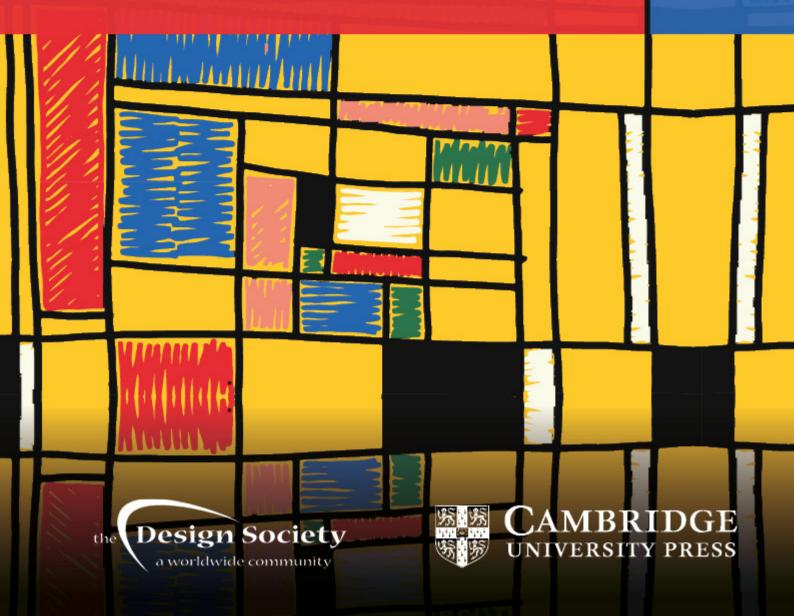
# PROCEEDINGS OF THE DESIGN SOCIETY





# INTERNATIONAL DESIGN CONFERENCE -DESIGN 2024

# 20-23 MAY 2024, CAVTAT, DUBROVNIK, CROATIA

### **Editors**

Mario Štorga, University of Zagreb FSB, Croatia Stanko Škec, University of Zagreb FSB, Croatia Tomislav Martinec, University of Zagreb FSB, Croatia Dorian Marjanović, University of Zagreb FSB, Croatia Neven Pavković, University of Zagreb FSB, Croatia Marija Majda Škec, University of Zagreb FSB, Croatia

### **Programme Committee**

P. John Clarkson, University of Cambridge, United Kingdom Tim C. McAloone, Technical University of Denmark, Denmark Julie Stal-Le Cardinal, CentraleSupélec, France Sandro Wartzack, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany Stanko Škec, University of Zagreb FSB, Croatia Mario Štorga, University of Zagreb FSB, Croatia

## Scientific Advisory Board

Abi Akle, Audrey, ESTIA, France Acharya, Shakuntala, Indian Institute of Technology Guwahati, India Ahumada-Tello, Eduardo, Autonomous University of Baja California, Mexico Ali, Wafa, Indus Valley School of Art & Architecture, Pakistan Allais, Romain, APESA, France Almefelt, Lars, Chalmers University of Technology, Sweden Ammersdörfer, Theresa, Technische Universität Clausthal, Germany Aoussat, Améziane, Arts et Métiers ParisTech, France Arlitt, Ryan Michael, Denmark Arrouf, Abdelmalek, LEMPAU, Batna1 University, Algeria Attia, Amir Ibrahem, California State University, Monterey Bay, United States of America Aurisicchio, Marco, Imperial College London, United Kingdom Bartz, Marcel, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany Basan, Robert, University of Rijeka, Faculty of Engineering, Croatia Baxter, Weston, Imperial College London, United Kingdom Becattini, Niccolo, Politecnico di Milano, Italy Behdinan, Kamran, University of Toronto, Canada Bencetic, Sanja, University of Zagreb Faculty of Architecture, School of Design, Croatia

