



ICED 11 København

THE 18TH INTERNATIONAL CONFERENCE
ON ENGINEERING DESIGN

15th-18th August 2011
Technical University of Denmark (DTU)
Copenhagen, Denmark

Organised By

Section for Engineering Design and Product Development
Department of Management Engineering at DTU
and the Design Society

Proceedings Volume DS68-8
IMPACTING SOCIETY THROUGH ENGINEERING DESIGN
VOLUME 8: DESIGN EDUCATION

Edited By

Steve Culley
Ben Hicks
Tim McAlloone
Thomas Howard
Bill Ion

Published by the Design Society

First published in 2011

This publication is copyright under the Berne Convention and the International Copyright Convention. All rights reserved. Apart from any fair dealing for the purpose of private study, research, criticism or review, as permitted under the Copyright, Designs and Patents Act of 1988, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, electrical, chemical, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owners. Unlicensed multiple copying of the contents of this publication is illegal. Inquiries should be addressed to the Design Society.

© 2011 The Design Society, unless otherwise stated.

The Design Society is a charitable body, registered in Scotland, number SC 031694

ISBN 978-1-904670-28-5, 346 pages.

Printed by Lightning Source, Inc., La Vergne, TN, USA
and by Lightning Source UK Ltd., Milton Keynes, UK

The publishers are not responsible for any statement made in this publication. Data, discussion, and conclusions developed by authors are for information only and are not intended for use without independent substantiating investigation on the part of potential users. Opinions expressed are those of the Author and not necessarily those of the Design Society.

Preface by the Programme Chair

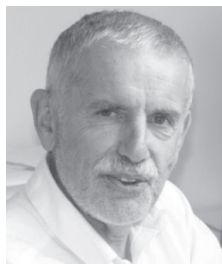
Welcome to the ICED11 Proceedings!

A large team of individuals working together are responsible for the selection of the 416 papers being presented here at ICED11, the establishment of the themes, sessions and the creation of the podium and discussion activities. This team consists of the programme chairs, the theme chairs and their assistants, and last but by no means least the reviewers. In particular, the written comments of the reviewers have been critical to the programme team in making their final choices and grouping papers into the conference themes.

The papers have been collated into a multiple range of formats: a book of abstracts, a memory stick of full proceedings and ten volumes of proceedings, available via a print-on-demand supplier. These have been numbered against both Design Society and ISSN referencing. This will enable more extensive access, referencing and citation in the future.

For ICED11 there is no difference in prestige between the papers in podium and discussion sessions. All have passed the ICED quality threshold and papers in the discussion sessions have been selected and grouped to stimulate fundamental and exciting debate. To facilitate this we have put in place a new 5 x 5 format – 5 slides in 5 minutes. We are also introducing a number of techniques to encourage audience participation and for the first time we are trialling live minutes – so as to provide a record of the debates. Further to this, recorded interviews with all the theme chairs will be undertaken on the final day of the conference so that there is also a persistent summary of each theme following the conference. The records from the discussion sessions will be made available at the conference and also uploaded to the DS website alongside the interviews with the theme chairs.

So we hope that you enjoy the programme and participate fully in what is arguably the Premier engineering design research conference in the world. We also hope that you find time to enjoy Copenhagen, catch up with old friends and make some new ones.



A handwritten signature in black ink that reads "Steve Culley".

Steve Culley
Programme Chair



A handwritten signature in black ink that reads "Ben Hicks".

Ben Hicks
Assistant Programme Chair

Preface by the Conference Chair

With these, the proceedings of the eighteenth International Conference on Engineering Design, ICED11, it can safely be stated that engineering design research is firmly established as a strong research discipline. In its 30 year history this is the first time that an ICED conference has returned to the same city, “Wonderful Copenhagen”. In the Danish official ‘Year of Design’ the city is the perfect conference location, hosting the highest quality design, ranging from industrial design, through stunning architecture, to a dynamic engineering design industry, which has extensively backed the ICED11 conference.

As design researchers, design practice is our research object and industrial companies are our research laboratories. Based on our observations, discussions and participation in design activities, we gather knowledge and insights and crystallise these into both academic models and practical methods. Our customers are students, in training as the product developers and innovators of the future, and industrialists, engaging with us to get insight into tools and methods, which fit to their practices and empower them to meet the challenges of global competition.

The theme we have chosen for ICED11 is Impacting Society through Engineering Design. Design has a central role in bringing engineering and technology to practical use. Each of the 416 papers in these proceedings provides its own contribution to the ICED11 theme. We’re delighted to see the variety and the quality of contributions that our colleagues from the design research community have contributed to ICED11.

We have taken great care to create a conference showing leading edge research into engineering design and product development practice and to provide a lively backdrop for knowledge exchange and research discussion.

Our goals with ICED11 have been to place particular emphasis on industry participation, provocative and relevant keynote speeches, maximum time for debate and discussion, and space to go in to depth, via the SIG workshops. And all this with a Danish flavour, which we hope you find welcoming, fun and “hyggelig”!

Welcome to ICED11!



A handwritten signature in black ink that reads "Tim McAlone".

Tim McAlone
Conference Chair



A handwritten signature in black ink that reads "Tom Howard".

Tom Howard
Assistant Conference Chair

Preface by the Design Society President

The International Conference on Engineering Design (ICED) is the flagship conference of the Design Society, a Society created in 2001, on the foundations laid by Workshop Design-Konstruktion (WDK), to promote the development of the understanding of all aspects of design. The ICED conferences were inaugurated in 1981 in Rome, and with one extra conference have been held every two years since then, in fifteen countries of the world. Thirteen conferences were held under the auspices of WDK, and this is the fifth organised by the Design Society. It is also the first time that ICED has returned to a city in which the conference has been held before – Copenhagen was the second host city in 1983, and this revisit is most appropriate in view of the leading role that the city and its technical university have played in design research and practice over many years.

The 2011 Conference continues the format established in 2009, with a programme made up of plenary sessions, podium presentations, discussion sessions with focused debate and workshops led by the Design Society's Special Interest Groups. We hope that this varied programme, combined with extensive opportunities for networking, will provide an exciting opportunity for researchers and practitioners to learn about the latest developments in engineering design.

Organising an international conference takes an enormous amount of work, and I would like to express the thanks of the Society to the great team that has worked over many months to ensure the success of the Conference. Especially I would like to thank Tim McAloone, Tom Howard and colleagues at the Technical University of Denmark for their great work in the Organising Committee, and Steve Culley, Ben Hicks and the Programme Committee for bringing together such an excellent programme. Of course, their work would be in vain without the fantastic contributions of the authors, reviewers, theme chairs and session chairs, and the thanks of the Society are due to all of them.



A handwritten signature in black ink, which appears to read 'Chris McMahon'.

Chris McMahon
Design Society President

ICED11 Design Society Programme Committee

Stephen Culley - Programme Chair
University of Bath, United Kingdom

Ben Hicks - Assistant Programme Chair
University of Bath, United Kingdom

Thomas Howard - Organising Committee Representative
Technical University of Denmark, Denmark

Udo Lindemann - Design Society Representative
Technical University of Munich, Germany

Tim McAloone - Organising Committee Representative
Technical University of Denmark, Denmark

Margareta Norell - Design Society Representative
KTH Royal Institute of Technology, Sweden

Martin Grimheden – Design Society Representative
KTH Royal Institute of Technology, Sweden

ICED11 Organising Team

Tim McAloone – Technical University of Denmark, Denmark
Thomas Howard – Technical University of Denmark, Denmark
Sofiane Achiche – Technical University of Denmark, Denmark
Saeema Ahmed-Kristensen – Technical University of Denmark, Denmark
Mogens Myrup Andreasen – Technical University of Denmark, Denmark
Per Boelskifte – Technical University of Denmark, Denmark
Hans Peter Lomholt Bruun – Technical University of Denmark, Denmark
Georg Christensen – Technical University of Denmark, Denmark
Claus Thorp Hansen – Technical University of Denmark, Denmark
Anja Maier – Technical University of Denmark, Denmark
Krestine Mouggaard – Technical University of Denmark, Denmark
Birna S. Colbe Månsson – Technical University of Denmark, Denmark
John Restrepo – Technical University of Denmark, Denmark
Hamish McAlpine – University of Bath, United Kingdom

ICED11 Theme Chairs

John Clarkson and David Wynn, Design Processes
Yoram Reich, Design Theory and Research Methodology
Marco Cantamessa, Design Organisation and Management
Udo Lindemann, Product and Systems Design
Andy Dong, Design Methods and Tools
Johan Malmkvist, Lars Almfelt and Andreas Dagman, Design for X,
Design to X
Wei Chen and Harrison Kim, Design Information and Knowledge
Petra Badke-Schaub, Human Behaviour in Design
Bill Ion, Design Education

ICED11 Scientific Committee

- Aakjaer Jensen, Thomas – Universe Foundation, Denmark
- Achiche, Sofiane – Technical University of Denmark, Denmark
- Adams, Robin – Purdue University, United States
- Ahm, Thorkild – IPU, Denmark
- Albers, Albert – Karlsruher Institute of Technology (KIT), Germany
- Almefelt, Lars – Chalmers, Sweden
- Anderl, Reiner – Technische Universität Darmstadt, Germany
- Andersson, Kjell – KTH Royal Institute of Technology, Sweden
- Andrade, Ronaldo – Universidade Federal do Rio de Janeiro, Brazil
- Andreasen, Mogens Myrup – Technical University of Denmark, Denmark
- Antonsson, Erik – California Institute of Technology, United States
- Aoussat, Ameziane – Ecole Nationale Supérieure des Arts et Métiers, France
- Arai, Eiji – Osaka University, Japan
- Arlbjorn, Jan – University of Southern Denmark, Denmark
- Auricchio, Marco – Imperial College London, United Kingdom
- Badke-Schaub, Petra – TU DELFT, Netherlands
- Bathelt, Jens – Eidgenössische Technische Hochschule Zuerich, Switzerland
- Ben-Ahmed, Walid – RENAULT, France
- Bey, Niki – DTU Management Engineering, Denmark
- Bhamra, Tracy – Loughborough University, United Kingdom
- Bigand, Michel – Ecole Centrale de Lille, France
- Binder, Thomas – the Danish Design School, Denmark
- Birkhofer, Herbert – Darmstadt University of Technology, Germany
- Björnemo, Robert – Lund University, Sweden
- Björk, Eva-Stina – NHV Nordic School of Public Health, Sweden
- Blanco, Eric – Grenoble INP, France
- Blessing, Lucienne T.M. – University of Luxembourg, Luxembourg
- Blount, Gordon – Coventry University, United Kingdom
- Boelskifte, Per – DTU - Technical University of Denmark, Denmark
- Bohemia, Erik – Northumbria University, United Kingdom
- Bojčević, Nenad – University of Zagreb, Croatia
- Boks, Casper – Norwegian University of Science and Technology, Norway
- Bolognini, Francesca – University of Cambridge, United Kingdom
- Bonjour, Eric – FEMTO-ST Institute, France
- Booker, Julian David – University of Bristol, United Kingdom
- Borg, Jonathan C. – University of Malta, Malta
- Boujut, Jean-François – Grenoble Institute of Technology, France
- Bouwhuis, Dominic G – University of Technology Eindhoven, Netherlands
- Bracewell, Robert Henry – Cambridge University, United Kingdom
- Brandt, Eva – The Danish Design School, Denmark
- Brissaud, Daniel – Université de Grenoble, France
- Broberg, Ole – Technical University of Denmark, Denmark
- Brown, David C. – WPI, United States
- Bruun, Hans Peter Lomholt – DTU, Denmark
- Buch, Anders – DTU-Management, Denmark
- Burchardt, Carsten – Siemens Industry Software GmbH & Co, KG, Germany
- Burvill, Colin Reginald – The University of Melbourne, Australia
- Bylund, Nicklas – Sandvik Coromant, Sweden
- Cagan, Jonathan – Carnegie Mellon University, United States
- Caillaud, Emmanuel – Université de Strasbourg, France
- Campbell, Matthew Ira – University of Texas at Austin, United States
- Cantamessa, Marco – Politecnico di Torino, Italy
- Cardoso, Carlos Coimbra – Delft University of Technology, Netherlands
- Casakin, Hernan – Ariel University Center, Israel
- Cash, Philip – University of Bath, United Kingdom
- Chakrabarti, Amaresh – Indian Institute of Science, India
- Chamakiotis, Petros – University of Bath, United Kingdom
- Chen, Wei – Northwestern University, United States

ICED11 Scientific Committee cont.

