

NORDDESIGN 2018

DESIGN IN THE ERA OF DIGITALIZATION

This programme was created by Philip Ekströmer, Johan Ölvander and Simon Schütte. Graphic design and illustrations by Philip Ekströmer and Malin Wilhelmsson.

Cover image: Klara Rydebrink, Design and Product Development student. Photo by Philip Ekströmer

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PREFACE

Welcome to the 13th biennial Norddesign Conference 'Design in the era of digitalization'! Following previous editions in Helsinki (1996), Stockholm (1998), Copenhagen (2000), Trondheim (2002), Tampere (2004), Reykjavik (2006), Tallinn (2008), Gothenburg (2010), Aalborg (2012), Helsinki (2014) and Trondheim (2016) it is our pleasure to welcome you back to Sweden and invite you to Linköping. The Norddesign conference series aims to serve as a Nordic complement to the large European and American Design Society conferences within the fields of Engineering and Product Design, but also welcomes participants from other countries. A Nordic Scientific Advisory committee, consisting of representatives from the main universities of technology in the Nordic region, guards over the quality and the continuity of the conference series. The Norddesign 2018 conference is hosted and organized by the Division of Machine Design at Linköping University, in co-operation with the Product Development Academy in Sweden and the Design Society.

CONFERENCE PROGRAM

The theme of the 2018 conference is 'design in the era of digitalization', which covers a wide range of topics, ranging from the use of big data in the early phases of the design process, to the use of virtual reality in product development, and from the use of physical computing in design, to design automation. The proceedings will be published as open access by the Design Society on their website www.designsociety.org. During the conference, the papers are available via OneDrive. Use this shortlink <https://goo.gl/mmJPSL> or the QR code at the bottom of this page.

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LOCAL ORGANIZING TEAM



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HEAD OF THE ORGANIZING COMMITTEE



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GENERAL CONFERENCE CHAIR



RENEE WEVER

CO-CONFERENCE CHAIR



JOHAN PERSSON

SCIENTIFIC COORDINATOR



PHILIP EKSTRÖMER

ART DIRECTOR



RITA ENQUIST

CONFERENCE ADMINISTRATOR



LISBETH HÄGG

ADMINISTRATIVE COORDINATOR

ACKNOWLEDGEMENTS

The organising committee would like to thank all colleagues and students that have contributed to making Norddesign2018 possible. We are also thankful to the reviewers and the Scientific advisory committee for assuring a high scientific quality of the conference, the Product Development Academy in Sweden for arranging the doctoral colloquium and the Design Society for publishing the proceedings.

KEYNOTE SPEAKERS



KEYNOTE 1: TOM DJAJADININGRAT **UNEXPECTED FACTORS: THERE'S MORE TO INNOVATION THAN ENGINEERING AND DESIGN**

Tom Djajadiningrat is creative director in the Research & Innovation Studio of Philips Design in Eindhoven. He leads the Future of UI project which investigates the relevance of new UI technologies to the future of Philips. Most of his projects are related to professional healthcare or personal health as Philips repositions itself as a health and well-being company. In his work, he aims for co-created, tangible concepts which embody a position, question common sense and influence decisions. His deliverables are typically experience prototypes, stories, patents and publications.

Before joining Philips in 2006, Tom worked for eight years in design research groups at TU Delft, TU Eindhoven and the University of Southern Denmark. During these years he published and lectured extensively on bridging interaction and industrial design, in a mix of product and method oriented work. Though now in industry, he retains a heartfelt interest in design research and education as breeding grounds for truly fresh ideas.