Bender, Beate, Ruhr-Universität Bochum, Germany Benjamin, Stacy, Northwestern University, United States of America Bergsjö, Dag, Chalmers University of Technology, Sweden Bertoni, Alessandro, Blekinge Institute of Technology, Sweden Bertoni, Marco, Blekinge Institute of Technology, Sweden Blandino, Graziana, Politecnico di Torino, Italy Boahen, Samuel, Kwame Nkrumah University of Science and Technology, Ghana Bojčetić, Nenad, University of Zagreb FSB, Croatia Bonjour, Eric, Université de Lorraine, France Bordegoni, Monica, Politecnico di Milano, Italy Borg, Jonathan, University of Malta, Malta Borgianni, Yuri, Free University of Bozen Bolzano, Italy Boujut, Jean-Francois, Univ. Grenoble Alpes, CNRS, Grenoble INP, G-SCOP, France **Bouwhuis, Dominic G.,** Eindhoven University of Technology, The Netherlands Brahma, Arindam, Chalmers University of Technology, Sweden Brisco, Ross, University of Strathclyde, United Kingdom Bursac, Nikola, Hamburg University of Technology, Germany Bylund, Nicklas, United States of America Cagan, Jonathan, Carnegie Mellon University, United States of America Caldwell, Nicholas, University of Suffolk, United Kingdom Calvo, Rafael A., Imperial College London, United Kingdom Campean, Felician, University of Bradford, United Kingdom Cantamessa, Marco, Politecnico di Torino, Italy Carulli, Marina, Politecnico di Milano, Italy Caruso, Giandomenico, Politecnico di Milano, Italy Casakin, Hernan, Ariel University, Israel Cascini, Gaetano, Politecnico di Milano, Italy Cash, Philip, Northumbria University, United Kingdom Chamberlain, Paul, Sheffield Hallam University, United Kingdom Chantzaras, Christos, Technical University of Munich, Germany Chen, Liuqing, Zhejiang University, China Chiarello, Filippo, University of Pisa, Italy Childs, Peter R. N., Imperial College London, United Kingdom Choi, Christina Youngmi, Royal College of Art, United Kingdom Chong, Leah, Massachusetts Institute of Technology, United States of America Chulvi, Vicente, Universitat Jaume I, Spain Ciliotta Chehade, Estefania, Northeastern University, United States of America Clarkson, P. John, University of Cambridge, United Kingdom Cluzel, François, Laboratoire Genie Industriel, CentraleSupélec, Université Paris-Saclay, France Colombo, Samuele, Politecnico di Torino, Italy Conrad, Franziska, University of Southampton, United Kingdom Conrad, Jan, Hochschule Kaiserslautern University of Applied Sciences, Germany Coskun, Aykut, Koç University, Turkiye Coutellier, Daniel, INSA Hauts-de-France, France D'Amico, Enrique, National University of La Plata, Argentina **Deininger, Michael,** *Technical University of Denmark, Denmark* Dekoninck, Elies Ann, University of Bath, United Kingdom Del Curto, Barbara, Politecnico di Milano, Italy Del Giorgio Solfa, Federico, National University of La Plata, Argentina Demke, Niels, Helmut-Schmidt-Universität/Universität der Bundeswehr Hamburg, Germany Eckert, Claudia, The Open University, United Kingdom Ehlers, Tobias, Gottfried Wilhelm Leibniz Universität Hannover, Germany

**Eifler, Tobias,** *Technical University of Denmark, Denmark* Eisenbart, Boris, Swinburne University of Technology, Australia Ellman, Asko Uolevi, Tampere University, Finland Eneberg, Magnus, KTH Royal Institute of Technology, Sweden Eppinger, Steven, Massachusetts Institute of Technology, United States of America Erbe, Torsten, ASML BV, The Netherlands Erden, Zuhal, Atilim University, Turkiye Ericson, Åsa, Luleå University of Technology, Sweden Eriksson, Yvonne, Mälardalen University, Sweden Eynard, Benoit, Université de Technologie de Compiègne, France Fain, Nuša, Carleton University, Canada Fantoni, Gualtiero, University of Pisa, Italy Fargnoli, Mario, Universitas Mercatorum, Italy Farrugia, Philip, University of Malta, Malta Favi, Claudio, Università degli studi di Parma, Italy Fazelpour, Mohammad, University of Maryland, United States of America Ferrise, Francesco, Politecnico di Milano, Italy Fillingim, Kenton Blane, Oak Ridge National Laboratory, United States of America Finger - CMU, Susan, Carnegie Mellon University, United States of America Fiorineschi, Lorenzo, University of Florence, Italy Fischer, Xavier, ESTIA, France Formentini, Giovanni, Aarhus University, Denmark Forte, Sven, CONTACT Software, Germany Fortin, Clement, Skolkovo Institute of Science and Technology, Russia Fujita, Kikuo, Osaka University, Japan Gaha, Raoudha, Université de Technologie de Compiègne, France Gembarski, Paul Christoph, Leibniz Universität Hannover, Germany Georgiev, Georgi V., Center for Ubiquitous Computing, University of Oulu, Finland Gerhard, Detlef, Ruhr-Universität Bochum, Germany Gero, John, UNC Charlotte, United States of America Göbel, Jens Christian, University of Kaiserslautern-Landau, Germany Goker, Mehmet, United States of America Gomes, Giovana Monteiro, Technical University of Denmark, Denmark Gonçalves, Milene, Delft University of Technology, The Netherlands Gooch, Shayne, University of Canterbury, New Zealand Gopsill, James, University of Bristol, United Kingdom Götz, Stefan, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany Goucher-Lambert, Kosa, University of California, Berkeley, United States of America Goudswaard, Mark, University of Bristol, United Kingdom Grafinger, Manfred, TU Wien, Austria Graziosi, Serena, Politecnico di Milano, Italy Grierson, Hilary, University of Strathclyde, United Kingdom Guagliano, Mario, Politecnico di Milano, Italy Guertler, Matthias R., University of Technology Sydney, Australia Gunn, Wendy, Aalborg University, Denmark Gupta, Ravi Kumar, National Institute of Technical Teachers Training Bhopal, India Hackenberg, Georg, University of Applied Sciences Upper Austria, Austria Hashemi Farzaneh, Helena, MTU Aero Engines, Germany Hassannezhad, Mohammad, Queen Mary University of London, United Kingdom Hatchuel, Armand, MINES ParisTech, France Hehenberger, Peter, University of Applied Sciences Upper Austria, Austria Hicks, Ben, University of Bristol, United Kingdom

