



ICED 13

THE 19TH INTERNATIONAL CONFERENCE
ON ENGINEERING DESIGN

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Seoul, Korea

Organised By

Creative Design Institute, Sungkyunkwan University
and the Design Society

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DESIGN FOR HARMONIES

VOLUME 9: DESIGN METHODS AND TOOLS

Edited By

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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.



A handwritten signature in black ink, appearing to read 'Udo Lindemann'.

Udo Lindemann
Programme Chair



A handwritten signature in black ink, appearing to read 'Srinivasan V'.

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.



A stylized, handwritten signature in black ink, appearing to read 'Yong Se Kim'.

Yong Se Kim
Conference Chair



A stylized, handwritten signature in black ink, appearing to read 'Sang Won Lee'.

Sang Won Lee
Assistant Conference Chair

Preface by the Design Society President

The 2013 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.



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

Chris McMahon
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Table of Contents

Preface by ICED13 Programme Chair
Preface by ICED13 Conference Chair
Preface by the Design Society President
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VOLUME 9: DESIGN METHODS AND TOOLS

A modular design tool for visualizing complex multiscale systems <i>Paul Egan, Jonathan Cagan, Christian Schunn, Philip LeDuc</i>	9-1
Smart tiles systems - Spatial structures based on tile systems without external joints <i>Polina Karake Tener, Yasha Jacob Grobman</i>	9-13
Topographic optimization with variable boundary conditions: Enabling optimal design of interacting components <i>Martin John Leary, Darpan Shidid, Maciej Mazur, Milan Brandt, Aleksandar Subic</i>	9-23
Concept of product development simulator for an excavator using a haptic device <i>Omer Eldirdiry, Asko Uolevi Ellman</i>	9-31
Lack of integration between engineering industrial design processes: an analysis based on the historical evolution of professions and tools <i>Pierre-Antoine Bernard Arrighi, Akin Kazakci</i>	9-39
Application of dynamic value-attribute modeling in a product family <i>Chathura Withanage, Seung Ki Moon, Taezoon Park, Truong Ton Hien Duc</i>	9-49
The DNA of design and design signature: A perspective in motorcycle design <i>Sushil Chandra</i>	9-59
Theory driven design and real prototyping of biomass pyrolytic stove <i>Mbeo Calvince Ogeya, eric Coatanéa Coatanéa, Galina Medyna Medyna</i>	9-69
Designing on the road; exploring the who, where and why of individual mobility devices <i>Mieke van der Bijl-Brouwer, Pieta van der Molen, Mascha van der Voort</i>	9-79
Knee dynamic analysis in the development of above knee prosthesis for alpine skiing <i>Ivan Demšar, Matej Supej, Jože Duhovnik</i>	9-89
CDS platform: A platform for multi-physics computational design synthesis <i>Amir Hooshmand, Marc Schlaich, Liliya Belaus, Matthew Campbell</i>	9-99
Designing crime prevention - A review of methods <i>Rodger Neil Watson</i>	9-109

