ICED13

THE 19TH INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN

19th-22nd August 2013
Sungkyunkwan University (SKKU)
Seoul, Korea

Organised By
Creative Design Institute, Sungkyunkwan University
and the Design Society

Proceedings Volume DS75-08
DESIGN FOR HARMONIES
VOLUME 8: DESIGN EDUCATION

Edited By
Udo Lindemann
Srinivasan V
Yong Se Kim
Sang Won Lee
Bill Ion
Johan Malmqvist

Published by the Design Society

First published in 2013

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.

© 2013 The Design Society, unless otherwise stated.

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

ISBN 978-1-904670-51-3, EAN 9781904670513, 162 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

We welcome you to the proceedings of arguably the biggest conference on engineering design: 19th International Conference on Engineering Design (ICED13) held in Sungkyunkwan University, Seoul, Korea!

This proceedings is a compilation of the 342 peer-reviewed and accepted papers submitted to ICED13. The proceedings is published in different forms: a book of abstracts, a soft-copy of proceedings on a USB-based memory device and a hard-copy of proceedings, which is available via a print-on-demand supplier. All these different forms of proceedings are numbered against both Design Society and ISSN referencing to allow wider access, better referencing and improved citation in the near and distant future. All the accepted papers are divided among the following 9 themes: Design Processes; Design Theory and Research Methodology; Design Organisation and Management; Products, Services and Systems Design; Design for X, Design to X; Design Information and Knowledge; Human Behaviour in Design; Design Education; and Design Methods and Tools. The hard-copy of the proceedings is in turn divided into 9 volumes where each volume comprises papers from a theme. All the accepted papers are presented in podium or discussion sessions in the conference. It is important to make it explicit that all the accepted papers have successfully cleared the criteria for acceptance in ICED13. The division into podium and discussion sessions is solely based on grouping similar papers so as to allow relevant, connected, lively and stimulating presentations and discussions. For this year's conference we have introduced a number of novel schemes to reduce the bureaucratic load for authors and organisers and, it is hoped, to increase the quality of the conference. To name a few: (i) automatic production of the cover page of papers based on title of paper, details of authors, abstract and list of keywords in the Conference Management System, (ii) electronic acceptance of terms and conditions in copyrights, (iii) feedback of acceptance and quality of reviews to reviewers from authors, etc.

This proceedings is a consequence of dedicated efforts of many people, namely, the authors, the reviewers, the chairs and associate chairs of the various themes, and the members of the Programme Committee. The Programme Chair on behalf of Programme Committee would like to acknowledge the contributions of: (a) Authors for submitting papers, (b) Reviewers for providing timely comments and feedbacks to improve the quality of papers, (c) Chairs and Associate Chairs of themes for assisting in selection of reviewers, providing directions for improvements to papers with the status of major revisions, and helping in the final decisions of papers.

We hope that you enjoy the programme of ICED13 as much as we have enjoyed creating and organising it.

Udo Lindemann
Programme Chair

Srinivasan V
Assistant Programme Chair

Preface by ICED13 Conference Chair

Welcome to the 19th International Conference on Engineering Design 2013 (ICED13), and its conference proceedings. The theme of ICED13, *Design for Harmonies,* is well reflected in the programme and papers of the conference. As design practice and research make progress, integration and incorporation of diverse viewpoints take more essential roles. ICED13 will make its mark in the history of ICED and the Design Society as an important cornerstone for harmonies in design.

Increasing numbers of presentations in topics like human behavior in design and product, service and systems design indicate that issues of harmonies of products and services and those of human-centered views and technology support are at the core of design research. With continued excellence in the topics of design methods and tools, design information and knowledge and design processes, strong research foundations of design have been confirmed in the programme. Presentations in design organisation and management, design for X, design to X, and design theory and research methodology also demonstrate the leadership of the Design Society community in these important issues. Design education is yet another important area where new needs and requirements appear as the roles of design become broader. As Seoul is the very first Asian city hosting ICED, more papers from Asian countries appear in ICED13. This reflects harmonies of East and West being strengthened in design research. ICED13 will make a good transition for drawing more such harmonies.