Hirz, Mario, Graz University of Technology, Austria Holder, Daniel, University of Stuttgart, Germany Horvat, Nikola, University of Zagreb FSB, Croatia Howard, Thomas J., Technical University of Denmark, Denmark Howell, Bryan, Brigham Young University, United States of America Huang, Tao, East Tennessee State University, United States of America Hurst, Ada, University of Waterloo, Canada Husung, Stephan, Technische Universität Ilmenau, Germany I. Hallstedt, Sophie, Chalmers University of Technology, Sweden **Iijima, Junichi,** Tokyo University of Science, Japan Ilies, Horea, University of Connecticut, United States of America Inkermann, David, Technische Universität Clausthal, Germany Ioannou Kazamia, Kika, University of Nicosia, Cyprus **Ion, William,** *University of Strathclyde, United Kingdom* Isaksson, Ola, Chalmers University of Technology, Sweden Jagtap, Santosh, Indian Institute of Technology Guwahati, India Janković, Marija, CentraleSupélec, France Jean, Camille, Arts et Métiers ParisTech, France Johansson, Glenn, Lund University, Sweden Johansson Askling, Christian, Blekinge Institute of Technology, Sweden Jowers, Iestyn, The Open University, United Kingdom Jung, Eui Chul, Seoul National University, South Korea Jurčević Lulić, Tanja, University of Zagreb FSB, Croatia Juuti, Tero Sakari, Tampere University, Finland Kattwinkel, Daniela, Ruhr-Universität Bochum, Germany Keates, Simeon, University of Chichester, United Kingdom Keiding, Villads, Technical University of Denmark, Denmark Keldmann, Troels, Keldmann Healthcare A/S, Denmark Keshwani, Sonal, Indraprastha Institute of Information Technology, Delhi, India Khan, Mohammed Rajik, National Institute of Technology Rourkela, India Kiessling, Jonathan Max, University of Stuttgart, Germany Kim, Harrison, University of Illinois Urbana-Champaign, United States of America Kim, Yong Se, University of Turku, Finland Koch, Alexander, Bundeswehr University Munich, Germany Koh, Edwin, Singapore University of Technology and Design, Singapore Köhler, Christian, htw saar - University of Applied Sciences, Germany Kokkolaras, Michael, McGill University, Canada Komashie, Alexander, University of Cambridge, United Kingdom Komoto, Hitoshi, National Institute of Advanced Industrial Science and Technology (AIST), Japan Koronis, Georgios, University of the Aegean, Greece Kota, Srinivas, Birla Institute of Technology and Science, Pilani, India Kovacevic, Ahmed, City, University of London, United Kingdom Krause, Dieter, Hamburg University of Technology, Germany Krauss, Gordon, Harvey Mudd College, United States of America Kreimeyer, Matthias, University of Stuttgart, Germany Krus, Petter, Linköping University, Sweden Kwak, Minjung, Soongsil University, South Korea Lamé, Guillaume, CentraleSupélec, France Lee, Boyeun, University of Exeter Business School, United Kingdom Legaard, Jesper Falck, Design School Kolding, Denmark Legardeur, Jeremy, University of Bordeaux, ESTIA Institute of Technology, France Leroy, Yann, CentraleSupélec, France