A proposal of the usability checklist corresponding to task flows <i>Toshihisa Doi, Toshiki Yamaoka</i>	9-117
Elaboration and assessment of a set of criteria for the evaluation of product ideas <i>Mathias Messerle, Hansgeorg Binz, Daniel Roth</i>	9-125
An integrated screening framework to analyze flexibility in engineering systems design <i>Mehdi Ranjbar Bourani, Michel-Alexandre Cardin, Wen Sin Chong, Ravindu Atapattu, Kok Seng Foo</i>	9-135
Clarification of sustainability consequences of manufacturing processes in conceptual design <i>Sophie Hallstedt, Ola Isaksson</i>	9-145
A visualization methodology for evaluating parts made of short fiber reinforced thermoplastics regarding their lightweight potential <i>Georg Gruber, Johannes Köbler, Sandro Wartzack</i>	9-155
Analyzing social influence through network simulations in choice modeling <i>Peilin Tian, Wei Chen</i>	9-165
A decision support system for market segment driven product design <i>Ningrong Lei, Seung Ki Moon</i>	9-177
An advanced procedure model for property-based product development <i>Thomas Luft, Hartmut Krehmer, Sandro Wartzack</i>	9-187
An approach to generate flexibility in engineering design of sustainable waste-to-energy systems <i>Junfei Hu, Michel-Alexandre Cardin, Kim-Leng Poh, Eng Seng Chia</i>	9-197
Performance measurement in global product development <i>Thomas Paul Taylor, Saeema Ahmed Kristensen</i>	9-207
Robust design proposal by the use of structural topology optimization considering uncertainties of input parameters and boundary conditions <i>Thomas Stangl, Michael Walter, Sandro Wartzack, Thomas Schneyer</i>	9-217
Comparison of low- and high-fidelity approach in model based design in the case of a portable motion platform <i>Asko Uolevi Ellman, Petter Krus, Ville Jouppila</i>	9-227
SysML-based model integration for online collaborative design of mechatronic systems <i>Hongri Fan, Yusheng Liu, Ying Liu</i>	9-237
Uncertainty modeling to enable software development platforms that can automate complex mechanical systems design <i>Kevin Otto, Christoffer Levandowski, Anders Forslund, Hans Johannesson, Rikard Söderberg</i>	9-247
Evaluating the failures criticality in collaborative design with suppliers <i>Hélène Personnier, Marie-Anne Le Dain, Richard Calvi</i>	9-257

Market performance prediction based conceptual design of mid-sized passenger aircrafts <i>Soon Young Han, Hae-Jin Choi</i>	9-267
Approaches for mapping between preferential probabilities and relative design preference ratings <i>Haifeng Ji, Tomonori Honda, Maria C. Yang</i>	9-277
Continuous design FMEA – Proposal for a new perspective on FMEA <i>Luiz Fernando Segalin de Andrade</i>	9-287
Are companies ready for the revolution in design – Modelling maturity for virtual prototyping <i>Susanna Aromaa, Simo-Pekka Leino, Juhani Viitaniemi</i>	9-297
Research on design idea generation support through design practice <i>Tamotsu Murakami, Shota Higashihara, Takamasa Fukuda, Kazutaka Ueda</i>	9-305
Co-evolution of design tactics and CSCWD systems: Methodological circulation and the TATIN-PIC platform <i>Andrea Luigi Guerra, Thierry Gidel, Atman Kendira, Enrico Vezzetti, Alistair Jones</i>	9-315
Linking of function carriers with physical contradictions <i>Milosav Ognjanovic, Jasmina Babic, Sanja Vasin</i>	9-325
Supporting communication in the supply chain with design rationale maps <i>Marco Aurisicchio, Rob Bracewell, Gareth Armstrong</i>	9-335
Implementing collaborative crowdsourcing in different design problems <i>Donata Gabelloni, Gabriele Montelisciani, Gualtiero Fantoni</i>	9-345
Applying models of help desk conversations to the design of a customer sales support interface <i>Stan Ruecker, Gerry Derksen, Ted Pollari, Piotr Michura, Amanda Geppert, Lauren Braun, Kwame Green, Samia Pedraça, Scott Audette</i>	9-355
Operationalization of the quadrant-based validation in case of a designerly software development methodology <i>Els Du Bois, Imre Horvath</i>	9-365
Proofs of utility, innovation, profitability and concept for innovation selection <i>Bernard Yannou, Benjamin Zimmer, Romain Farel, Marija Jankovic, Julie Stal-Le Cardinal</i>	9-377
Agent-based consistency check in early mechatronic design phase <i>Michael Rauscher, Peter Goehner</i>	9-389
Predicting the behavior of solution alternatives within product improvement processes <i>Michael Abramovici, Andreas Lindner, Susanne Dienst, Madjid Fathi</i>	9-397
Promoting void-based design concept generation through computer-supported interactive structurization of verbal and drawing expression <i>Yutaka Nomaguchi, Tatsuya Ogawa, Kikuo Fujita</i>	9-407

Combining surveying patent information, reappearing problem and discovering breakthrough for design-around <i>Hsiang-Tang Chang, Chen-Yen Chang, Yuan-Po Yang</i>	9-417
A classification of the industrial relevance of robust design methods <i>Tobias Eifler, Martin Ebro, Thomas J. Howard</i>	9-427