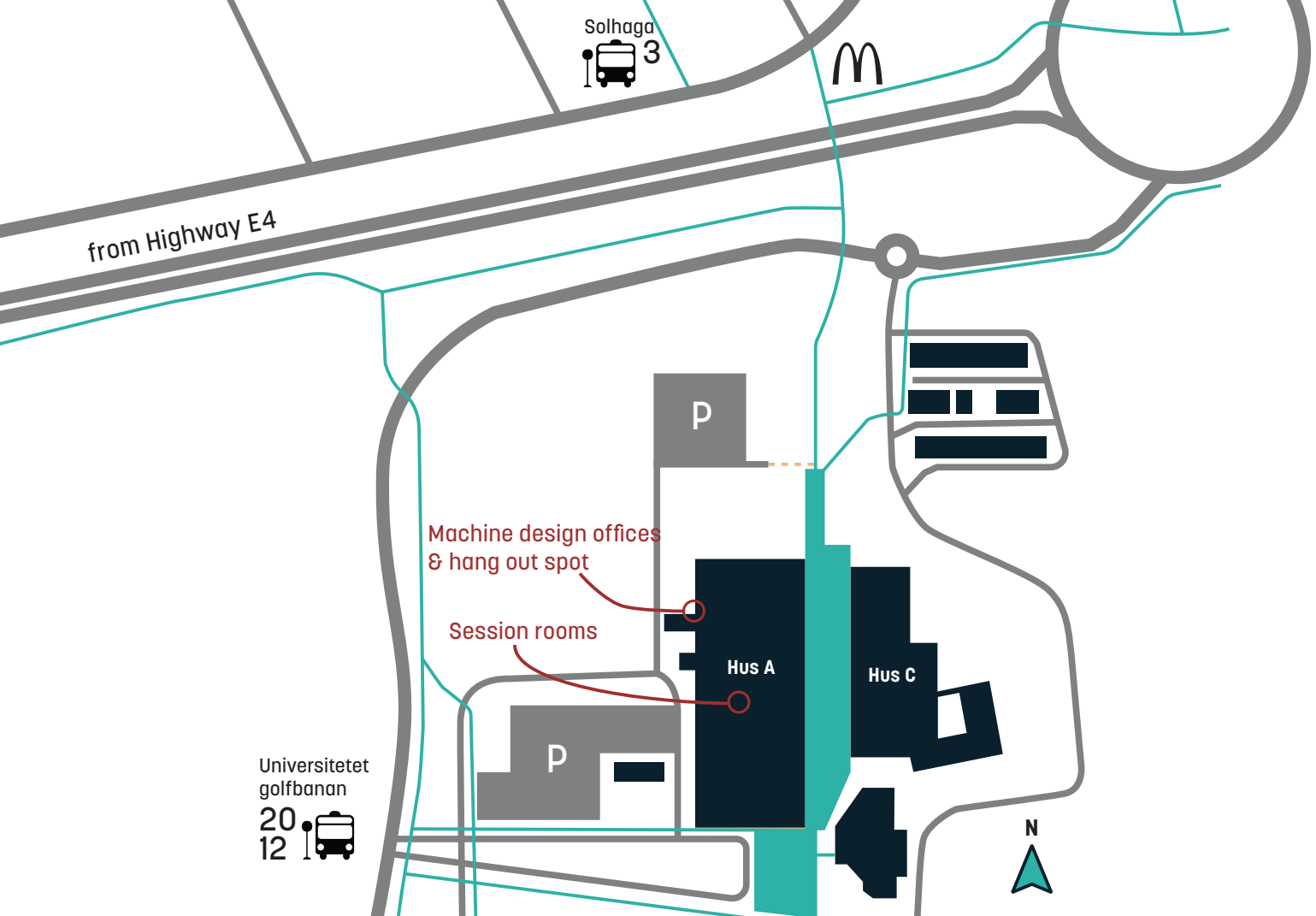
Tom Djajadiningrat studied Industrial Design Engineering at Brunel University and the Royal College of Art and holds a PhD from Delft University.



KEYNOTE 2: CLAUDIA ECKERT **PHILOSOPHICAL ASPECTS OF MODELS IN ENGINEERING AND DESIGN**

Dr Claudia Eckert is professor of design at the Open University, England. She has a broad interest in understanding and supporting design processes of complex products. After a PhD on communication in the knitwear industry and post doctoral study on sources of inspiration in knitwear design, she joined the Engineering Design Centre in Cambridge in 1999 and worked for ten years mainly on engineering change and process planning in engineering processes. She is fascinated by design as a professional practise in different domains. She studies design processes of complex incremental products in industry through interviews and observations to identify problems to address them through tools, methods and the development of design theory. This brings her in touch with a broad range of topics from process management, processes planning, collaboration, sustainability and energy. The main focus of her research has been engineering design, fashion design and in recent years also construction, which has led to a long standing interest in comparisons between design domains. Dr Eckert collaborates and co-authors widely with researcher in the UK, Europe and the US.