Li, Jamy, Toronto Metropolitan University, Canada Liao, Ting, Stevens Institute of Technology, United States of America Lindahl, Mattias, Linköping University, Sweden Liu, Ying, Cardiff University, United Kingdom Liu, Yuan, Beijing Institute of Fashion Technology, China Livotov, Pavel, Offenburg University of Applied Sciences, Germany López Forniés, Ignacio, Universidad de Zaragoza, Spain Lugnet, Johan, Luleå University of Technology, Sweden **Luo**, Jianxi, Singapore University of Technology and Design, Singapore Mahdjoub, Morad, Université de Technologie de Belfort-Montbéliard, France Maier, Anja, University of Strathclyde, United Kingdom Malmqvist, Johan, Chalmers University of Technology, Sweden Mandolini, Marco, Università Politecnica delle Marche, Italy Maranzana, Nicolas, Arts et Métiers ParisTech, France Marcocchia, Giulia, CY école de design, France Marconi, Marco, Università degli Studi della Tuscia, Italy Marini, Michele, Technical University of Denmark, Denmark Marjanović, Dorian, University of Zagreb FSB, Croatia Martinec, Tomislav, University of Zagreb FSB, Croatia Marxt, Christian, ETH Zurich, Switzerland Masclet, Cédric, Univ. Grenoble Alpes, CNRS, Grenoble INP, G-SCOP, France Maselli, Vincenzo, Sapienza Università di Roma, Italy Matsumae, Akane, Kyushu University, Japan Matthews, Jason Anthony, University of the West of England, United Kingdom Maurya, Santosh Kumar, Hitachi, Ltd., Japan McAloone, Tim, Technical University of Denmark, Denmark McKay, Alison, University of Leeds, United Kingdom Menshenin, Yaroslav, Université Grenoble Alpes, Grenoble INP, France Merlo, Christophe, ESTIA, France Miehling, Jörg, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany Milčić, Diana, University of Zagreb Faculty of Graphic Arts, Croatia Millet, Dominique, SeaTech, Ecole d'ingénieurs - Université de Toulon, France Moehringer, Stefan, Simon Moehringer Anlagenbau GmbH, Germany Moghaddam, Mohsen, Northeastern University, United States of America Montagna, Francesca, Politecnico di Torino, Italy Moon, Seung Ki, Nanyang Technological University, Singapore Morosi, Federico, Politecnico di Milano, Italy Mörtl, Markus, Technical University of Munich, Germany Motte, Damien, Lund University, Sweden Mougaard, Krestine, Technical University of Denmark, Denmark Murakami, Tamotsu, University of Tokyo, Japan Ndiaye, Yakhoub, Singapore University of Technology and Design, Singapore Nespoli, Oscar, University of Waterloo, Canada Nicolas Perry, Nicolas, Arts et Métiers ParisTech, France Nielsen, Brita Fladvad, Norwegian University of Science and Technology, Norway Nizamis, Kostas, University of Twente, The Netherlands Nomaguchi, Yutaka, Osaka University, Japan Nordin, Axel, Lund University, Sweden **Oehmen, Josef,** Technical University of Denmark, Denmark Oh, David C., North Carolina State University, United States of America Öhrwall Rönnbäck, Anna, Luleå University of Technology, Sweden Ölvander, Johan, Linköping University, Sweden

**Onkar, Prasad,** Indian Institute of Technology Hyderabad, India Otsuka, Akimasa, Sanyo-Onoda City University, Japan Paetzold-Byhain, Kristin, Technische Universität Dresden, Germany Panarotto, Massimo, Chalmers University of Technology, Sweden Papalambros, Panos Y., University of Michigan, United States of America Papantonopoulos, Sotiris, Democritus University of Thrace, Greece Pavković, Neven, University of Zagreb FSB, Croatia Peters, Diane, Kettering University, United States of America Petiot, Jean-François, École Centrale de Nantes, France Pigosso, Daniela C. A., Technical University of Denmark, Denmark Pinquié, Romain, Univ. Grenoble Alpes, CNRS, Grenoble INP, G-SCOP, France Plaumann, Benedikt, Hamburg University of Applied Sciences, Germany Pradel, Patrick, Loughborough University, United Kingdom Prakash, Raghu Vasu, Indian Institute of Technology Madras, India Pulm, Udo, Hamburg University of Applied Sciences, Germany Purwaningrum, Lu'lu', Universitas Sebelas Maret, Indonesia Quattelbaum, Bastian, Hochschule Niederrhein University of Applied Sciences, Germany Qureshi, Ahmed, University of Alberta, Canada Ranscombe, Charlie, Swinburne University of Technology, Australia Reich, Yoram, Tel Aviv University, Israel Riel, Andreas, Grenoble INP, France Rohmer, Serge, Université de Technologie de Troyes, France Rossi, Monica, Politecnico di Milano, Italy **Roth, Daniel,** *University of Stuttgart, Germany* Rotini, Federico, University of Florence, Italy Royo, Marta, Universitat Jaume I, Spain Ruiz-Pastor, Laura, Universitat Jaume I, Spain Sakao, Tomohiko, Linköping University, Sweden Sarkar, Prabir, Indian Institute of Technology Ropar, India Sastre, Ricardo Marques, Federal University of Rio Grande do Sul, Brazil Schabacker, Michael, Otto von Guericke University Magdeburg, Germany Schaub, Harald, University of Bamberg, Germany Schleich, Benjamin, Technische Universität Darmstadt, Germany Schulte, Jesko, Blekinge Institute of Technology, Sweden Schulze, Sven-Olaf, INCOSE, Germany Seering, Warren, Massachusetts Institute of Technology, United States of America Self, James, Ulsan National Institute of Science and Technology, South Korea Sener, Bahar, Middle East Technical University, Turkiye Shafiee, Sara, Technical University of Denmark, Denmark Shea, Kristina, ETH Zurich, Switzerland Silva, Arlindo, Singapore University of Technology and Design, Singapore Singh, Ravindra, Delhi Technological University, India Singh, Vishal, Indian Institute of Science, Bangalore, India Siyam, Ghadir, BP, Canada Smojver, Ivica, University of Zagreb FSB, Croatia Snider, Chris, University of Bristol, United Kingdom Song, Binyang, Virginia Tech, United States of America Sosa, Ricardo, Monash University, New Zealand Stal-Le Cardinal, Julie, CentraleSupélec, France Stanković, Tino, ETH Zurich, Switzerland Stark, Rainer G., Technische Universität Berlin, Germany Stauffer, Larry Allen, University of Idaho, United States of America