- Childs, Peter R.N. – Imperial College London, United Kingdom
- Chirone, Emilio – Università di Brescia, Italy
- Christensen, Bo – Copenhagen Business School, Denmark
- Clarkson, Peter John – University of Cambridge, United Kingdom
- Claudio, Dell’Era – Politecnico di Milano, Italy
- Clausen, Christian – Technical University of Denmark, Denmark
- Coatanea, Eric – Aalto University, Finland
- Cormican, Kathryn – National University of Ireland, Galway, Ireland
- Coutellier, Daniel – Université de Valenciennes, France
- Culley, Steve – University of Bath, United Kingdom
- Cutting-Decelle, Anne-Françoise – Ecole Centrale Paris, France
- Dankwort, C. Werner – University of Kaiserslautern, Germany
- Darlington, Mansur – University of Bath, United Kingdom
- Darses, Françoise – CNRS-LIMSI, France
- de Vere, Ian James – Swinburne University of Technology, Australia
- de Weck, Olivier Ladislav – MIT, United States
- Deans, Joe – The University of Auckland, New Zealand
- Dekoninck, Elies Ann – University of Bath, United Kingdom
- Dong, Andy – The University of Sydney, Australia
- Donndelinger, Joseph A. – General Motors LLC, United States
- Dorst, Kees – UTS, Australia
- Drejer, Anders – Aalborg University, Denmark
- Duffy, Alex – University of Strathclyde, United Kingdom
- Duhovnik, Joe – University of Ljubljana, Slovenia
- Eckert, Claudia – The Open University, United Kingdom
- Eder, Ernst – Royal Military College of Canada (retired), Canada
- Eigner, Martin – University of Kaiserslautern, Germany
- Ekman, Kalevi – Aalto University, Finland
- Ellman, Asko – Tampere University of Technology, Finland
- Elspass, Wilfried J. – ZHAW, Switzerland
- Eppinger, Steven – Massachusetts Institute of Technology, United States
- Eri, Özgür – Franklin W. Olin College of Engineering, United States
- Evans, Steve – Cranfield University, United Kingdom
- Fadel, Georges M. – Clemson University, United States
- Fan, Ip-Shing – Cranfield University, United Kingdom
- Fan, Zhun – Technical University of Denmark, Denmark
- Fargnoli, Mario – University of Rome “La Sapienza”, Italy
- Finger, Susan – Carnegie Mellon University, United States
- Fischer, Xavier – ESTIA, France
- Fortin, Clement – CRIAQ, Canada
- Frankenberger, Eckart – Airbus, Germany
- Frise, Peter R. – University of Windsor, Canada
- Fujita, Kikuo – Osaka University, Japan
- Fukuda, Shuichi – Stanford University, United States
- Galle, Per – The Danish Design School, Denmark
- Gardoni, Mickael – ÉTS / INSA de Strasbourg, Canada
- Gausemeier, Jürgen – Heinz Nixdorf Institute, Germany
- Gerhard, Detlef – Vienna University of Technology, Austria
- Gericke, Kilian – University of Luxembourg, Luxembourg
- Gero, John – Krasnow Institute for Advanced Study, United States
- Gerson, Philips M. – Hanze University Groningen, Netherlands
- Gertsen, Frank – Aalborg University, Denmark
- Giess, Matt – Université de Technologie de Compiègne, United Kingdom
- Girard, Philippe – University Bordeaux, France
- Gogu, Grigore – Institut Français de Mécanique Avancée, France
- Goh, Yee Mey – Loughborough University, United Kingdom
- Goker, Mehmet H. – Salesforce.com, United States
- Goldschmidt, Gabriela – Technion - Israel Institute of Technology, Israel

Gomes, Samuel – Belfort-Montbeliard University of Technology, France

Graessler, Iris – Robert Bosch GmbH, Germany

Green, Graham – University of Glasgow, United Kingdom

Gries, Bruno – Capgemini Consulting, Germany

Grimheden, Martin – KTH Machine Design, Sweden

Grote, Karl-Heinrich – Otto-von-Guericke-University Magdeburg, Germany

Grubiši, Izvor – University of Zagreb, Croatia

Gunn, Wendy – SPIRE, Denmark

Gurumoorthy, Balan – Indian Institute of Science, India

Gzara, Lilia – Grenoble Institute of Technology, France

Hadj-Hamou, Khaled – Institut National Polytechnique de Grenoble, France

Hagelskjaer Lauridsen, Erik – Technical University of Denmark, Denmark

Hales, Crispin – Hales & Gooch Ltd., United States

Hansen, Claus Thorp – Technical University of Denmark, Denmark

Hansen, Poul Kyvsgaard – Aalborg Universitet, Denmark

Hansen, Zaza Nadja Lee – The Technical University of Denmark, Denmark

Hansen, Christian Lindschou – DTU, Denmark

Hatchuel, Armand – Mines Paris Tech, France

Hein, Lars – IPU, Denmark

Helten, Katharina – TU München, Germany

Hemphälä, Jens – KTH Royal Institute of Technology, Sweden

Henderson, Mark Richard – Arizona State University, United States

Hicks, Ben – University of Bath, United Kingdom

Hohne, Gunter – Technische Universität Ilmenau, Germany

Holliger, Christoph – University of Applied Sciences Northwestern Switzerland, Switzerland

Horvath, Imre – Delft University of Technology, Netherlands

Hosnedl, Stanislav – University of West Bohemia, Czech Republic

Howard, Thomas James – Technical University of Denmark, Denmark

Hsuan, Juliana – Copenhagen Business School, Denmark

Huet, Greg – Ecole Polytechnique Montreal, Canada

Ijomah, Winifred – University of Strathclyde, United Kingdom

Ilies, Horea – University of Connecticut, United States

Ion, William – University of Strathclyde, United Kingdom

Isaksson, Karl Ola – Luleå tekniska universitet, Sweden

Jackson, Mats – Malardalen University, Sweden

Jelaska, Damir – University of Split, Croatia

Jensen, Torben Elgaard – Technical University of Denmark, Denmark

Jensen, Ole Kjeldal – Technical University of Denmark, Denmark

Johannesson, Hans – Chalmers, Sweden

Johansson, Glenn – School of Engineering, Jönköping University, Sweden

Jorgensen, Ulrik – Technical University of Denmark, Denmark

Jun, Thomas – Loughborough University, United Kingdom

Kannengiesser, Udo – NICTA, Australia

Karlsson, Lennart – Luleå University of Technology, Sweden

Keates, Simeon – IT University of Copenhagen, Denmark

Keldmann, Troels – Keldmann Healthcare A/S, Denmark

Kim, Harrison – University of Illinois at Urbana-Champaign, United States

Kim, Yong Se – Creative Design Institute, Sungkyunkwan University, SK

Kiryama, Takashi – Tokyo University of the Arts, Japan

Kokkolaras, Michael – University of Michigan, United States

Kotzab, Herbert – CBS, Denmark

Kovacevic, Ahmed – City University London, United Kingdom

Kreimeyer, Matthias – MAN Truck & Bus AG, Germany

Kreye, Melanie E – University of Bath, United Kingdom

Krishnamurty, Sundar – University of Massachusetts-Amherst, USA

Kristensen, Tore – Copenhagen Business School, Denmark

Krus, Petter – Linköping University, Sweden

Kuosmanen, Petri – Aalto University/School of Engineering, Finland

Ladeby, Klaes – Technical University of Denmark, Denmark

ICED11 Scientific Committee cont.

- Larsson, Andreas – Lund University, Sweden
Larsson, Tobias C. – Blekinge Institute of Technology, Sweden
Le Masson, Pascal – Mines Paris Tech, France
Leary, Martin John – RMIT university, Australia
Lee, SeungHee – University of Tsukuba, Japan
Legardeur, Jeremy – ESTIA, France
Lenau, Torben – Technical University of Denmark, Denmark
Levy, Pierre Denis – Eindhoven University of Technology, Netherlands
Lilly, Blaine – Ohio State University, United States
Lindahl, Mattias – Linköping University, Sweden
Lindemann, Udo – TUM, Germany
Lloveras, Joaquim – Technical University of Catalonia, Spain
Mabogunje, Ade – Stanford University, United States
MacGregor, Steven – IESE Business School, Spain
Maher, Mary – University of Maryland, United States
Maier, Anja Martina – Technical University of Denmark, Denmark
Maier, Jonathan – Clemson University, United States
Malmqvist, Johan Lars – Chalmers University of Technology, Sweden
Manfredi, Enrico – University of Pisa, Italy
Marini, Vinicius Kaster – Technical University of Denmark, Denmark
Marjanovic, Dorian – University of Zagreb Faculty of Mechanical Engineering and Naval Architecture, Croatia
Marle, Franck – Ecole Centrale Paris, France
Matta, Nada – Université de Technologie de Troyes, France
Matthews, Jason – University of Glamorgan, United Kingdom
Matzen, Detlef – University of Southern Denmark, Denmark
Maurer, Maik – Technische Universität München, Germany
McAloone, Tim C. – Technical University of Denmark, Denmark
McAlpine, Hamish Charles – University of Bath, United Kingdom
McKay, Alison – University of Leeds, United Kingdom
McMahon, Christopher Alan – University of Bath, United Kingdom
Medland, Anthony – University of Bath, United Kingdom
Meerkamm, Harald – University Erlangen-Nuremberg, Germany
Mekhilef, Mounib – University of Orléans, France
Merlo, Christophe – ESTIA, France
Millet, Dominique – SUPMECA Toulon, France
Mocko, Gregory Michael – Clemson University, United States
Moehringer, Stefan – Simon Moehringer Anlagenbau GmbH, Germany
Moes, Niels – Delft University of Technology, Netherlands
Montagna, Francesca – Politecnico di Torino, Italy
Mortensen, Niels Henrik – Technical University of Denmark, Denmark
Mulet, Elena – Universitat Jaume, Spain
Mullineux, Glen – University of Bath, United Kingdom
Munk, Lone – Novo Nordisk A/S, Denmark
Murakami, Tamotsu – University of Tokyo, Japan
Nadeau, Jean-Pierre – Ecole Nationale Supérieure des Arts et Métiers de Bordeaux, France
Nagai, Yukari – JAIST, Japan
Neugebauer, Line – DTU, Denmark
Newnes, Linda – University of Bath, United Kingdom
Nielsen, Teit Anton – DTU, Denmark
Nielsen, Ole Fiil – Worm Development, Denmark
Norell Bergendahl, Margareta E B – KTH, Sweden
Öhrwall Rönnbäck, Anna B – Linköping University, Sweden
Olesen, Jesper – Bang & Olufsen, Denmark
Olsson, Annika – Lund University, Sweden
Ölundh Sandström, Gunilla – KTH, The Royal Institute of Technology, Stockholm, Sweden
Otto, Kevin Norbert – RSS, United States
Ottosson, Stig – Tervix, Sweden
Ouertani, Mohamed Zied – Cambridge University, United Kingdom
Ovtcharova, Jivka – Karlsruhe Institute of Technology (KIT), Germany