She is a co-chair of the "Modelling and Managing Engineering Processes" Special Interest Group of the Design Society and a member of the Board of Management the Design Society. She serves as an area editor of Research in Engineering Design and IEEE Transaction on Engineering Management.



SOCIAL EVENTS

Tuesday 14/8

Airplane croquis

Ever wanted to croquis with airplanes instead of humans? Now you can! This might be the worlds first airplane croquis and you could be a part of it! We gather at 09.00 at the registration desk for transport to the Air Force Museum

Informal get-together

Informal hang out with food outside Machine Design offices.

Wednesday 15/8

Welcome reception

Finger food and drinks @ Linköping Konsert & Kongress. Perfect for meeting and greeting.

Thursday 16/8

Boat tour with dinner

Boat tour on Göta kanal and lake Roxen. Loads of locks and beautiful nature. Conference dinner on board.

SCHEDULE AT A GLANCE

Below is an overview of the schedule for Norddesign 2018. The session plans are found on the following pages.

	14/8	15/8	16/8	17/8
08.00				
09.00	Sketching workshop 09.00-12.00 We meet @ 09.00 at the registration desk for transport to the Air Force museum	Welcome talk and Keynote 1 08.30-09.45 A2	Session 4A-D 08.30-10.10 A36, A37, A38 & ACAS	Keynote 2 08.20-09.20 A2
10.00		FIKA		FIKA
11.00		Session 1A-D 10.10-12.00 A36, A37, A38 & ACAS	Session 5A-D 10.40-12.20 A36, A37, A38 & ACAS	Session 6A-D 09.50-11.30 A36, A37, A38 & ACAS
12.00				LUNCH TO GO
13.00	LUNCH FOR THE SKETCHERS	LUNCH	LUNCH	
14.00	PhD colloqium 14.00-16.00 AG21, AG22, AG23 & AG24	Session 2A-D 13.00-14.40 A36, A37, A38 & ACAS	Excursion to Visualiseringscenter, Norrköping 13.00-17.00 We meet @ 13.00 at the registration desk for transport to Norrköping	
15.00		FIKA		
16.00		Session 3A-D 15.10-17.15 A36, A37, A38 & ACAS		
17.00	Informal get-together 17-ish Outside Machine Design offices			
18.00			Buss transfer to boat	
19.00		Welcome reception 18.00- Finger food and drinks @ Linköping Konsert & Kongress	Conference dinner 19.00- Boat tour on Göta kanal and lake Roxen, conference dinner on board.	

SESSION 1A - MACHINE LEARNING

15/8 @ 10.10-12.00 IN A36 CHAIR JOHAN PERSSON

Machine learning as a design material: a curated collection of exemplars for visual interaction

Danwei Tran Luciani, Martin Lindvall and Jonas Löwgren

Thinking with things that learn

Maria Luce Lupetti

Methodology for plausibility checking of structural mechanics simulations using deep learning on existing simulation data

Tobias Spruegel, Richard Rothfelder, Sebastian Bickel, Andreas Grauf, Christopher Sauer, Benjamin Schleich and Sandro Wartack

A Data Management and Visualization Tool for Integrating Optimization Results in Product Development

Athanasios Papageorgiou and Johan Ölvander

SESSION 1B - PROTOTYPING

15/8 @ 10.10-12.00 IN A37 CHAIR MICAEL DERELÖV

Augmenting Physical Prototype Activities in Early-Stage Product Development

Sampsa Matias Ilmari Kohtala, Jørgen Andreas Bogen Erichsen, Heikki Sjöman and Martin Steinert

Defining Requirements in Prototyping: The Holistic Prototype and Process Development

Stefan Schork and Eckhard Kirchner

Open ended problems - An robot programming experiment design to compare and test different development and design approaches

Achim Gerstenberg and Martin Steinert

Product Modeling Tools: Approach to a targeted Application in User-Centered Product Design

Felix Oberhofer and Thomas Maier

SESSION 1C - HEALTH

15/8 @ 10.10-12.00 IN A38 CHAIR JOHAN MALMQVIST

Complex entanglements: design-led research for infection prevention and control training tools