Stechert, Carsten, Ostfalia University of Applied Sciences, Germany Steinert, Martin, Norwegian University of Science and Technology, Norway Stetter, Ralf, RWU University of Applied Sciences Ravensburg-Weingarten, Germany Stylidis, Kostas, Chalmers University of Technology, Sweden Sullivan, Brendan, Politecnico di Milano, Italv Škec, Marija Majda, University of Zagreb FSB, Croatia Škec, Stanko, University of Zagreb FSB, Croatia **Štorga, Mario,** University of Zagreb FSB, Croatia Tan, James Ah Kat, Singapore Tavčar, Jože, Lund University, Sweden Thoben, Klaus-Dieter, Universität Bremen / BIBA, Germany Thoring, Katja, Technical University of Munich, Germany Tiradentes Souto, Virginia, University of Brasilia, Brazil Todeti, Somasekhara Rao, National Institute of Technology Karnataka, Surathkal, India Tomiyama, Tetsuo, International Professional University of Technology in Tokyo, Japan Törlind, Peter, Luleå University of Technology, Sweden Trauer, Jakob, :em engineering methods AG, Germany Tyl, Benjamin, APESA, France Udiljak, Toma, University of Zagreb FSB, Croatia Umeda, Yasushi, The University of Tokyo, Japan Ura, Sharifu, Kitami Institute of Technology, Japan Usenyuk-Kravchuk, Svetlana, Ural Federal University, Russia Valderrama Pineda, Andres Felipe, Aalborg University, Denmark Valjak, Filip, University of Zagreb Faculty of Architecture, School of Design, Croatia Vallet, Flore, Laboratoire Genie Industriel, CentraleSupélec, Université Paris-Saclay, France Van der Loos, Mike, The University of British Columbia, Canada van der Vegte, Wilhelm Frederik, Delft University of Technology, The Netherlands Vareilles, Elise, ISAE-SUPAERO, France Vasantha, Gokula, Edinburgh Napier University, United Kingdom Vezzetti, Enrico, Politecnico di Torino, Italy Vielhaber, Michael, Saarland University, Germany Vietor, Thomas, Technische Universität Braunschweig, Germany Vignoli, Matteo, University of Bologna, Italy Vrdoljak, Milan, University of Zagreb FSB, Croatia Vrolijk, Ademir-Paolo, Government of Canada, Canada Vukašinović, Nikola, University of Ljubljana, Faculty of Mechanical Engineering, Slovenia Vuletic, Tijana, University of Glasgow, United Kingdom Wan, Fang, Southern University of Science and Technology, China Wang, Yan, Georgia Institute of Technology, United States of America Wang, Yue, *The Hang Seng University of Hong Kong, Hong Kong* Wartzack, Sandro, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany Wattts, Regan, University of Antwerp, Belgium Watz, Matilda, Blekinge Institute of Technology, Sweden Wendrich, Robert E., Rawshaping Technology RBSO, The Netherlands Wenngren, Johan, Luleå University of Technology, Sweden Wever, Renee, Linköping University, Sweden Whitfield, Robert Ian, University of Strathclyde, United Kingdom Wynn, David, University of Auckland, New Zealand Xiong, Xue, Tongji Uiversity, China Yanagisawa, Hideyoshi, The University of Tokyo, Japan Yannou, Bernard, CentraleSupélec, France Yildirim, Unal, Hubei University of Automotive Technology, China