Ozkil, Ali Gurcan – dtu, Denmark
Paetzold, Kristin – University Bundeswehr
Munich, Germany
Papalambros, Panos Y. – University of Michigan,
United States
Paredis, Chris – Georgia Tech, United States
Pavkovic, Neven – University of Zagreb, Croatia
Pedersen, Rasmus – Worm Development,
Denmark
Petiot, Jean-François – Ecole Centrale Nantes,
France
Ploug, Ole – Hydro Aluminium, Denmark
Prasad, Brian – Parker Aerospace, United States
Pulm, Udo – BMW, Germany
Raine, John – AUT University, New Zealand
Ramani, Karthik – Purdue University, United
States
Ramirez, Mariano – University of New South
Wales, Australia
Randmaa, Merili – Tallinn University of
Technology, Estonia
Ray, Pascal – Institut Français de Mécanique
Avancee, France
Reich, Yoram – Tel Aviv University, Israel
Reidsema, Carl – University of Queensland,
Australia
Remmen, Arne Remmen – Aalborg University,
Denmark
Restrepo, John – Technical University of
Denmark, Denmark
Riel, Andreas – EMIRAcle and Grenoble Institute
of Technology, France
Riitahuhta, Asko Olavi – Tampere University of
Technology, Finland
Rinderle, James – University of Massachusetts,
United States
Ritzén, Sofia – KTH, Sweden
Roth, Bernard – Stanford University, United
States
Roucoules, Lionel – Arts et Métiers ParisTech,
France
Rovida, Edoardo – Politecnico di Milano, Italy
Štorga, Mario – University of Zagreb, Faculty of
Mechanical Engineering and Naval
Architecture, Croatia
Sachse, Pierre – University of Innsbruck, Austria
Sagot, Jean-Claude – Université Technologique
de Belfort Montbéliard, France
Sakao, Tomohiko – Linköping University,
Sweden
Salehi, Vahid – University of Bath, United
Kingdom
Salustri, Filippo Arnaldo – Ryerson University,
Canada
Schabacker, Michael – Otto-von-Guericke
University Magdeburg, Germany
Schaub, Harald – IABG, Germany
Seering, Warren – Massachusetts Institute of
Technology, United States
Setchi, Rossi – Cardiff University, United
Kingdom
Shah, Jami – Arizona State U, Tempe, United
States
Shea, Kristina – Technische Universität
München, Germany
Shimomura, Yoshiki – Tokyo Metropolitan
University, Japan
Shu, L.H. – University of Toronto, Canada
Siadat, Ali – Arts et Métiers ParisTech, France
Sigurjónsson, Jóhannes B. – NTNU, Norwegian
University of Science And Technology,
Norway
Simmons, John – Heriot-Watt University, United
Kingdom
Simpson, Timothy W. – Penn State University,
United States
Snider, Chris – University of Bath, United
Kingdom
Stal-Le Cardinal, Julie – Ecole Centrale Paris,
France
Stankovic, Tino – University of Zagreb, Croatia
Stark, Rainer G. – Berlin Institute of Technology,
Germany
Stören, Sigurd – Norwegian University of
Science and Technology, Norway
Subrahmanian, Eswaran – Carnegie Mellon and
Center for Science Technology & Policy, India
Summers, Joshua – Clemson University, United
States
Sundin, Erik – Linköping University, Sweden
Sunnersjö, Staffan – Jonköping University,
Sweden
Söderberg, Rikard – Chalmers, Sweden
Takai, Shun – Missouri University of Science and
Technology, United States
Tan, Ah Kat – Ngee Ann Polytechnic, Singapore,
Singapore
Tan, Adrian – BIO Intelligence Service, France
Taura, Toshiharu – Kobe University, Japan
Tegel, Oliver – Dr.Ing. h.c. F. Porsche AG,
Germany
Thallemer, Axel – Universitaet fuer industrielle
und kuenstlerische Gestaltung, Austria

ICED11 Scientific Committee cont.

- Thurston, Deborah Lee – University of Illinois, United States
- Tichkiewitch, Serge – Grenoble INP, France
- Tollenaere, Michel – Institut Polytechnique de Grenoble, France
- Tomiyaama, Tetsuo – TU Delft, Netherlands
- Torry-Smith, Jonas Mørkeberg – Technical University of Denmark, Denmark
- Troussier, Nadege – Université de Technologie de Compiègne, France
- Törlind, Peter – Luleå University of Technology, Sweden
- Udiljak, Toma – University of Zagreb, Croatia
- Uflacker, Matthias – Hasso Plattner Institute, Germany
- Ullman, David – Robust Decisions Inc, United States
- Vajna, Sandor – Otto-von-Guericke Magdeburg, Germany
- Valderrama Pineda, Andres Felipe – Technical University of Denmark, Denmark
- Vance, Judy M. – Iowa State University, United States
- Vaneker, Tom Henricus Jozef – University of Twente, Netherlands
- Vermaas, Pieter – Delft University of Technology, Netherlands
- Visser, Willemien – CNRS-INRIA, France
- Vukic, Fedja – University of Zagreb, Croatia
- Wallace, Ken – University of Cambridge, United Kingdom
- Wartzack, Sandro – Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany
- Weber, Christian – Ilmenau University of Technology, Germany
- Weil, Benoit – MinesParisTech, France
- Weiss, Menachem – TECHNION, Israel
- Whitfield, Robert Ian – University of Strathclyde, United Kingdom
- Whitney, Daniel E – MIT, United States
- Wikander, Jan – KTH Royal Institute of Technology, Sweden
- Wood, Kristin Lee – The University of Texas, United States
- Wynn, David C – University of Cambridge, United Kingdom
- Wörösch, Michael – DTU Management, Denmark
- Yan, Xiu – University of Strathclyde, United Kingdom
- Yang, Maria – MIT, United States
- Yannou, Bernard – Ecole Centrale Paris, France
- Youn, Byeng D. – Seoul National University, South Korea
- Young, Robert – Loughborough University, United Kingdom
- Yuen, Matthew – Hong Kong University of Science and Technology, China
- Žavbi, Roman – University of Ljubljana, Slovenia
- Zeiler, Wim – Technical University Eindhoven, Netherlands
- Zissimos, Mourelatos – Oakland University, United States

Table of Contents

Preface by the Program Chair	i
Preface by the Conference Chair	ii
Preface by the Design Society President	iii
ICED11 Design Society Programme Committee	v
ICED11 Organising Team	v
ICED11 Theme Chairs	vi
ICED11 Scientific Committee	vii
VOLUME 1: DESIGN PROCESSES	
Monitoring a Property Based Product Development – from Requirements to a Mature Product <i>Hartmut Krehmer, Harald Meerkamm, Sandro Wartzack</i>	1-1
Item Life Cycles in Product Data Management: A Case Study on How to Implement a Design Data Validation Process <i>Bertrand Nicquevert, Jean-François Boujut</i>	1-12
Process Optimization by DSM-Based Modelling of Inputs and Outputs <i>Maik Maurer</i>	1-24
Morphological Analysis of a Sustainable School Design <i>Wim Zeiler</i>	1-35
Enabling Set-Based Concurrent Engineering in Traditional Product Development <i>Dag Raudberget</i>	1-45
Generic Model of The Early Phase of An Innovation Process Regarding Different Degrees Of Product Novelty <i>Robert Orawski, Jan Krollmann, Markus Mörtl und Udo Lindemann</i>	1-57
Bayesian Project Monitoring <i>Peter C Matthews And Alex D M Philip</i>	1-69
User Centered Design in The Wild <i>Stompff G., Henze L.A.R., Jong, F. De , Vliembergen E. Van, Stappers P.J., Smulders F.E.H.M., Buijs J.A.</i>	1-79
Integrated Process and Product Model for The Evaluation of Product Properties <i>Christoph Westphal, Sandro Wartzack</i>	1-91
Product Development Processes in Small and Middle-Sized Enterprises – Identification and Elimination of Inefficiency caused by Product Variety <i>Katharina G. M. Eben, Katharina Helten, Udo Lindemann</i>	1-101
Neutral Description and Exchange of Design Computational Workflows <i>Gondhalekar A. C., Guenov M. D.1, Wenzel H. , Nunez M.1, Balachandran L. K.1</i>	1-113
ICED11	ix

Decision Based Variable Mechatronic Design Processes <i>Peter Hehenberger, Babak Farrokhzad, Florian Poltschak</i>	1-122
Using Simulation to Support Process Integration and Automation of the Early Stages of Aerospace Design <i>Warren Kerley, Gareth Armstrong, Carla Pepe, Michael Moss, P John Clarkson</i>	1-134
Study on The Introduction of Design Management in The Product Development Process of Brazilian Clothing Companies <i>Graziela Kauling, Maurício Bernardes</i>	1-147
Lean Product Development: Hype Or Sustainable New Paradigm? <i>Amer Catió, Michael Vielhaber</i>	1-157
Structured Concept Development with Parameter Analysis <i>Ehud Kroll</i>	1-169
Creating Value through Lean Product Development – Applying Lean Principles <i>Jörgen Furuholm, Håkan Swan, Johan Tingström</i>	1-180
What are the Characteristics of Engineering Design Processes? <i>Anja M Maier, Harald Störrle</i>	1-188
Empirical Verifications of Some Radical Innovation Design Principles onto the Quality of Innovative Designs <i>Bernard Yannou, Marija Jankovic, Yann Leroy</i>	1-199
Decision-Making in Disruptive Innovation Projects: A Value Approach <i>F. Petetin, G. Bertoluci, J. C. Bocquet</i>	1-211
A Comparison of Evolutionary and Revolutionary Approaches in Mechatronic Design <i>Ralf Stetter, Stefan Möhringer, Udo Pulm</i>	1-221
Consideration of Goal Interrelations in Lifecycle-Oriented Product Planning <i>Clemens Hepperle, Armin Förg, Markus Mörtl And Udo Lindemann</i>	1-233
Rules for Implementating Dynamic Changes in DSM-Based Plans <i>Arie Karniel, Yoram Reich</i>	1-243
Analysis Of Created Representations Of The Design Object During The Problem Solving Process <i>Albert Albers And Aaron Wiedner</i>	1-256
Influence of Design Evaluations on Decision-Making and Feedback During Concept Development <i>Vinicius Kaster Marini, Saeema Ahmed-Kristensen And John Restrepo</i>	1-266
A Mechatronic Case Study Highlighting the Need for Re-Thinking The Design Approach <i>Jonas Mørkeberg Torry-Smith, Niels Henrik Mortensen</i>	1-276
Design Support Tools for Product-Service Systems <i>Yong Se Kim, Sang Won Lee, Jee-Hyong Lee, Dae Man Han And Hye Kyung Lee</i>	1-288
Design Process Automation – A Structured Product Description by Properties and Development of Optimization Algorithms <i>Sebastian Gramlich, Herbert Birkhofer And Andrea Bohn</i>	1-299
Solving Global Problems using Collaborative Design Processes <i>Torben Lenau, Christina Okai Mejborn</i>	1-310

Lean Approach to Integrate Collaborative Product Development Processes And Digital Engineering Systems <i>Thomas Vosgien, Marija Jankovic, Benoit Eynard, Thomas Nguyen Van, Jean-Claude Bocquet</i>	1-321
An Empirical Evaluation of a Framework for Design for Variety and Novelty <i>Srinivasan V, Amaresh Chakrabarti</i>	1-334
Indicating the Criticality of Changes During the Product Life Cycle <i>Florian G. H. Behncke, Udo Lindemann</i>	1-344
Characterizing the Dynamics of Design Change <i>Afreen Siddiqi, Olivier L. De Weck, Bob Robinson, Rene Keller</i>	1-355
The Influence of A Company's Strategy on Creativity and Project Results in An NPD – Case Study <i>Nikola Vukšinovi, Nuša Fain, Jože Duhovnik</i>	1-366
When Sensemaking Meets Resource Allocation: An Exploratory Study of Ambiguous Ideas in Project Portfolio Management <i>Ernesto Gutiérrez</i>	1-373
The Continuous “Fuzzy Front End” as a Part of The Innovation Process <i>Milan Stevanović, Dorian Marjanović</i>	1-383
Comparisons of Design Methodologies and Process Models across Disciplines: A Literature Review <i>Kilian Gericke, Lucienne Blessing</i>	1-393
A Framework for Developing Viable Design Methodologies for Industry <i>Timo Lehtonen, Tero Juuti, Hannu Oja, Seppo Suistoranta, Antti Pulkkinen, Asko Riitahuhta</i>	1-405
Development of A Framework for Improving Engineering Processes <i>Carla Pepe, Daniel Whitney, Elsa Henriques, Rob Farndon, Michael Moss</i>	1-417
Coping With Deviation And Decision-Making <i>Joakim Eriksson, Anette Brannemo</i>	1-429
Ensuring the Integration of Performance and Quality Standards in Design Process Management: Codesteer Methodology <i>Aurélien Poulet, Bertrand Rose, Emmanuel Caillaud</i>	1-441
Engaging Actors in Co-Designing Heterogeneous Innovations <i>Ulrik Jørgensen, Hanne Lindegaard And Tanja Rosenqvist</i>	1-453
Capturing Interactions in Design Preferences: A Colorful Study <i>Hannah Turner, Seth Orsborn</i>	1-465
Re-Conceptualising Value in The Engineering Design Process: The Value Cycle Map <i>Ghadir I. Siyam, David C. Wynn, P. John Clarkson</i>	1-475
Facing the Open Innovation Dilemma – Structuring Input at the Company's Border <i>Andreas Kain, Rafael Kirschner, Alexander Lang, Udo Lindemann</i>	1-487
Integrated System and Context Modeling of Iterations and Changes in Development Processes <i>Stefan Langer, Arne Herberg, Klaus Körber, Udo Lindemann</i>	1-499
Embodiment Design through the Integration of OTSM-TRIZ Situation Analysis with Topological Hybridization of Partial Solutions <i>Alessandro Cardillo, Gaetano Cascini, Francesco Saverio Frillici, Federico Rotini</i>	1-509