Alastair Macdonald

Narrative health communication: Exploring how medical comics can be designed to support children with serious illness

Inga Nedrebø Søreide, Marikken Høiseth and Anne Carlijn Vis

Applying Function-Means Tree Modelling to Personalized Medicines

Maria Siiskonen, Staffan Folestad and Johan Malmqvist

Designing for Wellbeing with Health Data Tracking – Maintaining the User Perspective in Objective Data

Thea Marcelie Togstad and Ole Andreas Alsos

SESSION 1D - DESIGN PROCESS 1

15/8 @ 10.10-12.00 IN ACAS CHAIR CLAUD THORP HANSEN

Development methods for 2030: An interpretation of the scenarios of the method application

Albert Albers, Nikola Bursac, Florian Marthaler, Andreas Siebe, Nicolas Reiss and Tobias Hirschter

Supporting distributed design teams with regard to processes, methods & tools and competencies & qualifications

Ann-Kathrin Bavendiek, Hilko Paulsen, Thomas Vietor and Simone Kauffeld

Production – as seen in product development: A theoretical review of how established product development process models address the production system

Fredrik Henriksson and Jonas Detterfelt

The Way We Design: A design process and manual for industrial product development

Patrick Kenger

SESSION 2A - VIRTUAL AND AUGMENTED REALITY

15/8 @ 13.00-14.40 IN A36 CHAIR TOBIAS LARSSON

A Review of Augmented Reality Research for Design Practice: Looking to the Future

Lorenzo Giunta, Jamie O'Hare, James Gopsill and Elies Dekoninck

A model-driven decision arena: Augmenting decision making in early design

Johan Wall, Tobias Larsson and Marco Bertoni

A study into the influence of visual prototyping methods and immersive technologies on the perception of abstract product properties

Tegan Forbes, Peter Kinnell and Yee Mey Goh

Using VR to improve design of assembly tasks and to increase efficiency in conducting the tasks

Yvonne Eriksson, Marie Sjölander and Jonas Söderberg

SESSION 2B - AFFECTIVE ENGINEERING 1

15/8 @ 13.00-14.40 IN A37 CHAIR SIMON SCHÜTTE

Making a difference: Integrating physiological and psychological needs in user description

Tina Schröppel and Sandro Wartack

An analysis of designer empathy in the early phases of design projects

Antti Surma-Aho, Tua Björklund and Katja Hölttä-Otto

Identification of haptic exploration procedures over textile surfaces with a Leap Motion Controller

Lars C. Gussen, Max Ellerich and Robert H. Schmitt

Perceived industrial usefulness of the ACD3-matrix - an interview study with product developers

Lars-Ola Bligård, Eva Simonsen and Cecilia Berlin

SESSION 2C - AGILE DEVELOPMENT

15/8 @ 13.00-14.40 IN A38 CHAIR RENEE WEVER

Agile management of systems of objectives in the development of mechatronic systems by ASD – Agile Systems Design

Albert Albers, Jonas Heimicke, Tobias Hirschter, Thilo Richter, Nicolas Reiß, Alexander Maier and Nikola Bursac

Agile Prototyping for technical systems – Towards an adaption of the Minimum Viable Product principle

Guenther Schuh, Chirstian Doelle and Sebastian Schloesser

Scaling agile practices on different time scopes for complex problem solving

Jan Breitschuh, Albert Albers, Patrick Seyb, Sophie Hohler, Jonathan Benz, Nicolas Reiß and Nikola Bursac

Challenges in Agile Universal Design of ICT

Øyvind Hjartnes and Miriam Begnum

SESSION 2D - DESIGN PROCESS 2

15/8 @ 13.00-14.40 IN ACAS CHAIR KERSTIN JOHANSEN

Risk management practices in product development companies

Jesko Schulte and Sophie I. Hallstedt

Managing Assumptions during Analysis - Study on successful Approaches of Design Engineers

Sven Matthiesen and Thomas Nelius

Target Weighing Approach: Study to evaluate the benefits of a methodical approach in comparison to classical company processes for the identification of lightweight design potentials

Sven Revfi, Albert Albers and Marcus Stegmiller

System simulation of a high-pressure storage depending on the degree of product maturity