Yip, Man Hang, University of Cambridge, United Kingdom
Zainal Abidin, Shahriman, Universiti Teknologi MARA, Malaysia
Zhang, Wendy, University of Canterbury, New Zealand
Zhang, Yanfang, Kyushu University, Japan
Zhang, Zai Fang, Shanghai University, China
Ziegler, Martin, Helbling Technik Bern AG, Switzerland
Zimmermann, Markus, Technical University of Munich, Germany
Zolghadri, Marc, ISAE-Supméca, France
Zorn, Stefan, University of Rostock, Germany
Žeželj, Dragan, University of Zagreb FSB, Croatia



## INTERNATIONAL DESIGN CONFERENCE -DESIGN 2024

# 20-23 MAY 2024, CAVTAT, DUBROVNIK, CROATIA

#### TABLE OF CONTENTS

#### Design Theory and Research Methods

Design meety and recourse methods	
Circularity in product engineering - towards a forward-looking approach across product generation Albert Albers, Leonard Tusch, Michael Jäckle, Moritz Seidler and Christoph Kempf	ns pp. 1 - 12
Feedback thought at the intersection of systems and design science Igor Czermainski de Oliveira, Daniel Guzzo and Daniela C. A. Pigosso	pp. 13 - 22
Introducing a framework to translate user scenarios into engineering specifications with "action steps" <i>Ulugbek Vahobjon Ugli Ismatullaev and KwanMyung Kim</i>	pp. 23 - 34
Innovation of meaning: design-driven study based on the interpretive theory of new meaning Shotaro Kushi and Hideyoshi Yanagisawa	pp. 35 - 44
Virtual design hackathons: a data collection framework Tomislav Martinec, Filip Valjak, Nikola Horvat, Mark Goudswaard, Daniel Nygård Ege, Robert Ballantyne, Martin Francis Berg, Tobias Glaser, Cornelius Grosse, Zvonimir Lipšinić, Fanika Lukačević, Marek S. Lukasiewicz, Robert Mašović, Adam McClenaghan, Teresa Monti, Henrik H. Øvrebø, Pascal Schmitt, Vegar Stubberud, Emmanuel TJ Taiwo and Ana Lisac	pp. 45 - 54
Playing against the rules: a new perspective on the potential of games and play as convivial and critical tools for imagining futures <i>Anna O. Meshcheryakova and Fabian Hemmert</i>	pp. 55 - 64
Human- and design-centric source: comparison using requirements checklist <i>Gouri Naik and V. Srinivasan</i>	pp. 65 - 74
Prototyping future societies: GIGA-mapping and narratives as design material <i>Brita Fladvad Nielsen, Gunika Rishi and Mari Bjerck</i>	pp. 75 - 84
A proposed framework for data-driven human factors evaluation Isabelle Ormerod, Henrikke Dybvik, Mike Fraser and Chris Snider	pp. 85 - 94
Operationalizing community-based open scientific design research benchmarks: application to model-based architecture design synthesis <i>Romain Pinquié, Lionel Roucoules, Pierre-Alain Yvars and Raphaël Chenouard</i>	pp. 95 - 104
Human interaction with the physical world: a brief review of studies on affordances <i>Khyati Priya, Jayesh Pillai and Avinash Shende</i>	pp. 105 - 114
Replication studies in engineering design - a feasibility study Jonas Rode, Ingo Jonuschies, Sven Matthiesen and Kilian Gericke	pp. 115 - 124
Future design narratives: an interdisciplinary approach to a decolonial glossary <i>Victoria Rodriguez Schon and Manuela Celi</i>	pp. 125 - 134
New combination of methods for supporting a simplified set-based design approach <i>Mikael Ström, Göran Gustafsson and Hans Johannesson</i>	pp. 135 - 144