A Framework for Integrated Process Modeling and Planning of Mechatronic Products <i>David Hellenbrand And Udo Lindemann</i>	1-521
KPI Measurement In Engineering Design – A Case Study <i>Bruno Gries, John Restrepo</i>	1-531
Information Models Used to Manage Engineering Change: A Review of The Literature 2005-2010 <i>Naveed Ahmad, David C. Wynn, P. John Clarkson</i>	1-538

VOLUME 2: DESIGN THEORY AND RESEARCH METHODOLOGY

On the Link Between Features and Functions <i>D. Gabelloni, R. Apreda, G. Fantoni</i>	2-1
Understanding the Worlds of Design and Engineering - an Appraisal of Models <i>Martin Gudem, Casper Boks</i>	2-13
Courses of Product Development Identification – Effects and Visions <i>Milosav Ognjanovi</i>	2-23
Integral Design: To Combine Architecture and Engineering for a Sustainable Built Environment <i>Wim Zeiler</i>	2-31
How to Validate Research in Engineering Design? <i>Alex Barth, Emmanuel Caillaud, Bertrand Rose</i>	2-41
Towards a Scientific Model of Function-Behavior Transformation <i>Yong Chen, Zhinan Zhang, Zelin Liu, Youbai Xie</i>	2-51
Design of Functions by Function Blending <i>Yu Park, Shota Ohashi, Eiko Yamamoto, Toshiharu Taura</i>	2-61
A Method for Selecting Base Functions for Function Blending in Order to Design Functions <i>Syo Sakaguchi, Akira Tsumaya, Eiko Yamamoto, Toshiharu Taura</i>	2-73
A Systematic Approach of Design Theories Using Generativeness and Robustness <i>Armand Hatchuel, Pascal Le Masson, Yoram Reich, Benoit Weil</i>	2-87
Accepting Ambiguity of Engineering Functional Descriptions <i>Pieter E. Vermaas</i>	2-98
Theoretical Framework for Comprehensive Abstract Prototyping Methodology <i>Imre Horváth</i>	2-108
Design Inspired Innovation for Rural India <i>Sten Ekman, Annalill Ekman, Uday Salunkhe, Anuja Agarwal</i>	2-120
The Semantic Debate in Design Theories Applied to Product Identity Creation <i>Grégoire Bonnemaire, Andre Liem</i>	2-130
Modeling Paradoxes in Novice and Expert Design <i>Kees Dorst, Claus Thorp Hansen</i>	2-142
Designer Behaviour and Activity: An Industrial Observation Method <i>Philip Cash, Ben Hicks, Steve Culley, Filippo Salustri</i>	2-151

Design Research Reflections – 30 Years On <i>Crispin Hales, Ken Wallace</i>	2-163
Development of an Evaluation Framework for Implementation of Parametric Associative Methods in an Industrial Context <i>Vahid Salehi, Chris McMahon</i>	2-173
Measuring History: Does Historical Car Performance Follow the TRIZ Performance S Curve? <i>Chris Dowlen</i>	2-183
Comparing Designing Across Different Domains: an Exploratory Case Study <i>Jeff Wt Kan, John S Gero</i>	2-194
Product Failure: A Life Cycle Approach <i>Luca Del Frate</i>	2-204
Designing Patent Portfolio for Disruptive Innovation – A New Methodology Based on C-K Theory <i>Yacine Felk, Pascal Le Masson, Benoit Weil, Patrick Cogez, Armand Hatchuel</i>	2-214
Virtualisation of Product Development/ Design – Seen from Design Theory and Methodology <i>Weber, C., Husung, S.</i>	2-226
Investigating Elementary Design Methods – Using and Extending the Genome-Approach <i>Sebastian Zier, Hermann Kloberdanz, Herbert Birkhofer, Andrea Bohn</i>	2-236
Environment Based Design (EBD) Vs. X Development: A Dialog Between Theory and Retrospection <i>Yong Zeng, Jean Vareille</i>	2-246
Dimensions of Objectives in Interdisciplinary Product Development Projects <i>Albert Albers, Quentin Lohmeyer, Bjoern Ebel</i>	2-256
The Impact of Examples on Creative Design: Explaining Fixation and Stimulation Effects <i>Marine Agogu�, Akin Kazakci, Benoit Weil, Mathieu Cassotti</i>	2-266
A Method for Design Reasoning Using Logic: from Semantic Tableaux to Design Tableaux <i>Hendriks, Lex; Kazakci, Akin Osman</i>	2-275
Description, Prescription and “Bad” Design <i>Paul Winkelman</i>	2-287
LINKographer: An Analysis Tool to Study Design Protocols Based on FBS Coding Scheme <i>Morteza Pourmohamadi, John S Gero</i>	2-294
Do Functions Exist? <i>G.Fantoni, R.Apreda, D.Gabelloni, A.Bonaccorsi</i>	2-304
E3 Value Concept for a New Design Paradigm <i>Yong Se Kim, Chang Kyu Cho, Young Dae Ko, Haeseong Jee</i>	2-314
CK, an Engineering Design Theory? - Contributions, Limits and Proposals <i>Denis Choulier, Eric Coatanea, Joelle Forest</i>	2-323
A Theory of Decomposition in System Architecting <i>Hitoshi Komoto, Tetsuo Tomiyama</i>	2-334

A Framework for Comparing Design Modelling Approaches Across Disciplines <i>Boris Eisenbart, Kilian Gericke, Lucienne Blessing</i>	2-344
A Note on the Debate on Scientific Process Vs. Design Process <i>Damien Motte, Robert Björnemo</i>	2-356
Conducting Preliminary Design Around an Interactive Tabletop <i>Thierry Gidel, Atman Kendira, Alistair Jones, Dominique Lenne, Jean-Paul Barthès, Claude Moulin</i>	2-366
Toward an Adaption-Innovation Strategy for Engineering Design <i>Philip Samuel, Kathryn Jablokow</i>	2-377

VOLUME 3: DESIGN ORGANISATION AND MANAGEMENT

How Design Researchers can lead Higher Education to a Greater Impact on Society <i>Howard T.J., McMahon C.A., Giess M.D.</i>	3-1
Addressing the Risks of Global Product Development <i>Hansen, Z.N.L. & Ahmed-Kristensen, S.</i>	3-11
Design Driven Portfolio Management <i>Søren Ingomar Petersen, Martin Steinert, Sara Beckman</i>	3-21
Business Plans Informed by Design <i>Søren Ingomar Petersen, John Heebøll</i>	3-31
Influence of the Time Perspective on New Product Development Success Indicators <i>Afroz Moatari Kazerouni-, Sofiane Achiche, Onur Hisarciklilar, Vincent Thomson</i>	3-40
Considerations on Design Management of Furniture Manufacturing Companies in Southern Brazil <i>Ana Galafassi, Mauricio Bernardes</i>	3-52
Technology Development Practices in Industry <i>Ulf Högman, Hans Johannesson</i>	3-62
Challenges in Networked Innovation <i>Christiane Maurer, Rianne Valkenburg</i>	3-74
Experiences with Idea-Promoting Initiatives – Why they don't always Work <i>Liv Gish</i>	3-83
Improving the Management of Design Project Risks using the Concept of Vulnerability : A Systems Approach <i>Vidal La., Marle F., Bocquet Jc.</i>	3-93
A Frequency Analysis Approach to Ensure the Robustness of Interactions-Based Clustering of Project Risks <i>Marle F., Vidal La.</i>	3-104
Effective Scheduling of User Input During the Design Process <i>Young Mi Choi, Ph.D.</i>	3-116
Engineering Environment for Product Innovation <i>Michael Bitzer, Michael Vielhaber</i>	3-123

Requirements for Product Development Self-Assessment Tools <i>Christoph Knoblinger¹, Josef Oehmen, Eric Rebentisch, Warren Seering Katharina Helten</i>	3-133
Expanding The Social Dimension: Towards A Knowledge Base for Product-Service Innovation <i>Åsa Ericson, Andreas C. Larsson, Tobias C. Larsson</i>	3-143
Designing a Process for a Monopoly to transform to a Free Market Competitor – The Swedish Pharmacy System <i>Annalill Ekman, Stefan Carlsson, Sten Ekman</i>	3-153
Managing Resource Scarcity in Small Enterprises' Design Processes <i>Lars Löfqvist</i>	3-164
Collaborative Glitches in Design Chain: Case Study of an Unsuccessful Product Development with a Supplier <i>Hélène Personnier, Marie-Anne Le Dain, Richard Calvi</i>	3-176
Recommendations for Risk Identification Method Selection according to Product Design and Project Management Maturity, Product Innovation Degree and Project Team <i>Viviane Vasconcellos Ferreira Grubisic, Thierry Gidel, André Ogliari</i>	3-187
Identification and Design of Pilot Projects to Implement Lean Development <i>Katharina Helten, Katharina G.M. Eben, Udo Lindemann</i>	3-199
Exploring Collaboration in a Networked Innovation Project in Industry <i>Katinka Bergema, Maaïke Kleinsmann, Cees De Bont, Rianne Valkenburg</i>	3-211
Business Model Design Methodology for Innovative Product-Service Systems: A Strategic and Structured Approach <i>Ji Hwan Lee, Dong Ik Shin, Yoo S. Hong, Yong Se Kim</i>	3-221
Prototyping in Organizational Process Engineering <i>Matteo Vignoli, Diego Maria Macri, Fabiola Bertolotti</i>	3-233
On the Stability of Coordination Patterns in Multidisciplinary Design Projects <i>João Castro, Martin Steinert, Warren Seering</i>	3-245
Management of Product Development Projects through Integrated Modeling of Product and Process Information <i>Kazuya Oizumi, Kei Kitajima, Naoto Yoshie, Tsuyoshi Koga, Kazuhiro Aoyama</i>	3-253
Packaging Design in Organic Food Supply Chains – A Case Study in Sweden <i>Annika Olsson, Helena Lindh, Gwenola Bertoluci</i>	3-264
A Holistic Procedure for Process Integration in Design Cooperation <i>Christiane Beyer, Karl-Heinrich Grote, Oliver Tegel, Christian Kubisch</i>	3-274
Exploit and Explore: Two Ways of Categorizing Innovation Projects <i>Åsa Ericson, Åsa Kastensson</i>	3-284
Steering the Value Creation in an Airplane Design Project from the Business Strategies to the Architectural Concepts <i>Ndrianarilala Rianantsoa, Bernard Yannou, Romaric Redon</i>	3-294
A Comparison of the Integration of Risk Management Principles in Product Development Approaches <i>Denis Bassler, Josef Oehmen, Warren Seering, Mohamed Ben-Daya</i>	3-306

Supporting Cycle Management by Structural Analysis of the Organisational Domain in Multi-Project Environment <i>Fatos Elezi, Alvaro Pechuan, Alexander Mirson, Sebastian Kortler, Wieland Biedermann, Udo Lindemann</i>	3-317
The Central Role of Exploration in Designing Business Concepts and Strategy <i>Senni Kirjavainen, Tua A. Björklund</i>	3-325
Integration of Suppliers into the Product Development Process using the Example of the Commercial Vehicle Industry <i>Nicole Katharina Stephan, Christian Schindler</i>	3-335
Overcoming the Keep the Market Out Premise (KMOP) in Product Development <i>A. Lang, R. Kirschner, A. Kain, U. Lindemann</i>	3-346
Stakeholders' Analysis Tools to Support the Open Innovation Process Management – Case Study <i>Istefani Carísio De Paula, Samanta Yang, André Korzenowski, Marcelo Nogueira Cortimiglia</i>	3-354
Inside a PSS Design Process: Insights through Protocol Analysis <i>Tomohiko Sakao, Svante Paulsson, Hajime Mizuyama</i>	3-365
Knowledge Management Challenges In New Business Development - Transition Of The Energy System <i>Ole Kjeldal Jensen, Saeema Ahmed-Kristensen, Nevena Jensen</i>	3-377
Rethinking Value: A Value-Centric Model of Product, Service and Business Development <i>Merili Randmaa, Krestine Mouggaard, Thomas Howard, Tim C. McAloone</i>	3-387