In addition to a technical programme of keynote, podium and discussion sessions, ICED13 has organized a few special events such as the Young Members Event. Ten selected presentations by young designers and design researchers will address the Future of Design. This event is open to the (young) public so that diverse harmonies can be achieved by the attendees. With opening and closing ceremonies and receptions as well as a conference banquet, diverse opportunities for cultural harmonies are prepared. For example, Korean traditional culture experiences are available for conference attendees and accompanying guests together with old Korean traditional buildings in order to draw harmonies from the Old and the New. The optional Gangnam-Style tour will introduce modern Korean culture as featured in the world hit music video.

We hope you enjoy ICED 13 and have the fun and excitement of Design for Harmonies.

Yong Se Kim
Conference Chair

Sang Won Lee
Assistant Conference Chair

Preface by the Design Society President

The2013 International Conference on Engineering Design (ICED) will be the nineteenth held since the conference series was inaugurated in 1981. It will also be the sixth held under the auspices of the Design Society, an international society founded in 2001 to develop an understanding of all aspects of design. The previous five conferences have been in Stockholm, Melbourne, Paris, Stanford (California) and Copenhagen, and by holding the conference in Asia for the first time it is surely established as a truly world-wide event. The 2013 conference continues the tradition of holding the conference in an exciting location with a vibrant design research community and for which design is important to local industry and commerce. Seoul is exceptional in this regard, the dynamic heart of the world's second largest metropolis whose success is built on great design and engineering.

ICED13 also continues the format, established in 2009 and continued in 2011, of a conference 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 design research and practice.

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 make the Conference a success. Especially I would like to thank Yong Se Kim, Sang Won Lee and colleagues at Sungkyunkwan University for their great work in the Organising Committee, and Udo Lindemann, Srinivasan V 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.

Chris McMahon
Design Society President

ICED13 Programme Committee

Udo Lindemann – Programme Chair, Technical University of Munich, Germany

Srinivasan V – Assistant Programme Chair, Technical University of Munich, Germany

Panos Papalambros – Design Society Representative, University of Michigan, USA

Chris McMahon – Design Society Representative, University of Bristol, UK

Yong Se Kim – Organising Committee Representative, Sungkyunkwan University, Korea

Sang Won Lee – Organising Committee Representative, Sungkyunkwan University, Korea

ICED13 Organising Committee

Yong Se Kim – Conference Chair, Sungkyunkwan University, Korea

Sang Won Lee – Assistant Conference Chair, Sungkyunkwan University, Korea

Tom Howard – Technical University of Denmark, Denmark

Chris McMahon – University of Bristol, UK

Yoo Suk Hong – Seoul National University, Korea

Haeseong Jee – Hongik University, Korea

Jong Won Kim – Seoul National University, Korea

Kee-Ok Kim – Sungkyunkwan University, Korea

Myoun Kim – Sungkyunkwan University, Korea

Ji Hyun Lee – KAIST, Korea

Seong Il Lee – Sungkyunkwan University, Korea

ICED13 Theme Chairs

Design Processes
John Clarkson, University of Cambridge, UK
Gaetano Cascini, Politecnico di Milano, Italy

Design Theory and Research Methodology
Amaresh Chakrabarti, Indian Institute of Science, India
Yoram Reich, Tel Aviv University, Israel

Design Organisation and Management
Marco Cantamessa, Politecnico di Torino, Italy
Bernard Yannou, Ecole Centrale Paris, France

Products, Services and Systems Design
Olivier de Weck, Massachusetts Institute of Technology, USA
Yoo Suk Hong, Seoul National University, Korea