A theory landscape of design: mapping the theoretical discourse of the discipline <i>Katja Thoring and Roland M. Mueller</i>	pp. 145 - 154
Shame cues: detecting shame in disguise and playing with new perspectives to inform the design process <i>June Kyong Trondsen</i>	pp. 155 - 164
A new approach to derive variation shares by combining the C&C <sup>2</sup> approach and the PGE model <i>Peter Michael Tröster, Giorgi Tsutskiridze, Tobias Dieck and Albert Albers</i>	pp. 165 - 174
A novel approach towards utilizing graph analyzing objects arrangement - case studies from Airbnb homes in New York and Boston <i>Yanhua Yao</i>	pp. 175 - 184
Design Organisation, Collaboration and Management	
The Karakuri IoT toolkit: a collaborative solution for ideating and prototyping IoT opportunities Álvaro Aranda-Muñoz, Yuji Yamamoto and Kristian Sandström	pp. 185 - 194
Aligning production requirements with product and production maturities: enhancing production preparation during product development Rohith Areth Koroth, Fredrik Elgh, Martin Lennartsson and Dag Raudberget	pp. 195 - 204
On-site analysis of work-related stress to design workers-friendly manufacturing systems Graziana Blandino, Samuele Colombo and Francesca Montagna	pp. 205 - 214
Implementing an open innovation process in the premium marine industry Jonathan Burgess, Rob Fanner and Christian McLening	pp. 215 - 224
Investigating low data consistency in work planning processes - causes, measures, and opportunities Valesko Dausch, Christopher Langner, Daniel Roth, Matthias Kreimeyer and Matthias R. Guertler	pp. 225 - 234
Exploring space manufacturing: designing a lunar factory for space-bound products in the new space economy <i>Eva De Francesco, Anna Ettorre, Federica Acerbi and Brendan P. Sullivan</i>	pp. 235 - 244
Human in the loop: revolutionizing industry 5.0 with design thinking and systems thinking <i>Mohammad Hossein Dehbozorgi, James Postell, David Ward, Carlo Leardi, Brendan P. Sullivan and Monica Rossi</i>	pp. 245 - 254
Human-centred engineering design: a cross-disciplinary product innovation practice Sindre Wold Eikevåg, Jan Auernhammer, Christer W. Elverum, Henrikke Dybvik and Martin Steinert	pp. 255 - 264
Scientometric exploration of responsible innovation: mapping the knowledge landscape Nuša Fain, Nikola Vukašinović and Andrej Kastrin	pp. 265 - 274
Prototyping industry 4.0: enhancing efficiency and productivity in small enterprises through iteration and low-cost solutions <i>Håkon Havsgård, Daniel Nygård Ege and Martin Steinert</i>	pp. 275 - 284
Gamification as an innovative method in user experience design David Kessing, Tim Katzwinkel and Manuel Löwer	pp. 285 - 294
Nurture employees' creative behaviors: unveiling the impact of design thinking on human organizational behavior Michele Melazzini and Gianluca Carella	pp. 295 - 304
Relation between purpose of individual agile elements and the need for their adaptation in product design & development Marvin Michalides, Stefan Weiss, Emir Gadzo, Kristin Paetzold-Byhain and Alexander Koch	pp. 305 - 314
The relation between service and digital transition: implications for designers	pp. 315 - 324

The relation between service and digital transition: implications for designers Teresa Monti, Samuele Colombo, Francesca Montagna and Gaetano Cascini

Weak tie interactions in networking: five types of interaction structures <i>Georgina Nightingall and Weston Baxter</i>	pp. 325 - 334
Towards a method for human-centred analysis of external variety <i>Olga Sankowski and Dieter Krause</i>	pp. 335 - 344
Towards agile automotive development: benefits, challenges and organizational changes <i>Franziska Scharold and Kristin Paetzold-Byhain</i>	pp. 345 - 352
Drivers and barriers for design and designers in interdisciplinary product development - a literature-based conceptual model Bernd Stoehr, Christian Koldewey and Roman Dumitrescu	pp. 353 - 362
Design Information and Knowledge	
Understanding and definition of scanning and monitoring of the future space in the context of the product engineering process <i>Albert Albers, Carsten Thümmel, Jessica Schmidt, Stefan Eric Schwarz, Michael Schlegel,</i> <i>Andreas Siebe and Tobias Düser</i>	pp. 363 - 372
Supporting the digital thread through the principles of complementarity <i>Yana Brovar, Saina Sadeghzadeh and Clement Fortin</i>	pp. 373 - 382
Design delusions and prototyping: eliciting the link between prototypes and product performance Daniel Nygård Ege, Mark Goudswaard, James Gopsill, Ben Hicks and Martin Steinert	pp. 383 - 392
The evolution of design patterns in joint decision-making spaces Hermann Wolfram Klöckner and Katja Thoring	pp. 393 - 402
Enhancing design representations of information and knowledge of complex and long-living assets by applying system modelling techniques <i>Fabian Niklas Laukotka, Markus Christian Berschik and Dieter Krause</i>	pp. 403 - 412
Introducing a multipliable BOM-based automatic definition of information retrieval in plant engineering Max Layer, Sebastian Neubert and Ralph Stelzer	pp. 413 - 422
Automatic knowledge graph creation from engineering standards using the example of formulas Janosch Luttmer, Mostafa Kandel, Dominik Ehring and Arun Nagarajah	pp. 423 - 432
Intelligent competency mapping for improving knowledge management in consulting firms <i>MohammadReza Mirafzal, Sabrine Fhal, Piyush Wadhera and Julie Stal-Le Cardinal</i>	pp. 433 - 442
How to facilitate comparability among product models: applying a standardizing description approach <i>Lukas Paehler and Sven Matthiesen</i>	pp. 443 - 452
Visualizing and analysing data-driven shift from decentralized to centralized automotive E/E architectures <i>Tejas Pravin Phadnis, Nils Feyerabend and Joachim Axmann</i>	pp. 453 - 462
Integration of product development data for further ontological utilization Jessica Pickel, Sebastian Bickel, Stefan Goetz and Sandro Wartzack	pp. 463 - 472
Enhancing knowledge management in the engineering design process through a communication platform <i>Sinan Ugurlu, Manfred Grafinger, Detlef Gerhard and Pinar Demircioglu</i>	pp. 473 - 482
Design Methods and Tools	
Evaluation of a multi-user requirements axiomatic design decision support tool for manufacturing process selection <i>Edward Abela, Philip Farrugia, Pierre Vella, Glenn Cassar and Maria Victoria Gauci</i>	pp. 483 - 492