Daniel Duschek and Michael Vielhaber

SESSION 3A - DIGITALIZATION 1

15/8 @ 15.10-17.15 IN A36 CHAIR OLA ISAKSSON

A Study on the socio-technical aspects of digitization technologies for future integrated engineering work systems

Mona Tafvizi Zavareh, Stephanie Sadaune, Carina Siedler, Klaus J. Zink and Martin Eigner

Adaptation to Internet-Based Services by Seniors in Turkey

Nisan Kuzuluk, Melike Balkaya and Güney Güner

Design challenges in promoting inclusion for cultural heritage contents through low cost technology

Sara Khan, Rameshnath Krishnasamy and Claudio Germak

Automating the design of user interfaces using artificial intelligence

Suchitra Pyarelal and Amarendra Kumar Das

Addressing Challenges for Small Firms Providing Innovative Automation Solutions for Manufacturing Industry

Marcus Tynnhammar, Kerstin Johansen and Anna Öhrwall Rönnbäck

SESSION 3B - USER CENTERED DESIGN

15/8 @ 15.10-17.15 IN A37 CHAIR MATTIAS ARVOLA

Rainmaking on Mars, a social musical instrument for the journey to Mars

Betty Zhang and Nicolas Marechal

The User Repertory Grid Technique to Crowdsourced User Research Analysis: A Mixed-Methods Approach to Creating Personas

Dimitris Stergiadis and Mattias Arvola

A Design Model Roadmap for a Multisensory Experience

Ligia Pamela Godoy Cortés, Izaias Quadros de França, Romulo Gonçalves Lins and Luciana Pereira

Towards Inclusive Service Design in the Digital Society: Current Practices and Future Recommendations

Oda Lintho Bue and Miriam Begnum

SESSION 3C - SUSTAINABILITY

15/8 @ 15.10-17.15 IN A38 CHAIR SOPHIE HALLSTEDT

Inclusion of sustainability aspects in product development – two industrial cases from Sweden

Fredrik Paulson and Erik Sundin

Evaluation of an Eco Audit tool - through an LCA of a novel car disc brake

Katja Tasala Gradin and Anna Hedlund Åström

Addressing Sustainability in Product Requirements from a Systems Perspective

Matilda Watz and Sophie I. Hallstedt

Towards Strategic Sustainable Product Development: Challenges and Opportunities for Communicating Sustainability in a Value Chain

Sze Yin Kwok and Sophie I. Hallstedt

Design to Support People's Activity Systems — A Literature Review on the Application of Activity Theory in Design Research

Wanjun Chu, Paula Steenstra, Wiktoria Glad and Renee Weaver

SESSION 3D - DESIGN PROCESS 3

15/8 @ 15.10-17.15 IN ACAS CHAIR ANDERS WARELL

Finding balance in Generative Product Design

Alex Lobos

CPM / PDD in the context of Design Thinking and Agile Development of Cyber-Physical Systems

Tobias F. Luedeke, Christian Köhler, Jan Conrad, Michael Grashiller, Andreas Sailer and Michael Vielhaber

Co-creation in Public Service Innovation: A review of how to encourage employee engagement in co-creation

Astrid Mogstad, Marikken Høiseth and Ida Nilstad Pettersen

Design for Future: Strategic Planning and Design Innovation Framework for Digital Organizations

Akhil Patel, Pratul Chandra Kalita and Shrishti Asthana

SESSION 4A - DIGITALIZATION 2

16/8 @ 08.30-10.10 IN A36 CHAIR TOBIAS LARSSON

Digitalisation, sustainability and servitisation: Consequences on product development capabilities in manufacturing firms

Ola Isaksson, Sophie I. Hallstedt, Anna Öhrwall Rönnbäck

Consistent digitalization of engineering design – an ontology-based approach

Patricia Kügler, Benjamin Schleich and Sandro Wartack

Towards Adopting Digital Twins to Support Design Reuse during Platform Concept Development

Jonas Landahl, Massimo Panarotto, Hans Johannesson, Ola Isaksson and Johan Lööf

Integration of Measurement Functions in Existing Systems – Retrofitting as Basis for Digitalization