Design for X, Design to X
Tim McAloone, Technical University of Denmark, Denmark
Sandro Wartzack, Friedrich-Alexander-University Erlangen-Nuremberg, Germany

Design Information and Knowledge
Andy Dong, The University of Sydney, Australia
Ying Liu, National University of Singapore, Singapore

Human Behaviour in Design
Petra Badke-Schaub, Delft University of Technology, The Netherlands
Keiichi Sato, Illinois Institute of Technology, USA

Design Education
Bill Ion, University of Strathclyde, UK
Johan Malmqvist, Chalmers University of Technology, Sweden

Design Methods and Tools
Panos Papalambros, University of Michigan, USA
Wei Chen, Northwestern University, USA

ICED13 Scientific Committee

Achiche, Sofiane - Polytechnique Montreal, Canada

Adams, Robin - Purdue University, USA

Agogino, Alice Merner - University of California at Berkeley, USA

Agogue, Marine - ENSMP, France

Ahmed-Kristensen, Saeema - Technical University of Denmark, Denmark

Ahn, Jaemyung - KAIST, Korea

Albers, Albert - Karlsruhe Institute of Technology, Germany

Allen, Janet Katherine - University of Oklahoma, USA

Allison, James T. - University of Illinois at Urbana-Champaign, USA

Almefelt, Lars - Chalmers University of Technology, Sweden

Anderl, Reiner - TU Darmstadt, Germany

Andersson, Kjell - KTH Royal Institute of Technology, Sweden

Andrade, Ronaldo - Universidade Federal do Rio de Janeiro, Brazil

Annamalai Vasantha, Gokula Vijaykumar - University of Strathclyde, UK

Aoussat, Améziane - ENSAM, France

Arai, Eiji - Osaka University, Japan

Aurisicchio, Marco - Imperial College London, UK

Badke-Schaub, Petra - Delft University of Technology, Netherlands

Balan, Gurumoorthy - Indian Institute of Science, India

Ben-Ahmed, Walid - RENAULT, France

Bertoni, Marco - Luleå University of Technology, Sweden

Bey, Niki - Technical University of Denmark, Denmark

Bhamra, Tracy - Loughborough University, UK

Bigand, Michel - Ecole Centrale de Lille, France

Binz, Hansgeorg - University of Stuttgart, Germany

Birkhofer, Herbert - TU Darmstadt, Germany

Bjärnemo, Robert - Lund University, Sweden

Björk, Evastina, Lilian - NHV Nordic School of Public Health, Sweden

Blanco, Eric - Grenoble Institute of Technology, France

Blessing, Lucienne - University of Luxembourg, Luxembourg

Boelskifte, Per - Technical University of Denmark, Denmark

Bohemia, Erik - Loughborough University, UK

Bojcetic, Nenad - University of Zagreb, Croatia

Boks, Casper - Norwegian University of Science and Technology, Norway

Bolognini, Francesca - Nukem Technologies, Italy

Booker, Julian David - University of Bristol, UK

Bordegoni, Monica - Politecnico di Milano, Italy

Borg, Jonathan C. - University of Malta, Malta

Boujut, Jean-François - Grenoble Institute of Technology, France

Bouwhuis, Dominic G - TU Eindhoven, Netherlands

Bracewell, Robert Henry - University of Cambridge, UK

Brown, David C. - Worcester Polytechnic Institute, USA

Bruun, Hans Peter Lomholt - Technical University of Denmark, Denmark

Burchardt, Carsten - Siemens Industry Software GmbH & Co. KG, Germany

Burvill, Colin Reginald - University of Melbourne, Australia

Bylund, Nicklas - Sandvik Coromant, Sweden

Cagan, Jonathan - Carnegie Mellon University, USA

Caillaud, Emmanuel - ENSAM, France

Campbell, Matthew Ira - University of Texas at Austin, USA

Cantamessa, Marco - Politecnico di Torino, Italy

Casakin, Hernan - Ariel University, Israel

Cascini, Gaetano - Politecnico di Milano, Italy

Cash, Philip - Technical University of Denmark, Denmark

Chakrabarti, Amaresh - Indian Institute of Science, India

Chan, Kuei-Yuan - National Cheng Kung University, Taiwan

ICED13 Scientific Committee cont.