VOLUME 4: PRODUCT AND SYSTEM DESIGN

Product Platform Automation for Optimal Configuration of Industrial Robot Families <i>Mehdi Tarkian, Johan Ölvander, Xiaolong Feng, Marcus Pettersson</i>	4-1
On the applicability of structural criteria in Complexity Management <i>Wieland Biedermann, Udo Lindemann</i>	4-11
Eco Tracing - A Systems Engineering Method for Efficient Tracelink Modelling <i>Rainer Stark, Asmus Figge</i>	4-21
Equilibrium Design Problems in Complex Systems Realization <i>Jitesh H. Panchal</i>	4-33
Balancing Internal and External Product Variety in Product Development <i>Iris Graessler</i>	4-45
Integrated Product and Production Model – Issues on Completeness, Consistency and Compatibility <i>Stellan Gedell, Anders Claesson, Hans Johannesson</i>	4-55
A Framework for Designing Product-Service Systems <i>Gokula Vijaykumar Annamalai Vasantha, Romana Hussain, Rajkumar Roy, Ashutosh Tiwari, Stephen Evans</i>	4-67

Orthogonal Views on Product/Service-System Design in an Entire Industry Branch <i>Tim C. Mcaloone, Krestine Mougaard, Line M. Neugebauer, Teit A. Nielsen, Niki Bey</i>	4-77
Representation and Analysis of Business Ecosystems Co-Specializing Products and Services <i>Changmuk Kang, Yoo S. Hong, Kwang Jae Kim, Kwang Tae Park</i>	4-88
Interdisciplinary System Model for Agent-Supported Mechatronic Design <i>Ralf Stetter, Holger Seemüller, Mohammad Chami, Holger Voos</i>	4-100
Strategic Planning for Modular Product Families <i>Henry Jonas, Dieter Krause</i>	4-112
Modularity Within a Matrix of Function and Functionality (MFF) <i>Žiga Zadnik, Vanja Čok, Mirko Karakašič, Milan Kljajin, Jože Duhovnik</i>	4-122
Proactive Modeling of Market, Product and Production Architectures <i>Niels Henrik Mortensen, Christian L. Hansen, Lars Hvam, Mogens Myrup Andreasen</i>	4-133
Designing Mechatronic Systems: A Model- Integration Approach <i>Ahsan Qamar, Jan Wikander, Carl During</i>	4-145
An Approach for More Efficient Variant Design Processes <i>Sebastian Schubert, Arun Nagarajah, Jörg Feldhusen</i>	4-157
The Process of Optimizing Mechanical Sound Quality in Product Design <i>Nielsen, Thomas Holst, Eriksen, Kaare Riise</i>	4-167
Development of Modular Products under Consideration of Lightweight Design <i>Thomas Gumpinger, Dieter Krause</i>	4-175
The Investigation and Computer Modelling of Humans with Disabilities <i>A. J. Medland, S.D. Gooch</i>	4-185
Evaluation of an Automated Design and Optimization Framework for Modular Robots using a Physical Prototype <i>Vaheed Nezhadali, Omer Khaleeq Kayani, Hannan Razzaq, Mehdi Tarkian</i>	4-195
Designing Consistent Structural Analysis Scenarios <i>Wieland Biedermann, Udo Lindemann</i>	4-205
Design of an Upper Limb Independence-Supporting Device using a Pneumatic Cylinder <i>Norihiko Saga, Koichi Kirihara, Naoki Sugahara</i>	4-215
Actuation Principle Selection – An Example of Trade-off Assessment by CPM-Approach <i>Torsten Erbe, Kristin Paetzold, Christian Weber</i>	4-222
Automated User Behavior Monitoring System for Dynamic Work Environments <i>Yeeun Choi, Minsun Jang, Yong Se Kim, Seongil Lee</i>	4-230
On the Design of Devices for People with Tetraplegia <i>S.D. Gooch, A. J. Medland, A. R. Rothwell, J.A. Dunn, M.J.Falconer</i>	4-238
Brownfield Process for Developing of Product Families <i>Timo Lehtonen, Jarkko Pakkanen, Jukka Järvenpää, Minna Lanz, Reijo Tuokko</i>	4-248
Approach for the Creation of Mechatronic System Models <i>Martin Follmer, Peter Hehenberger, Stefan Punz, Roland Rosen, Klaus Zeman</i>	4-258
Modeling and Design of Contacts in Electrical Connectors <i>Albert Albers, Paul Martin, Benoit Lorentz</i>	4-268
Empirical Consideration of Predicting Chain Failure Modes in Product Structures During Design Review Process <i>Yuichi Otsuka, Shotakiguchi, Hirokazu Shimizu, Yoshiharu Mutoh</i>	4-278

Indicating the Criticality of Changes During the Product Life Cycle <i>Florian G. H. Behncke, Udo Lindemann</i>	4-288
A Methodical Approach for Developing Modular Product Families <i>Dieter Krause, Sandra Eilmus</i>	4-299
Product Model of the Autogenetic Design Theory <i>Konstantin Kittel, Peter Hehenberger, Sándor Vajna, Klaus Zeman</i>	4-309
Product Development Support For Complex Mechatronic System Engineering– Case Fusion Reactor Maintenance <i>Simo-Pekka Leino, Harri Mäkinen, Olli Uuttu, Jorma Järvenpää</i>	4-319
Analyzing the Dynamic Behavior of Mechatronic Systems within the Conceptual Design <i>Frank Bauer, Harald Anacker, Tobias Gaukstern, Jürgen Gausemeier, Viktor Just</i>	4-329
Linear Flow-Split Linear Guides: Inflating Chambers to Generate Breaking Force <i>Nils Lommatzsch, Sebastian Gramlich, Herbert Birkhofer, Andrea Bohn</i>	4-337
A Knowledge-Based Master Modeling Approach to System Analysis and Design <i>Marcus Sandberg, Ilya Tyapin, Michael Kokkolaras, Ola Isaksson</i>	4-347
Social Systems Engineering – An Approach for Efficient Systems Development <i>Thomas Naumann, Ingo Tuttass, Oliver Kallenborn, Simon Frederick Königs</i>	4-357
Improving Data Quality in DSM Modelling: A Structural Comparison Approach <i>Steffen F- Schmitz, David C. Wynn, Wieland Biedermann, P. John Clarkson, Udo Lindemann</i>	4-369
Enhancing Intermodal Freight Transport by Means of an Innovative Loading Unit <i>Dipl.-Ing. Max Klingender, Dipl.-Ing. Sebastian Jursch</i>	4-381
Representing Product-Service Systems with Product and Service Elements <i>Yong Se Kim, Sang Won Lee And Dong Chan Koh</i>	4-390
A Classification Framework for Product Modularization Methods <i>Charalampos Daniilidis, Vincent Enßlin, Katharina Eben, Udo Lindemann</i>	4-400
A Meta Model of the Innovation Process to Support the Decision Making Process using Structural Complexity Management <i>Sebastian Kortler, Udo Lindemann</i>	4-410
Pareto Bi-Criterion Optimization for System Sizing : A Deterministic and Constraint Based Approach <i>Pierre-Alain Yvars</i>	4-420
Sick Systems: Towards a Generic Conceptual Representation of Healthcare Systems <i>Alexander Komashie, Thomas Jun, Simon Dodds, Hugh Rayner, Simon Thane, Alastair Mitchell-Baker, John Clarkson</i>	4-430
Property Rights Theory as a Key Aspect in Product Service Engineering <i>Anna Katharina Dill, Herbert Birkhofer, Andrea Bohn</i>	4-441
Product with Service, Technology with Business Model: Expanding Engineering Design <i>Tomohiko Sakao, Tim Mcaloone</i>	4-449
Analysing Modifications in the Synthesis of Multiple State Mechanical Devices using Configuration Space and Topology Graphs <i>Somasekhara Rao Todeti, Chakrabarti Amaresh</i>	4-461

VOLUME 5: DESIGN FOR X, DESIGN TO X

Ecodesign in Industrial Design Consultancies – Comparing Australia, China, Germany and the USA <i>Johannes Behirsch , Dr. Mariano Ramirez, Dr. Damien Giurco</i>	5-1
Design for Additive Manufacturing Technologies: New Applications of 3D-Printing for Rapid Prototyping and Rapid Tooling <i>Stefan Junk, Marco Tränkle</i>	5-12
Reflections on Design for Sustainability- A View from a Distinct Point and the Role of Interior Designer <i>K Ioannou-Kazamia, J Gwilliam</i>	5-19
Life Cycle Approach to Support Tooling Design Decisions <i>Inês Ribeiro , Paulo Peças, Elsa Henriques</i>	5-28
Designing with a Social Conscience: An Emerging Area in Industrial Design Education and Practice <i>Mariano Ramirez Jr</i>	5-39
Global Optimization of Environmental Impact by a Constraint Satisfaction Approach – Application to Ship-Ecodesign <i>Vincent Larroudé, Pierre-Alain Yvars, Dominique Millet</i>	5-49
Designing for Resilience: using a Delphi Study to Identify Resilience Issues for Hospital Designs in a Changing Climate <i>Mary Lou Masko, Claudia M. Eckert, Nicholas H.M. Caldwell, P. John Clarkson</i>	5-60
Modelling Time-Varying Value of an End-Of-Life Product for Design for Recovery <i>Minjung Kwak, Harrison M. Kim</i>	5-70
The Impact of Safety Standards and Policies on Optimal Automobile Design <i>Steven Hoffenson, Panos Papalambros</i>	5-81
Design for Diagnosis <i>Ralf Stetter, Ulrike Phleps</i>	5-91
An Engineering-Based Environmental Management System Design <i>Colin Burvill, John Weir, Martin Leary</i>	5-103
Getting to Sustain (-Able Systems) via using Survivable and Impose-Able Ones <i>Richard Tabor Greene</i>	5-113
Toward Proactive Eco-Design Based on Engineer and Eco-Designer's Software Interface Modeling <i>Maud Rio, Tatiana Reyes, Lionel Roucoules</i>	5-124
Designing Sustainable Society Scenarios using Forecasting <i>Yuji Mizuno, Yusuke Kishita, Haruna Wada, Maki Hirotsaki, Shinichi Fukushige, Yasushi Umeda</i>	5-135
Success Criteria for Implementing Sustainability Information in Product Development <i>Silje Helene Aschehoug, Casper Boks</i>	5-145
Universal Design and Visual Impairment: Tactile Products for Heritage Access <i>Jaume Gual, Marina Puyuelo, Joaquim Lloveras</i>	5-155
Developing an Ecology of Mind in Design <i>Emma L Dewberry</i>	5-165