Gunnar Vorwerk-Handing, Georg Martin and Eckhard Kirchner

SESSION 4B - PLATFORM DESIGN 1

16/8 @ 08.30-10.10 IN A37 CHAIR JOHAN ÖLVANDER

Procedural model to ensure consistency and validity of complex, variant-oriented product portfolios

Felix Braun, Matthias Kreimeyer and Kristin Paetzold

Modularisation in two Global Product Developing Companies – Current State and Future Outlook

Dag Raudberget, Samuel Andre and Fredrik Elgh

Efficient Module Design for Chassis-Mounted Components of Commercial Vehicles

Johannes Stocker, Mesut Çavusoglu, Matthias Felgenhauer and Markus Lienkamp

Automated Generation of Vehicle Architectures and Derivation of Modular Systems within the Vehicle Front

Matthias Felgenhauer and Markus Lienkamp

SESSION 4C - DESIGN THINKING

16/8 @ 08.30-10.10 IN A38 CHAIR RENEE WEVER

From team collaboration to product success - the domino effect of design thinking

Danielly de Paula, Franziska Dobrigkeit and Kathryn Cormican

Design Thinking and Systems Thinking for Cyber-Physical Systems

Didem Gurdur and Martin Törngren

Design thinking for organizations: functional guidelines

Pedro Targo Ishio Correia, Ricardo Gaspar and Romulo Lins

The Effect of Product Technology to Product Acceptance in The User Interaction of Wearable Products – An Assessment of Activity Tracker Product Designed Within The Scope of Health Benefits

Özge Ceylan Esen and Ilgım Eroglu

SESSION 4D - DESIGN EDUCATION 1

16/8 @ 08.30-10.10 IN ACAS CHAIR TERO JUUTI

The Application of Augmented Reality in Interior Design Education

Elif Gürçınar and Özge Ceylan Esen

Rapid Concept Evaluations using Modular Construction Systems

Johan A Persson and Anton Wiberg

Adding Scrum-style project management to an advanced Design Thinking class

Franziska Dobrigkeit, Molly Wilson and Claudia Nicolai

Perceived long term value of industry project-based design courses: Alumni reflections from two decades of the Product Development Project

Maria Mikkonen, Tiina Tuulos and Tua Björklund

SESSION 5A - DIGITALIZATION 3

16/8 @ 10.40-12.20 IN A36 CHAIR JOHAN PERSSON

Designing with the use of data for a better understanding of people and application domain.

Eleonora Fiore, Paolo Tamborrini and Silvia Barbero

State of the art of generative design and topology optimization and potential research needs

Evangelos Tyflopoulos, David Tollnes Flem, Martin Steinert and Anna Olsen

Studying the Technologies of Industry 4.0 with Influence on Product Development using Factor Analysis

Guenther Schuh, Christian Doelle, Christian Mattern, Marie-Christine Modler and Sebastian Schloesser

Identifying Expedient Variations in PGE – Product Generation Engineering

Simon Rapp, Georg Moeser, Philipp Eichhorn and Albert Albers

SESSION 5B - PLATFORM DESIGN 2

16/8 @ 10.40-12.20 IN A37 CHAIR JOHAN ÖLVANDER

The hunt for proper relation weights in product architecture clustering

David Williamsson, Ulf Sellgren and Anders Söderberg

Developing Key Performance Indicators for Variant Management of Complex Product Families

Michael Schmidt, Johanna Schwöbel and Markus Lienkamp

Innovation Toolkit for identification of the Optimal Module Options in Open Platform Architecture Products

Ravi K Sikhwal and Peter R N Childs

Modularisation for Construction: A Data Driven Strategy

Tanawan Wee and Marco Aurisicchio

SESSION 5C - ADDITIVE MANUFACTURING

16/8 @ 10.40-12.20 IN A38 CHAIR OLA ISAKSSON

Design for Qualification: A process for developing additive manufacturing components for critical systems

Christo Dordlofva and Peter Törlind

Function modelling and constraints replacement to support design for additive manufacturing of satellite components

Olivia Borgue, Jakob Müller, Massimo Panarotto and Ola Isaksson

Integrating additive manufacturing and repair strategies of aeroengine components in the computational multi-disciplinary engineering design process