Chen, Wei - Northwestern University, USA
Childs, Peter R.N. - Imperial College London, UK
Choi, Young Mi - Georgia Institute of Technology, USA
Chu, Chih-Hsing - National Tsing Hua University, Taiwan
Chun-Hsien, Chen - Nanyang Technological University, Singapore
Clarkson, Peter John - University of Cambridge, UK
Claudio, Dell'Era - Politecnico di Milano, Italy
Coatanéa, Eric - Aalto University, Finland
Cormican, Kathryn - National University of Ireland, Ireland
Coutellier, Daniel - University of Valenciennes, France
Crilly, Nathan - University of Cambridge, UK
Cugini, Umberto - Politecnico di Milano, Italy
Culley, Steve - University of Bath, UK
Daly, Shanna - University of Michigan, USA
Deans, Joe - University of Auckland, New Zealand
Dekoninck, Elies Ann - University of Bath, UK
Dong, Andy - University of Sydney, Australia
Donndelinger, Joseph A. - General Motors LLC, USA
Dorst, Kees - University of Technology Sydney, Australia
Duffy, Alex - University of Strathclyde, UK
Eckert, Claudia - Open University, UK
Eigner, Martin - TU Kaiserslautern, Germany
Ekman, Kalevi - Aalto University, Finland
Ellman, Asko Uolevi - Tampere University of Technology, Finland
Elspass, Wilfried J. - Zurich University of Applied Sciences, Switzerland
Eppinger, Steven - Massachusetts Institute of Technology, USA
Ericson, Åsa - Luleå University of Technology, Sweden
Eris, Özgür - Delft University of Technology, Netherlands
Evans, Steve - University of Cambridge, UK
Fadel, Georges M. - Clemson University, USA
Fan, Ip-Shing - Cranfield University, UK
Fantoni, Gualtiero - University of Pisa, Italy
Fargnoli, Mario - Sapienza University of Rome, Italy
Feldhusen, Jörg - RWTH Aachen, Germany
Filippi, Stefano - University of Udine, Italy
Finger, Susan - Carnegie Mellon University, USA
Fischer, Xavier - ESTIA, France
Frankenberger, Eckart - Airbus, Germany
Frise, Peter R. - University of Windsor, Canada
Fujita, Kikuo - Osaka University, Japan
Fukuda, Shuichi - Stanford University, USA
Gardoni, Mickael - ÉTS / INSA de Strasbourg, Canada
Georgiev, Georgi - Kobe University, Japan
Gerhard, Detlef - Vienna University of Technology, Austria
Gericke, Kilian - University of Luxembourg, Luxembourg
Gero, John - Krasnow Institute for Advanced Study, USA
Gerson, Philips M. - Hanze University of Applied Sciences, Netherlands
Giess, Matt - Glue Reply, UK
Goel, Ashok - Georgia Institute of Technology, USA
Goh, Yee Mey - Loughborough University, UK
Göhlich, Dietmar - TU Berlin, Germany
Goker, Mehmet H. - Salesforce.com, USA
Goldschmidt, Gabriela - Technion - Israel Institute of Technology, Israel
Gomes, Samuel - University of Technology Belfort-Montbeliard, France
Graessler, Iris - Robert Bosch GmbH, Germany
Graziosi, Serena - Politecnico di Milano, Italy
Green, Graham - University of Glasgow, UK
Gries, Bruno - Capgemini Consulting, Germany
Grimheden, Martin - KTH Royal Institute of Technology, Sweden
Grote, Karl-Heinrich - Otto-von-Guericke University Magdeburg, Germany
Gzara, Lilia - Grenoble Institute of Technology, France