Management of Energy Related Knowledge in Integrated Product Development – Concept and Selected Instruments <i>Uwe Götze, Erhard Leidich, Annett Bierer, Susann Köhler</i>	5-176
Sustainability Innovation in Early Phases <i>Massimo Panarotto, Peter Törlind</i>	5-187
Manufacturing Cost Estimation During Early Phases of Machine Design <i>Michele Germani, Marco Mandolini, Paolo Cicconi</i>	5-198
Design for Dependability – Identifying Potential Weaknesses in Product Concepts <i>Tim Sadek, Michael Wendland</i>	5-210
Impact of Modularised Production on Product Design in Automotive Industry <i>Waldemar Walla, Thomas Baer, Jivka Ovtcharova</i>	5-220
Design for Reliability: An Event- and Function-Based Framework for Failure Behavior Analysis in the Conceptual Design of Cognitive Products <i>Thierry Sop Njindam, Kristin Paetzold</i>	5-228
A New Approach to Modularity in Product Development – Utilising Assembly Sequence Knowledge <i>Authors: A. Robert, X.T. Yan, S. Roth, K. Deschinkel, S. Gomes</i>	5-238
Approach to Visualize the Supply Chain Complexity Induced by Product Variety <i>Max Brosch, Gregor Beckmann, Dieter Krause</i>	5-249
Integration of Remanufacturing Issues into the Design Process <i>Gillian Hatcher, Winifred Ijomah And James Windmill</i>	5-259
Investigating the Requirements Needed to Make Appropriate End of Life Decisions <i>Kirsty Doyle, Winifred L. Ijomah, Jiju Antony</i>	5-265
Product and Process Evaluation in the Context of Modularization for Assembly <i>Niklas Halfmann, Steffen Elstner, Dieter Krause</i>	5-271
A Case Study of Design for Affordance: Affordance Features of a Simple Medical Device <i>Yong Se Kim, Young Chan Cho, Sun Ran Kim</i>	5-282
Which Guideline is Most Relevant? Introduction of a Pragmatic Design for Energy Efficiency Tool <i>Karola Rath, Herbert Birkhofer, Andrea Bohn</i>	5-293
The Concept of Ecological Levers – A Pragmatic Approach for the Elicitation of Ecological Requirements <i>Shulin Zhao, Herbert Birkhofer, Andrea Bohn</i>	5-302
Methodology for Choosing Life Cycle Impact Assessment Sector-Specific Indicators <i>Bruno Chevalier, Tatiana Reyes-Carrillo, Bertrand Laratte</i>	5-312
Selection of Physical Effects Based on Disturbances and Robustness Ratios in the Early Phases of Robust Design <i>Johannes Mathias, Tobias Eifler, Roland Engelhardt, Hermann Kloberdanz, Herbert Birkhofer, Andrea Bohn</i>	5-324
Requirements of a Carbon Footprinting Tool for Designers <i>Rhoda Trimmingham, Sofia Garcia-Noriega</i>	5-336
Extraction and Analysis Methodology for Supporting Complex Sustainable Design <i>Helen Liang, David Birch</i>	5-346

VOLUME 6: DESIGN INFORMATION AND KNOWLEDGE

Scenario-Based Design in Design Pattern Mining <i>Claudia Iacob</i>	6-1
Integral Designed Database Morphology for Active Roofs <i>Wim Zeiler, Emile Quanjel</i>	6-11
Dual Perspective on Information Exchange Between Design and Manufacturing <i>Jessica Bruch, Glenn Johansson</i>	6-21
The Digital Divide: Investigating the Personal Information Management Practices of Engineers <i>Hamish McAlpine, Ben Hicks, Can Tiryakioglu</i>	6-31
Predicting Emerging Product Design Trend by Mining Publicly Available Customer Review Data <i>Conrad Tucker, Harrison M. Kim</i>	6-43
How Product Representation Types are Perceived at the Client's End to Facilitate Communication and Decision Making <i>André Liem</i>	6-53
Data Management Planning in Engineering Design and Manufacturing Research <i>Mansur Darlington, Tom Howard, Alex Ball, Steve Culley, Chris McMahon</i>	6-65
Capturing the Conceptual Design Process with Concept-Configuration-Evaluation Triplets <i>Ehud Kroll, Alexander Shihmanter</i>	6-76
Modeling and Management of Product Knowledge in an Engineer-to-Order Business Model <i>Fredrik Elgh</i>	6-86
Manifestation of Uncertainty - A Classification <i>Melanie E. Kreye, Yee Mey Goh, Linda B. Newnes</i>	6-96
Acquisition of Design-Relevant Knowledge within the Development of Sheet-Bulk Metal Forming <i>Sebastian Röhner, Thilo Breitsprecher, Sandro Wartzack</i>	6-108
Knowledge Representation for Supplier Discovery in Distributed Design and Manufacturing <i>Christian Mcarthus, Farhad Ameri</i>	6-121
Case Studies to Explore Indexing Issues in Product Design Traceability Framework <i>Neven Pavković, Nenad Bojčetić, Leonard Franić, Dorian Marjanović</i>	6-131
Learning from the Lifecycle: The Capabilities and Limitations of Current Product Lifecycle Practice and Systems <i>James A. Gopsill, Hamish C. McAlpine, Ben J. Hicks</i>	6-141
Visualising Ergonomics Data for Design <i>Hua Dong, Eujin Pei, Hongyan Chen, Robert Macredie</i>	6-153
Knowledge Configuration Management for Product Design and Numerical Simulation <i>J. Badin, D. Monticolo, D. Chamoret, S. Gomes</i>	6-161
Reference Model for Traceability Records Implementation in Engineering Design Environment <i>Mario Štorga, Dorian Marjanović, Tomaž Savšek</i>	6-173
ICED11	xxv

The Management of Manufacturing Processes using Complementary Information Structures <i>Greg Huet, Clément Fortin, Grant Mcorley And Boris Toche</i>	6-183
IT-Based Configuration and Dimensioning of Customer Specific Products – Towards a Framework for Implementing Knowledge Based Design Assistant Systems <i>Detlef Gerhard, Christoph Lutz</i>	6-192
Assessing the Conditions for Dissemination of End-User and Purchaser Knowledge in a Medtech Context <i>Carl Wadell, Margareta Norell Bergendahl</i>	6-200
A Scalable Approach for the Integration of Large Knowledge Repositories in the Biologically-Inspired Design Process <i>D. Vandevenne, P.-A. Verhaegen , S. Dewulf , J.R. Dufflou</i>	6-210
Understanding Engineering Systems Through the Engineering Knowledge Genome: Structural Genes of Systems Topologies <i>Offer Shai, Yoram Reich</i>	6-220
Interface Qualification Between the Research Central Team and Design Offices in Order to Evaluate the Knowledge Sharing <i>Marie Fraslin, Eric Blanco, Valerie Chanal</i>	
Challenges in Semantic Knowledge Management for Aerospace Design Engineering <i>Isaac Sanya, Essam Shehab, Dave Lowe</i>	6-241
Means for Internal Knowledge Reuse in Pre-Development – The Technology Platform Approach <i>Daniel Corin Stig, Dag Bergsjö</i>	6-249
Exploiting Neighborhood and Multi-Dimension Granular Information for Supporting Design Rationale Retrieval <i>Yan Liang, Ying Liu, Wing Bun Lee, Chun Kit Kwong</i>	6-262
Providing Design Solution Repositories in the Field of Mechanism Theory <i>Torsten Brix, Ulf Döring, Michael Reessing, Christian Weber</i>	6-272
A Parametric Design Framework to Support Structural and Functional Modeling of Complex Consumer Electronics Products <i>Kenichi Seki, Hidekazu Nishimura, Shaopeng Zhu, Laurent Balmelli</i>	6-282
The Challenge of Handling Material Information From Different Sources <i>A. Janus, D. Tartler, H. Krehmer, S. Wartzack</i>	6-292
The Retrieval of Structured Design Knowledge <i>Hongwei Wang, Aylmer L. Johnson, Rob H. Bracewell</i>	6-303
Identification, Translation and Realisation of Requirements for a Knowledge Management System in an Engineering Design Consultancy <i>Thomson, Avril Isabel</i>	6-313
Development of Engineering Knowledge Models to Achieve Product Innovation <i>Anna Karlsson, Peter Törlind</i>	6-322
Perceptions of and Challenges with Knowledge Sharing – Enterprise Collaboration in a Virtual Aeronautical Enterprise <i>Pär Johansson, Christian Johansson</i>	6-332

Software Supported Knowledge Transfer for Product Development <i>Sönke Krebber, Hermann Kloberdanz, Herbert Birkhofer, Andrea Bohn</i>	6-342
Search for Similar Technical Solutions by Object Abstraction using an Ontology <i>Andreas Kohn, Udo Lindemann</i>	6-350
A Methodology for Discovering Structure in Design Databases <i>Katherine Fu, Jonathan Cagan, Kenneth Kotovsky</i>	6-360
Comparative Study of Theoretical and Real uses of Eco-Designed Laundry Detergents <i>Chapotot, Emilie; Abi Akle, Audrey; Minel, Stéphanie; Yannou, Bernard</i>	6-370
Designers' Thinking and Acting in Meetings with Clients <i>Sónia Da Silva Vieira, Petra Badke-Schaub, António Fernandes, Teresa Fonseca</i>	6-382
A Structure for Representing Problem Formulation in Design <i>Mahmoud Dinar, Jami Shah, Pat Langley, Glen Hunt And Ellen Campana</i>	6-392
A New Metamodel to Represent Topologic Knowledge in Artificual Design <i>J. M. Jauregui-Becker, K.J.W. Gebauer , F. J. A. M. Van Houten</i>	6-402
N-Gram Analysis in the Engineering Domain <i>Martin Leary, Geoff Pearson, Colin Burvill, Maciej Mazur, Aleksandar Subic</i>	6-414
Applying Context to Organize Unstructured Information in Aerospace Industry <i>Yifan Xie, Steve J Culley, Frithjof Weber</i>	6-424
Improving Design Rationale Capture During Embodiment Design <i>Jeroen Van Schaik, Jim Scanlan, Andy Keane, Kenji Takeda, Dirk Gorissen</i>	6-436
Exploring the Synthesis of Information in Design Processes – Opening the Black-Box <i>Raja Gumienny, Tilmann Lindberg, Christoph Meinel</i>	6-446
Representation of Cross-Domain Design Knowledge through Ontology Based Functional Models <i>Dipl.-Ing. Milan Marinov, Dipl.-Wi.-Ing. Dan Gutu, B.Sc. Janet Todorova, Dr. Miklós Szotz, András Simonyi, Prof. Dr. Dr.-Ing. Dr. H.C. Jivka Ovtcharova</i>	6-456
Adapting Aerospace Design Rationale Mapping To Civil Engineering: A Preliminary Study <i>Nathan Eng, Emanuele Marfisi , Marco Aurisicchio</i>	6-468
Knowledge Sharing Approaches in Method Development <i>Peter Thor, Johan Wenngren, Åsa Ericson</i>	6-480
Application of MOKA Methodology to Capture Knowledge in Design for Poka-Yoke Assembly <i>Gabriela Estrada, Joaquim Lloveras</i>	6-490
The Evolution of Information While Building Cross-Domain Models of a Design: A Video Experiment <i>Naveed Ahmad, David C. Wynn, P. John Clarkson</i>	6-500

VOLUME 7: HUMAN BEHAVIOUR IN DESIGN

Improving Communication in Design: Recommendations From The Literature <i>Anja M Maier, Denniz Dönmez, Clemens Hepperle, Matthias Kreimeyer, Udo Lindemann, P John Clarkson</i>	7-1
--	-----

Culture and Concept Design: A Study of International Teams <i>Andrew Wodehouse, Ross Maclachlan, Hilary Grierson and David Strong</i>	7-12
Associative Thinking as a Design Strategy and its Relation to Creativity <i>Hernan Casakin</i>	7-22
Social Media Enabled Design Communication Structure in a Buyer-Supplier Relationship <i>V. Hölttä, T. Eisto</i>	7-32
Emotion-Driven Elicitation of Elderly People user needs Illustrated by a Walking Frame Case Study <i>Hjalte P. Gudmundsson, Casper L. Andersen, Sofiane Achiche, Per Boelskifte</i>	7-44
Choosing Innovation: How Reasoning Affects Decision Errors <i>Ronny Mounarath, Dan Lovallo, Andy Dong</i>	7-54
Enabling Objects for Participatory Design of Socio-Technical Systems <i>Ole Broberg</i>	7-64
Challenges and Limitations of Applying an Emotion-Driven Design Approach on Elderly Users <i>Casper L. Andersen, Hjalte P. Gudmundsson, Sofiane Achiche, Per Boelskifte</i>	7-74
On the Effective use of Design-By-Analogy: The Influences of Analogical Distance and Commonness of Analogous Designs on Ideation Performance <i>Joel Chan, Katherine Fu, Christian Schunn, Jonathan Cagan, Kristin Wood, Kenneth Kotovsky</i>	7-85
Ingredients of the Design Process: Going Through Emotional Passage <i>Cliff Shin</i>	7-97
Meaning-Based Assessment in Creative Design <i>Hernan Casakin, Shulamith Kreitler</i>	7-107
How Important is Team Structure to Team Performance? <i>Vishal Singh, Andy Dong, John S Gero</i>	7-117
Applied Test of Engineering Design Skill: Visual Thinking, Characterization, Test Development and Validation <i>Jami J. Shah, Jay Woodward, S. M. Smith</i>	7-127
Analysing the use of four Creativity Tools in a Constrained Design Situation <i>Snider, C.M., Dekoninck, E.A., Yue, H., Howard, T.J.</i>	7-140
Collaborative Trust Networks in Engineering Design Adaptation <i>Simon Reay Atkinson, Anja M Maier, Nicholas Caldwell, P John Clarkson</i>	7-152
The importance of Empathy in IT Projects: A Case Study on the Development of the German Electronic Identity Card <i>Eva Köppen, Ingo Rauth, Maxim Schnjakin, Christoph Meinel</i>	7-162
A Sound-Based Protocol to Study the Emotions Elicited by Product Appearance <i>Weihua Lu, Jean-François Petiot</i>	7-170
A Scenario of user Experience <i>Juan Carlos Ortiz Nicolás, Marco Aurisicchio</i>	7-182
The Relationship Between a Model and a Full-Size Object or Building: The Perception and Interpretation of Models <i>Yvonne Eriksson, Ulrika Florin</i>	7-194