Khalil Alhandawi, Lydia Lawand, Petter Andersson, Rebecka Brommesson, Ola Isaksson and Michael Kokkolaras

3D-printing as a Creative Modelling and Prototyping Tool

Stig Ottosson

SESSION 5D - DESIGN EDUCATION 2

16/8 @ 10.40-12.20 IN ACAS CHAIR JONAS DETTERFELT

In search of lost materiality; The case of digital modelling in Industrial Design Engineering

Philip Ekströmer and Renee Wever

OnOff: Creative Method Integration: from Physical to Digital and Back in Mechanical Engineering and Product Design

Iko Avital and Gedalya Mazor

University as a Laboratory: Exploring how engineering education can support industrial needs

Fredrik Henriksson, Kerstin Johansen and Malin Wilhelmsson

Development of Simulation Based Machine Design course

Kaur Jaakma and Panu Kiviluoma

SESSION 6A - MODEL BASED DESIGN

17/8 @ 09.50-11.30 IN A36 CHAIR JONAS DETTERFELT

Model-based design guidelines for better knowledge transfer into industrial applications

Viktoriia Butenko, Bartosz Gladysz, Marius Maurath and Albert Albers

Influencing factors and methods for knowledge transfer situations in Product Generation Engineering based on the SECI model

Albert Albers, Norbert Gronau, Simon Rapp, Marcus Grum, Alina Zaiser, Nikola Bursac and Edzard Weber

A modular design concept for a guide railing system of conveyors for beverage filling and packaging lines

Michael Wendland and Stefanie Reinhardt

How do C&C²-models improve the understanding of system behaviour in failure analysis?

Bartosz Gladysz, Tino Megner, Marcel Mayer and Albert Albers

SESSION 6B - AFFECTIVE ENGINEERING 2

17/8 @ 09.50-11.30 IN A37 CHAIR SIMON SCHÜTTE

Affective surface engineering- using soft and hard metrology to measure the Sensation and perception in surface properties

Lars Eriksson, Bengt-Göran Rosen and Martin Bergman

‘Is this wallet made of real leaves?’: A Study of Sustainable Materials’ Emotional Experiences

Fadzli Irwan Bahrudin and Marco Aurisicchio

Development of an expert software for affective product development.

Simon Schütte

Business games and creativity stimulus: the behavior of three different teams in the ideation process

Marcela Rosa, Lucas Rodrigues and Mario González

SESSION 6C - ENGINEERING DESIGN

17/8 @ 09.50-11.30 IN A38 CHAIR MICAEL DERELÖV

Potential Analysis of Smart Materials and Methodical Approach developing Adaptive Designs using Shape Memory Alloys

Andrea Hein, Daniel Holder, Jonas Maier and Thomas Maier

Methodical Evaluation of Sensor Positions for Condition Monitoring of Gears

Georg Martin, Sven Vogel, Tobias Schirra, Gunnar Vorwerk-Handing and Eckhard Kirchner

Design of a flexible chain for winch based point absorbers

Kjell Andersson, Ulf Sellgren and Anders Hagnestål

Analysis of dynamic system behaviour using sequence modelling with the C&C²-Approach – a case study on a power tool hammer mechanism

Sven Matthiesen, Andreas Wettstein and Patric Grauburger

SESSION 6D - INNOVATION

17/8 @ 09.50-11.30 IN ACAS CHAIR ANNA ÖHRWALL RÖNNBÄCK

Evaluating the value and costs of technology in the manufacturing industry

Janne Mämmelä, Tero Juuti, Tuomas Korhonen, Pasi Julkunen, Timo Lehtonen, Jarkko Pakkanen and Mikko Vanhatalo

Evidence of Lead Users in Past Innovations

Niko Lappalainen and Katja Hölttä-Otto

Healthcloud - Participatory design of user interfaces for senior people's active aging

Jörgen Normark, Åsa Wikberg-Nilsson, Cecilia Björklund and Sari-Anne Wiklund-Axelsson

Creative Space in a Digital Context – a Critical Evaluation

Silje Helene Aschehoug, Kjersti Øverbø Schulte and Inger Gamme

REVIEWERS

Stergios Adamopoulos, Linnaeus University, Sweden
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