Hales, Crispin - Hales & Gooch Ltd., USA

Hansen, Claus Thorp - Technical University of Denmark, Denmark

Hatchuel, Armand - Mines ParisTech, France

Helten, Katharina - Technical University of Munich, Germany

Henderson, Mark Richard - Arizona State University, USA

Hicks, Ben - University of Bath, UK

Hoffenson, Steven - Chalmers University of Technology, Sweden

Hohne, Gunter - TU Ilmenau, Germany

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

Holmlid, Stefan - Linköping University, Sweden

Hölttä-Otto, Katja - Singapore University of Design and Technology, Singapore

Hong, Yoo Suk - Seoul National University, Korea

Horvath, Imre - Delft University of Technology, Netherlands

Hosnedl, Stanislav - University of West Bohemia, Czech Republic

Howard, Thomas J. - Technical University of Denmark, Denmark

Huet, Greg - École de Technologie Supérieure, Canada

Ijomah, Winifred - University of Strathclyde, UK

Ilies, Horea - Universitry of Connecticut, USA

Ion, William - University of Strathclyde, UK

Isaksson, Karl Ola - GKN Aerospace Engine Systems, Sweden

Jackson, Mats - Malardalen University, Sweden

Jagtap, Santosh - Lund University, Sweden

Johannesson, Hans - Chalmers University of Technology, Sweden

Johansson, Glenn - Jönköping University, Sweden

Johnson, Aylmer - University of Cambridge, UK

Jun, Thomas - Loughborough University, UK

Jupp, Julie Rose - University of Technology Sydney, Australia

Kannengiesser, Udo - Metasonic AG, Germany

Karlsson, Lennart - Luleå University of Technology, Sweden

Kazakci, Akin Osman - Mines ParisTech, France

Keates, Simeon - University of Abertay Dundee, UK

Keldmann, Troels - Keldmann Healthcare A/S, Denmark

Kelly, Jarod - University of Michigan, USA

Kim, Harrison - University of Illinois at Urbana-Champaign, USA

Kim, Kee-Ok - Sungkyunkwan University, Korea

Kim, Sun K - Stanford University, USA

Kim, Yong Se - Sungkyunkwan University, Korea

Kiriyama, Takashi - Tokyo University of the Arts, Japan

Kitamura, Yoshinobu - Osaka University, Japan

Kloberdanz, Hermann - TU Darmstadt, Germany

Kokkolaras, Michael - McGill University, Canada

Kota, Srinivas - Grenoble Institute of Technology, France

Kovacevic, Ahmed - City University London, UK

Krause, Dieter - Hamburg University of Technology, Germany

Kreimeyer, Matthias - MAN Truck & Bus AG, Germany

Kremer, Gul - Penn State University, USA

Kristensen, Tore - Copenhagen Business School, Denmark

Kuosmanen, Petri - Aalto University, Finland

Larsson, Andreas - Lund University, Sweden

Larsson, Tobias C. - Blekinge Institute of Technology, Sweden

Le Masson, Pascal - Mines ParisTech, France

Leary, Martin John - RMIT university, Australia

Lee, Sang Won - Sungkyunkwan University, Korea

Legardeur, Jeremy - ESTIA, France

Lenau, Torben Anker - Technical University of Denmark, Denmark

Levy, Pierre Denis - TU Eindhoven, Netherlands

Liem, André - Norwegian University of Science and Technology, Norway

Lilly, Blaine - Ohio State University, USA

Lindahl, Mattias - Linköping University, Sweden

Lindemann, Udo - Technical University of Munich, Germany

Linsey, Julie - Georgia Institute of Technology, USA

Liu, Ying - Cardiff University, UK

ICED13 Scientific Committee cont.