Review of Collaborative Engineering Environments: Software, Hardware, Peopleware <i>Jonathan Osborn, Joshua D. Summers, Gregory M. Mocko</i>	7-204
Exploring Consumer Needs with Lewin's Life Space Perspective <i>Kee-Ok Kim, Hye Sun Hwang</i>	7-214
Proposal of "Expectology " as Design Methodology <i>Tamotsu Murakami, Satoshi Nakagawa, Hideyoshi Yanagisawa</i>	7-224
An Approach to Analyzing user Impressions and Meanings of Product Materials in Design <i>Georgi V. Georgiev, Yukari Nagai</i>	7-234
A Method to Study Affective Dynamics and Performance in Engineering Design Teams <i>Malte F. Jung, Larry J. Leifer</i>	7-244
Cultural "Value Creation" in the Design of Cellular Phones <i>André Liem, Bijan Aryana</i>	7-254
Idea Screening in Engineering Design using Employee-Driven Wisdom of the Crowds <i>Balder Onarheim, Bo T. Christensen</i>	7-265
Facilitating Creative Problem Solving Workshops: Empirical Observations at a Swedish Automotive Company <i>Katarina Lund, Johan Tingström</i>	7-275
Creative Teamwork in Quick Projects Development QPD, 24 Hours of Innovation <i>Luz-Maria Jiménez, Denis Choulier, Jeremy Legardeur, Mickaël Gardoni</i>	7-285
Emotional Orientation and Context Analysis for Design Creativity Exercise Test <i>Jongho Shin and Yong Se Kim</i>	7-297
Understanding Fixation: A Study on the Role of Expertise <i>Vimal Viswanathan and Julie Linsey</i>	7-309
Adoption of a Systematic Design Process: A Study of Cognitive and Social Influences on Design <i>Thea Morgan, Theo Tryfonas</i>	7-320
Taxonomy of Cognitive Functions <i>Torsten Metzler, Kristina Shea</i>	7-330
Supporting Annotation-Based Argumentation Linking Discursive and Graphical Aspects of Design for Asynchronous Communication <i>Jean-François Boujut</i>	7-342
Initial Conditions: The Structure and Composition of Effective Design Teams <i>Greg Kress, Mark Schar</i>	7-353
Creativity Techniques for a Computer Aided Inventing System <i>Davide Russo, Tiziano Montecchi</i>	7-362
Characterizing Reflective Practice in Design – What about those Ideas you get in the Shower? <i>Rebecca M. Currano, Martin Steinert, Larry J. Leifer</i>	7-374
Monitoring Design Thinking Through In-Situ Interventions <i>Micah Lande, Neeraj Sonalkar, Malte Jung, Christopher Han, Banny Banerjee, Larry Leifer</i>	7-384

Design-by-Analogy using the Wordtree Method and an Automated Wordtree Generating Tool <i>E. V. Oriakhi, J. S. Linsey, X. Peng</i>	7-394
Around You: How Designers Get Inspired <i>Milene Gonçalves, Carlos Cardoso, Petra Badke-Schaub</i>	7-404
Information Behavior in Multidisciplinary Design Teams <i>Ensici, Ayhan, Badke-Schaub, Petra</i>	7-414
Designing: Insights from Weaving Theories of Cognition and Design Theories <i>Eswaran Subrahmanian, Yoram Reich, Frido Smulders, Sebastiaan Meijer</i>	7-424
Understanding the Front End of Design <i>T. Harrison, M. Aurisicchio</i>	7-437
Context-Specific Experience Sampling for Experience Design Research <i>Yong Se Kim, Yeon Koo Hong, Jin Hui Kim, Young Mi Kim</i>	7-448
Product Profile to Reduce Consumer Dissatisfaction in Terms of Soft Usability Problem and Demographical Factors: an Exploratory Study <i>Chajoong Kim, Henri Christiaans</i>	7-458
The Psychological Experience of user Observation <i>Elizabeth Gerber</i>	7-468
Problems and Potentials in the Creation of New Objects <i>Joakim Juhl, Martin Gylling</i>	7-480
A Protocol for Connective Complexity Tracking in the Engineering Design Process <i>James Mathieson, Michael Miller, Joshua Summer</i>	7-492
A New Framework of Studying the Cognitive Model of Creative Design <i>Ganyun Sun, Shengji Yao</i>	7-501

VOLUME 8: DESIGN EDUCATION

Identifying and Quantifying Industry Perceptions of Engineering Drawing Skills in Novice Malaysian Engineers <i>Zulkeflee Abdullah, Colin Reginald Burvill, Bruce William Field</i>	8-1
Measuring Malaysian Undergraduate Skills in Reading and Interpreting Engineering Drawing <i>Zulkeflee Abdullah, Bruce William Field, Colin Reginald Burvill</i>	8-13
Assessing Quality of Ideas in Conceptual Mechanical Design <i>William Lewis, Bruce Field, John Weir</i>	8-23
Fluency and Flexibility of Concepts Arising from Personalised Ideation Techniques <i>Bruce Field</i>	8-35
Exploiting Hand Sketching in Educating 'Mechanically Oriented' Engineering Students <i>Farrugia P.J., Borg J.C., Camilleri K.P.</i>	8-45
Implementing Design Critique for Teaching Sustainable Concept Generation <i>William Z Bernstein, Devarajan Ramnujan, Monica F Cox, Fu Zhao, John W Sutherland, Karthik Ramani</i>	8-55

Integrated Systems Design Education <i>Alastair Conway, Graham Wren, Bill Ion</i>	8-66
A Process of Conceptual Engineering Design for New Patentable Products <i>Joaquim Lloveras</i>	8-78
Strengthening Asian Advanced Design and Manufacture Education Through a Framework Approach <i>Fayyaz Rehman, Xiu-Tian Yan, Youhua Li, Xincai Tan, Eric Miller, Nick Woodfine</i>	8-88
Planning Industrial Phd Projects in Practice: Speaking Both 'academia' and 'practitionese' <i>Ingrid Kihlander, Susanne Nilsson, Katarina Lund, Sofia Ritzén, Margareta Norell Bergendahl</i>	8-100
Characterization of Leadership within Undergraduate Engineering Design Teams Through Case Study Analysis <i>Gary Palmer, Joshua D. Summers</i>	8-110
Do Basic Schemata Facilitate Embodiment Design? <i>Roman Žavbi, Nuša Fain, Janez Rihtarši</i>	8-120
Machine Part Exhibition and Functional Mock-Ups to Enrich Design Education <i>Gregor Beckmann, Dieter Krause</i>	8-130
Teaching Design for Environment in Product Design Classes <i>Michael C. Baeriswyl, Steven D. Eppinger</i>	8-140
Integration of DFMA Throughout an Academic Product Design and Development Process Supported by a Plm Strategy <i>Gilberto Osorio-Gomez, Santiago Ruiz-Arenas</i>	8-151
Learning Levels in Technical Drawing Education: Proposal for an Assessment Grid Based on the European Qualifications Framework (EQF) <i>Riccardo Metraglia, Gabriele Baronio, Valerio Villa</i>	8-161
A Coherent and Discriminating Skills Standard for Innovative Design <i>Denis Choulier, Pierre Alain Weite</i>	8-173
A Proposal for an Assessment Form for Engineering Design Theses <i>Robert Watty, Matthias Kreimeyer</i>	8-184
Adapting Industrial Design Education to Future Challenges of Higher Education <i>André Liem, Johannes B. Sigurjonsson</i>	8-194
New Job Roles in Global Engineering – from Education to Industrial Deployment <i>Kai Lindow, Patrick Müller, Rainer Stark</i>	8-205
An Ethical Stance: Engineering Curricula Designed for Social Responsibility <i>Ian De Vere, Ajay Kapoor, Gavin Melles</i>	8-216
Developing A Drawing Culture: New Directions in Engineering Education <i>Ian De Vere, Gavin Melles, Ajay Kapoor</i>	8-226
Shaping The Individual Designer: Participatory Design in Emergency Context. <i>Briede Westermeyer, Juan Carlos; Cartes, Jorge; Bustamante, Alejandro; Perez, Marcela</i>	8-236
A 'Theatric' Approach to the Teaching of Design <i>Jason Matthews, Tony Medland</i>	8-245
The DesignExchange: Supporting the Design Community of Practice <i>Celeste Roschuni, Alice M. Agogino, Sara L. Beckman</i>	8-255

Improving Engineering Education in India Using Information and Communication Technology: A New Framework <i>Prerak Mehta</i>	8-265
Foundations for a New Type of Design-Engineers – Experiences from DTU <i>Ulrik Jørgensen, Søsner Brodersen, Hanne Lindegaard, Per Boelskifte</i>	8-275
Sharing Experience in Design Education Based on Research and Industrial Practice <i>Stanislav Hosnedl, Zbynek Srp</i>	8-287

VOLUME 9: DESIGN METHODS AND TOOLS PART 1

Decision Support for Improving the Design of Hydraulic Systems by Leading Feedback into Product Development <i>Michael Abramovici, Andreas Lindner, Florian Walde, Madjid Fathi, Susanne Dienst</i>	9-1
Clustering Customer Dreams – An Approach for a More Efficient Requirement Acquisition <i>Benjamin Röder, Herbert Birkhofer, Andrea Bohn</i>	9-11
Proposal About the use of Data Base in Engineering Design <i>Francesco Rosa, Edoardo Rovida, Roberto Viganò</i>	9-21
Application of Basic Design Principles for Solution Search in Biomimetics <i>Manuela Iulia Parvan, Andreas Schwalmberger, Udo Lindemann</i>	9-30
Use of Constraints in the Early Stages of Design <i>Glen Mullineux</i>	9-40
A Knowledge-Based Superposing Sketch Tool for Design Concept Generation Through Reflection of Verbal and Drawing Expression <i>Yutaka Nomaguchi, Yuko Kotera, Kikuo Fujita</i>	9-50
Economic Impact Estimation of New Design Methods <i>Roland Koppe, Stefan Häusler, Frank Poppen, Stephan Große Austing, Axel Hahn</i>	9-61
Failure Mode and Effects Analysis in Combination with the Problem-Solving A3 <i>Eirin Lodgaard, Øystein Pellegård, Geir Ringen, Jon Andreas Klokkehaug</i>	9-71
Supporting Inclusive Product Design with Virtual User Models at the Early Stages of Product Development <i>Pierre T. Kirisci, Klaus-Dieter-Thoben, Patrick Klein, Markus Modzelewski</i>	9-80
Using Virtual Reality in Designing the Assembly Process of a Car <i>Ilse Becker, Ville Toivonen, Simo-Pekka Leino</i>	9-91
On the Types and Roles of Demonstrators for Designing Medical Devices <i>Benoît Herman, Julien Sapin, Khanh Tran Duy, Benoît Raucent</i>	9-101
Computational Representations for Multi State Design Tasks and Enumeration of Mechanical Device Behaviour <i>Somasekhara Rao Todeti, Amaresh Chakrabarti</i>	9-111
IFMEA – Integration Failure Mode and Effects Analysis <i>Stefan Punz, Martin Follmer, Peter Hehenberger, Klaus Zeman</i>	9-122
ELISE 3d - A Database-Driven Engineering and Design Tool <i>Authors: M. Maier, Dr. C. Hamm</i>	9-132

