consideration, as well as the chemical background. The inorganic chemistry of leaching is rather complicated and the main quantitative correlations are not clear till the end and may depend upon many ore parameters.