Lloveras, Joaquim - TU Catalonia, Spain
Mabogunje, Ade - Stanford University, USA
MacDonald, Erin - Iowa State University, USA
MacGregor, Steven Patrick - IESE Business School, Spain
Maier, Anja Martina - Technical University of Denmark, Denmark
Malak, Richard - Texas A&M, USA
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, Croatia
Marle, Franck - Ecole Centrale Paris, France
Matta, Nada - Universite of Technology of Troyes, France
Matthews, Jason Anthony - University of Glamorgan, UK
Matthiesen, Sven - Karlsruhe Institute of Technology, Germany
Maurer, Maik - Technical University of Munich, Germany
McAloone, Tim C. - Technical University of Denmark, Denmark
McDonnell, Janet Theresa - Central Saint Martins, UK
McKay, Alison - University of Leeds, UK
McMahon, Chris - University of Bristol, UK
Meboldt, Mirko - ETH Zurich, Switzerland
Mekhilef, Mounib - University of Orleans, France
Merlo, Christophe - ESTIA, France
Millet, Dominique - SUPMECA Toulon, France
Mocko, Gregory Michael - Clemson University, USA
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
Mörtl, Markus - Technical University of Munich, Germany
Moshaiov, Amiram - Tel Aviv University, Israel
Mougenot, Céline - Tokyo Institute of Technology, Japan
Moultrie, James - University of Cambridge, UK
Mourelatos, Zissimos P. - Oakland University, USA
Mulet, Elena - University of Jaume, Spain
Mullineux, Glen - University of Bath, UK
Murakami, Tamotsu - University of Tokyo, Japan
Nadeau, Jean-Pierre - ENSAM, France
Nagai, Yukari - JAIST, Japan
Nagel, Jacquelyn - James Madison University, USA
Newnes, Linda - University of Bath, UK
Nomaguchi, Yutaka - Osaka University, Japan
Norell Bergendahl, Margareta E B - KTH Royal Institute of Technology, Sweden
Oehmen, Josef - Massachusetts Institute of Technology, USA
Öhrwall Rönnbäck, Anna B - Linköping University, Sweden
Olesen, Jesper - Bang & Olufsen, Denmark
Ölundh Sandström, Gunilla - KTH Royal Institue of Technonolgy, Sweden
Ölvander, Johan - Linköping University, Sweden
Otto, Kevin - Singapore University of Design and Technology, Singapore
Ottosson, Stig - Gjøvik University College, Norway
Ouertani, Mohamed Zied - ABB, Germany
Ovtcharova, Jivka - Karlsruhe Institute of Technology, Germany
Paetzold, Kristin - University Bundeswehr Munich, Germany
Palm, William John - Roger Williams University, USA
Papalambros, Panos Y. - University of Michigan, USA
Parkinson, Matt - Pennsylvania State University, USA
Pavkovic, Neven - University of Zagreb, Croatia
Peters, Diane - LMS International, USA