Evaluation of Data Quality in the Context of Continuous Product Validation Throughout the Development Process <i>Jochen Reitmeier, Kristin Paetzold</i>	9-143
Geometric Manipulation Method for Evaluation of Aesthetic Quality in Early Design Phases <i>T. Stoll, A. Stockinger, S. Wartzack</i>	9-153
A Morphological Approach to Business Model Creation using Case-Based Reasoning <i>Ji Hwan Lee, Yoo S. Hong,</i>	9-165
A Metric to Represent the Evolution of Cad/Analysis Models in Collaborative Design. <i>Nicolas Drémont, Pascal Graignic, Nadège Troussier, Robert Ian Whitfield, Alex Duffy</i>	9-176
Significance of Requirements for the Implementation of New Technologies using Shape Memory Technology <i>Sven Langbein, Konstantin Lygin, Tim Sadek</i>	9-186
Interdisciplinary Systems Modeling using the Contact and Channel-Model for SYSML <i>Albers, Albert, Zingel, Christian</i>	9-196
A Novel Hybrid 2D and 3D Augmented Reality Based Method for Geometric Product Development <i>Pablo Prieto</i>	9-208
A Methodology to Evaluate the Structural Robustness of Product Concepts <i>Maximilian P. Kissel, David Hellenbrand, Udo Lindemann</i>	9-215
Towards Assessing the Value of Aerospace Components: A Conceptual Scenario <i>Marco Bertoni, Christian Johansson, Alessandro Bertoni</i>	9-226
Seven Years of Product Development in Industry – Experiences and Requirements for Supporting Engineering Design with ‘Thinking Tools’ <i>Sven Matthiesen</i>	9-236
Design of Innovative Product Profiles: Anticipatory Estimation of Success Potential <i>Yuri Borgianni, Alessandro Cardillo, Gaetano Cascini, Federico Rotini</i>	9-246
UMEA - A Follow-Up to Analyse Uncertainties in Technical Systems <i>Roland Engelhardt, Marion Wiebel, Tobias Eifler, Hermann Kloberdanz, Herbert Birkhofer, Andrea Bohn</i>	9-257
Selection of Design Concepts using Virtual Prototyping in the Early Design Phases <i>Mikko Seppälä, Andrea Buda, Eric Coatanéa</i>	9-267
Early Robustness Optimization of Automotive Modules – Regarding the Key Impact of the Human Factor <i>Fabian Wuttke, Florian Feustel, Martin Bohn, Steffen Csernak, Andrea Bohn</i>	9-275
Decision Processes in Engineering Design: A Network Perspective of Stakeholder and Task Interaction <i>Julie R. Jupp</i>	9-285
Immersive Product Improvement IPI – First Empirical Results of a New Method <i>Rafael Kirschner, Andreas Kain, Alexander Lang, Udo Lindemann</i>	9-295
A Methodology for Designing a Recommender System Based on Customer Preferences <i>Inês Jomaa, Emilie Poirson, Catherine Da Cunha, Jean-François Petiot</i>	9-305
Evaluation of Solution Variants in Conceptual Design by Means of Adequate Sensitivity Indices <i>Tobias Eifler, Johannes Mathias, Roland Engelhardt, Hermann Kloberdanz, Herbert Birkhofer, Andrea Bohn</i>	9-314

Modular Optimization Strategy for Layout Problems <i>Julien Bénabès, Emilie Poirson, Fouad Bennis, Yannick Ravaut</i>	9-324
Maintenance Engineering: Case Study of Fitness for Service Assessments <i>Francesco Giacobbe, Domenico Geraci, Emanuele Biancuzzo, Mirko Albino</i>	9-335
An Approach for the Automated Synthesis of Technical Processes <i>Tino Stankovi, Kristina Shea, Mario Štorga, Dorian Marjanovi</i>	9-345
Understanding Styling Activity of Automotive Designers: A Study of Manual Interpolative Morphing Through Freehand Sketching <i>Shahriman Zainal Abidin, Anders Warell, Andre Liem</i>	9-357
Advanced Applications of a Computational Design Synthesis Method <i>F. Bolognini, K. Shea, A.A.Seshia</i>	9-367
Exploring Potentials for Conservational Reasoning using Topologic Rules of Function Structure Graphs <i>Chiradeep Sen, Joshua D. Summers, Gregory M. Mocko</i>	9-377
A Decomposition Algorithm for Parametric Design <i>J. M. Jauregui-Becker, W. O. Schotborgh</i>	9-389
Innovation Through Design for Emotion <i>Vincent Berdillon, Anne Guenand</i>	9-399

VOLUME 10: DESIGN METHOD AND TOOLS PART 2

Can Existing Usability Techniques Prevent Tomorrow's Usability Problems? <i>Christelle Harkema, Ilse Luyk-De Visser, Kees Dorst, Aarnout Brombacher</i>	10-1
Application to a Car Body Frame Based on Parameter Guidelines for Deriving Diverse Solutions using Emergent Design System <i>Koichiro Sato, Yoshiyuki Matsuoka</i>	10-11
Hierarchical System Concept Generation <i>Rosenstein David, Yoram Reich</i>	10-24
Usage Context-Based Choice Modeling for Hybrid Electric Vehicles <i>Lin He, Wei Chen</i>	10-35
An Examination of the Application of Plan-Do-Check-Act Cycle in Product Development <i>Eirin Lodgaard, Knut Einar Aasland</i>	10-47
Realizing a Truly 3D Product Visualization Environment – A Case for using Holographic Displays <i>Eliab Z. Opiyo</i>	10-56
Design Exploration with Useless Rules and Eye Tracking <i>Iestyn Jowers, Miquel Prats, Alison Mckay, Steve Garner</i>	10-66
Simulation Based Generation of an Initial Design Taking into Account Geometric Deviations and Deformations <i>Michael Walter, Thilo Breitsprecher, Georg Gruber, Sandro Wartzack</i>	10-78
Collaborative Idea Generation using Design Heuristics <i>Seda Yilmaz, James L. Christian, Shanna R. Daly, Colleen M. Seifert, Richard Gonzalez</i>	10-91

Understanding Managers Decision Making Process for Tools Selection in the Core Front End of Innovation <i>Francesco P. Appio, Sofiane Achiche, Tim Mcaloone, Alberto Di Minin</i>	10-102
Evaluating the Risk of Change Propagation <i>Arman Oduncuoglu, Thomson, Vince</i>	10-114
Multilayer Network Model for Analysis and Management Of Change Propagation <i>Michael C. Pasqual, Olivier L. De Weck</i>	10-126
Can Designers be Proactively Supported as from Product Specifications? <i>Amanda Galea, Jonathan Borg, Alexia Grech, Philip Farrugia</i>	10-139
Design Preference Elicitation: Exploration and Learning <i>Yi Ren, Panos Papalambros</i>	10-149
Designing to Maximize Value for Multiple Stakeholders: A Challenge to Med-Tech Innovation <i>Lauren Aquino Shluzas, Martin Steinert, Larry J. Leifer</i>	10-159
Customer Value is Not a Number - Investigating the Value Concept in Lean Product Development <i>Martin Gudem, Martin Steinert, Torgeir Welo, Larry Leifer</i>	10-167
An Agent-Based System for Supporting Design Engineers in the Embodiment Design Phase <i>Martin Kratzer, Michael Rauscher, Hansgeorg Binz, Peter Goehner</i>	10-178
Combining Narrative and Numerical Simulation: A Supply Chain Case <i>Mette Sanne Hansen, Klaes Rohde Ladeby, Lauge Baungaard Rasmussen, Peter Jacobsen</i>	10-190
Change in Requirements During the Design Process <i>Mohd Nizam Sudin, Saeema Ahmed-Kristensen</i>	10-200
Understanding Adaptability Through Layer Dependencies <i>Robert Schmidt Iii, Jason Deamer, Simon Austin</i>	10-209
Interactivity in Early-Stage Design by Real-Time Update of Stress Information for Evolving Geometries <i>J. Trevelyan, D.J. Scales</i>	10-221
A Value-Centric QFD for Establishing Requirements Specification <i>Xinwei Zhang, Guillaume Auriol, Anne Monceaux, Claude Baron</i>	10-228
IT Support for the Creation and Validation of Requirements Specifications – with a Case Study for Energy Efficiency <i>Thomas Reichel, Gudula Runger, Daniel Steger, Haibin Xu</i>	10-238
A Decision Support System for the Concept Development of RIM Parts <i>Ricardo Torcato, Ricardo Santos, Madalena Dias, Richard Roth, Elsa Olivetti, Jose Carlos Lopes</i>	10-248
Abstract Prototyping in Software Engineering: A Review of Approaches <i>Els Du Bois, Imre Horvath</i>	10-258
Early Reliability Estimation in Automotive Industry <i>Michael Kopp, Daniel Hofmann, Bernd Bertsche, Christian HeB, Oliver Fritz</i>	10-270
System Dynamics Modeling of New Vehicle Architecture Adoption <i>Carlos Gorbea, Udo Lindemann, Olivier De Weck</i>	10-278

Evaluating Methods for Product Vision With Customers' Involvement to Support Agile Project Management <i>João Luis G. Benassi, Lucelindo D. Ferreira Junior, Daniel C. Amaral</i>	10-290
Wants Chain Analysis: Human-Centered Method for Analyzing and Designing Social Systems <i>Takashi Maeno, Yurie Makino, Seiko Shirasaka, Yasutoshi Makino, Sun K. Kim</i>	10-302
Redundancy Eliminations and Plausible Assumptions of Design Parameters for Evaluating Design Alternatives <i>Alexandros Zapaniotis, Argyris Dentsoras</i>	10-311
Use of Design Methodology to Accelerate the Development and Market Introduction of New Lightweight Steel Profiles <i>Frank Nehuis, Jan Robert Ziebart, Carsten Stechert, Thomas Vietor</i>	10-321
The use of Storyboard to Capture Experiences <i>Anders Wikström, Jennie Andersson, Åsa Öberg, Yvonne Eriksson</i>	10-331
Usability Compliant Supportive Technologies in Simulation-Driven Engineering <i>Jochen Zapf, Bettina Alber-Laukant, Frank Rieg</i>	10-341
A Visualization Concept for Supporting Module Lightweight Design <i>Thomas Gumpinger, Henry Jonas, Benedikt Plaumann, Dieter Krause</i>	10-349
Exploring a Decision-Making Forum in Early Product Development <i>ngrid Kihlander</i>	10-360
The Benefits and Pitfalls of Digital Design Tools <i>Tucker J. Marion, Sebastian K. Fixson</i>	10-370
A Haptic Based Hybrid Mock-Up for Mechanical Products Supporting Human-Centered Design <i>Daniel Krüger, Andreas Stockinger, Sandro Wartzack</i>	10-380
Models and Software for Corrugated Board and Box Design <i>Vahid Sohrabpour, Daniel Hellström</i>	10-392
Evolutionary Design Synthesis Comparison: Growth and Development Vs. Fixed-Mesh Cells <i>Or Yogeve, Andrew A. Shapiro, Erik K. Antonsson</i>	10-402
Autonomous Visualization Agents to Enhance the Analysis of Virtual Prototypes <i>Rafael Radkowski, Jürgen Gausemeier</i>	10-413
Identifying a Dynamic Interaction Model: A View from the Designer-User Interactions <i>Jaehyun Park, Richard Boland, Jr.</i>	10-426
Linkage of Methods Within the UMEA Methodology - An Approach to Analyse Uncertainties in the Product Development Process <i>Roland Engelhardt, Tobias Eifler, Johannes Mathias, Hermann Kloberdanz, Herbert Birkhofer, Andrea Bohn</i>	10-433
On the Functions of Products <i>M. Aurisicchio, N.L. Eng, J.C. Ortíz Nicolás, P.R.N. Childs, R.H. Bracewell</i>	10-443
Benchmarking Study of Automotive Seat Track Sensitivity to Manufacturing Variation <i>Maciej Mazur, Martin Leary, Sunan Huang, Tony Baxter, Aleksandar Subic</i>	10-456
Bioinspired Conceptual Design (BICD): Conceptual Design of a Grasshopper-Like Jumping Mechanism as a Case Study <i>Aylin Konez Eroglu, Zuhail Erden, Abdulkadir Erden</i>	10-466