Petiot, Jean-François - Ecole Centrale de Nantes, France

Ploug, Ole - Hydro Aluminium, Denmark

Prasad, Brian - Parker Aerospace, USA

Rai, Rahul - SUNY Buffalo, USA

Raine, John Kenneth - Auckland University of Technology, New Zealand

Reich, Yoram - Tel Aviv University, Israel

Reidsema, Carl Allen - University of Queensland, Australia

Remmen, Arne - Aalborg University, Denmark

Ren, Yi - University of Michigan, USA

Rexfelt, Oskar - Chalmers University of Technology, Sweden

Riel, Andreas Erik - Grenoble Institute of Technology, France

Riitahuhta, Asko Olavi - Tampere University of Technology, Finland

Rinderle, James - University of Massachusetts, USA

Ritzén, Sofia - KTH Royal Institute of Technology, Sweden

Rizzi, Caterina - University of Bergamo, Italy

Rohmer, Serge - University of Technologie of Troyes, France

Rosen, David - Georgia Institute of Technology, USA

Rotini, Federico - University of Firenze, Italy

Roucoules, Lionel - ENSAM, France

Rovida, Edoardo - Politecnico di Milano, Italy

Russo, Davide - University of Bergamo, Italy

Sachse, Pierre - University of Innsbruck, Austria

Sagot, Jean-Claude - University of Technology Belfort Montbeliard, France

Sakao, Tomohiko - Linköping University, Sweden

Salehi, Vahid - BMW AG, Germany

Salustri, Filippo Arnaldo - Ryerson University, Canada

Sangiorgi, Daniela - Lancaster University, UK

Sarkar, Prabir - Indian Institute of Technology Ropar, India

Sarkar, Somwrita - University of Sydney, Australia

Sato, Keiichi - Illinois Institute of Technology, USA

Schabacker, Michael - Otto-von-Guericke University Magdeburg, Germany

Schaefer, Dirk - Georgia Institute of Technology, USA

Schaub, Harald - IABG, Germany

Seepersad, Carolyn Conner - University of Texas at Austin, USA

Seering, Warren - Massachusetts Institute of Technology, USA

Sen, Chiradeep - Oregon Statue University, USA

Setchi, Rossi - Cardiff University, UK

Shea, Kristina - ETH Zurich, Switzerland

Shimomura, Yoshiki - Tokyo Metropolitan University, Japan

Siadat, Ali - ENSAM, France

Sigurjónsson, Jóhannes B. - Norwegian University of Science and Technology, Norway

Simpson, Timothy W. - Penn State University, USA

Singh, Vishal - Aalto University, Finland

Snider, Chris - University of Bath, UK

Söderberg, Rikard - Chalmers University of Technology, Sweden

Sonalkar, Neeraj - Stanford University, USA

Spitas, Christos - Delft University of Technology, Netherlands

Stal-Le Cardinal, Julie - Ecole Centrale Paris, France

Stankovic, Tino - ETH Zurich, Switzerland

Stark, Rainer G. - Berlin Institute of Technology, Germany

Stelzer, Ralph - TU Dresden, Germany

Stetter, Ralf - University of Applied Sciences Ravensburg-Weingarten, Germany

Stören, Sigurd - Norwegian University of Science and Technology, Norway

Storga, Mario - University of Zagreb, Croatia

Subrahmanian, Eswaran - Carnegie Mellon University, USA

Suh, Eun Suk - Seoul National University, Korea

Summers, Joshua David - Clemson University, USA

Sundin, Erik - Linköping University, Sweden

Tan, Adrian Ronald - BIO Intelligence Service, France

Tan, James Ah-Kat - Ngee Ann Polytechnic, Singapore

Taura, Toshiharu - Kobe University, Japan

ICED13 Scientific Committee cont.

Tegel, Oliver - Porsche AG, Germany

Terpenny, Janis P. - Iowa State University, USA

Thallemer, Axel - Universität für Künstlerische und Industrielle Gestaltung, Austria

Thoben, Klaus-Dieter - University of Bremen, Germany

Tollenaere, Michel - Grenoble Institute of Technology, France

Tomiyama, Tetsuo - Cranfield University, UK

Törlind, Peter - Luleå University of Technology, Sweden

Torry-Smith, Jonas Mørkeberg - Technical University of Denmark, Denmark

Troussier, Nadege - University of Technology of Troyes, France

Udiljak, Toma - University of Zagreb, Croatia

Vajna, Sandor J. - Otto-von-Guericke University Magdeburg, Germany

Valderrama Pineda, Andres Felipe - Aalborg University, Denmark

Vance, Judy M. - Iowa State University, USA

Vaneker, Tom Henricus Jozef - University of Twente, Netherlands

Vargas Hernandez, Noe - University of Texas at El Paso, USA

V, Srinivasan - Technical University of Munich, Germany

Vermaas, Pieter - Delft University of Technology, Netherlands

Vietor, Thomas - Braunschweig University of Technology, Germany

Vukic, Fedja - University of Zagreb, Croatia

Wang, Charlie C.L. - Chinese University of Hong Kong, Hong Kong

Wang, Yue - Hong Kong University of Science and Technology, Hong Kong

Wartzack, Sandro - Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany

Weber, Christian - TU Ilmenau, Germany

Weil, Benoit - Mines ParisTech, France

Weiss, Menachem P. - Technion - Israel Institute of Technology, Israel

Whitfield, Ian - University of Strathclyde, UK

Whitney, Daniel E - Massachusetts Institute of Technology, USA

Wood, Kristin - Singapore University of Design and Technology, Singapore

Wörösch, Michael - Technical University of Denmark, Denmark

Wynn, David - Cambridge University, UK

Yan, Liang - National University of Singapore, Singapore

Yan, Xiu-Tian - University of Strathclyde, UK

Yanagisawa, Hideyoshi - University of Tokyo, Japan

Yang, Maria - Massachusetts Institute of Technology, USA

Yannou, Bernard - Ecole Centrale Paris, France

Yilmaz, Seda - Iowa State University, USA

Yuen, Matthew - Hong Kong University of Science and Technology, Hong Kong

Zavbi, Roman - University of Ljubljana, Slovenia

Zeiler, Wim - TU Eindhoven, Netherlands

Zeng, Yong - Concordia University, Canada

Table of Contents

Preface by ICED13 Programme Chair
Preface by ICED13 Conference Chair
Preface by the Design Society President
ICED13 Programme Committee
ICED13 Organising Committee
ICED13 Theme Chairs
ICED13 Scientific Committee

VOLUME 8: DESIGN EDUCATION

A training strategy for managing distributed conceptual design work 8-1
Andrew J. Wodehouse, Philip J. Farrugia, Hilary J. Grierson, Jonathan C. Borg

Tutorial sustainable innovations - An innovative role-play concept for education 8-11
Karola Rath, Herbert Birkhofer, Hermann Kloberdanz, Dirk Hanusch

The development of a Lego Mindstorms-based curriculum for design and ergonomics students 8-21
David W. Garrett, Peter J. Underwood, Gyuchan Thomas Jun

People, place, process: Lessons learnt on the path to a d.school 8-29
Véronique B Hillen, Pierre Levy

Walk the talk. or: a design driven approach to design design education 8-39
Rianne C. Valkenburg, Janneke Sluijs

A comparative study between design students and professionals to understand the effectiveness of ergonomics education in industrial design courses in Turkey 8-49
Ilgım Eroğlu, Kerem Özcan, Abdüsselam Selami Çifter

Product-Service systems design education and a new interdisciplinary service design graduate program 8-57
Yong Se Kim, Sang Won Lee, Seong Il Lee, Kee-Ok Kim, Myoun Kim, Jong Hoon Won

Interactive fundamentals for graphic design 8-67
Viviana Cordova

Enhancing the concept generation capability of novice engineering designers 8-77
Martin John Leary, Colin Burvill, Bruce Field

Discursive constructions of design and implications for engineering education 8-85
Rikke Premer Petersen

Innovative teaching approach for the design process of mechanical products 8-95
Antoine Varret, Morad Mahdjoub

Concept development for innovative products - A challenge for engineering design education 8-105
Thomas Luft, Benjamin Schleich, Sandro Wartzack

Enriching requirement-activities in design through French-US instruction comparison 8-115
Guy Prudhomme, Franck Pourroy, Joshua David Summers, Jean-François Boujut

Tracking productivity patterns in an engineering design project 8-125
Anders Berglund, Johannes Blackne, Niklas Jansson, Sofia Ritzén

Reflections on the challenge of developing professional engineering designers and engineering design technologists – A New Zealand perspective 8-135
Antony John Robotham, John Kenneth Raine, Roy Jonathan Nates, David Edward White