Applying a product modularization approach on the case of a battery pack Julia Beibl, Katharina Zumach, Sven Wehrend, Marc Züfle, Eugen Hein, Benedikt Plaumann and Dieter Krause	pp. 493 - 502
Modeling uncertain requirements <i>Lukas Block</i>	pp. 503 - 512
Designing a framework for actuators for adaptive structures Matthias J. Bosch, Markus Nitzlader, Matthias Bachmann, Hansgeorg Binz, Lucio Blandini and Matthias Kreimeyer	pp. 513 - 522
Using cluster analysis to enhance a method for the management of disturbance factors via product structures <i>Richard Breimann, Laura Luran Sun and Eckhard Kirchner</i>	pp. 523 - 532
Automatic evaluation of the misplacement risk during manual assembly based on a CAD design <i>Alexander De Cock, Ncamisile Khanyile and Bieke Decraemer</i>	pp. 533 - 542
Developing a method to improve unknown identification and design efforts for environmental transition: a case study in the packaging industry <i>Marion Deshoulières, Pascal Le Masson and Benoît Weil</i>	pp. 543 - 552
Challenges of the integrative product and production system development Jan-Philipp Disselkamp, Ben Schütte and Roman Dumitrescu	pp. 553 - 562
Data- and simulation-based material behaviour prediction Anton Dybov, Carina Fresemann and Rainer Stark	pp. 563 - 572
Data-driven support for CAD parts modelling based on automated estimated production planning - approach and user research <i>Martin Erler, Sebastian Langula, Christian Wölfel, Julia Schneider, Christiane Kunath</i> <i>and Michael Königs</i>	pp. 573 - 582
Learnings from developing a custom virtual assembly environment for mountability issues of cooling cabinets <i>Georg Hackenberg and Christian Zehetner</i>	pp. 583 - 592
From tears to tiers - architectural principles for federated PLM landscapes Erik Herzog, Johan Tingström, Johanna Wallén Axehill, Åsa Nordling Larsson and Christopher Jouannet	pp. 593 - 602
What can we learn from outstanding designers? The relationship between design expertise and prototyping <i>Birgit Jobst, Katja Thoring and Petra Badke-Schaub</i>	pp. 603 - 612
New methodology for the characterization of 3D model reconstructions to meet conditions of input data and requirements of downstream applications <i>Robert Joost, Stephan Mönchinger and Kai Lindow</i>	pp. 613 - 622
Enhancing the IFM framework based on a meta-analysis of other design methods Merlin Krüger, Kilian Gericke and Stefan Zorn	pp. 623 - 632
Future-robust product design - validating influencing factors on upgradeable mechatronic systems Maximilian Kuebler, Carolin Lange, Bastian Glasmacher, Tobias Düser and Albert Albers	pp. 633 - 642
A comparative study of VR CAD modelling tools for design Aman Kukreja, Christopher Michael Jason Cox, James Gopsill and Chris Snider	pp. 643 - 652
Engineering designers' CAD performance when modelling from isometric and orthographic projections Fanika Lukačević, Niccolò Becattini and Stanko Škec	pp. 653 - 662
The impact of specialized software on concept generation Julian Martinsson Bonde, Richard Breimann, Johan Malmqvist, Eckhard Kirchner and Ola Isaksson	pp. 663 - 672

pp. 673 - 682
pp. 683 - 692
pp. 693 - 702
pp. 703 - 712
pp. 713 - 722
pp. 723 - 734
pp. 735 - 744
pp. 745 - 754
pp. 755 - 764
pp. 765 - 774
pp. 775 - 784
pp. 785 - 794
pp. 795 - 804
pp. 805 - 814
pp. 815 - 824
pp. 825 - 834
pp. 835 - 844
pp. 845 - 854

6 degree of freedom positional object tracking for physical prototype digitisation Michael Wyrley-Birch, Aman Kukreja, James Gopsill, Christopher Michael Jason Cox and Chris Snider	pp. 855 - 864
Criticality-based planning of prototype sequences Stefan Zorn, Tobias Glaser and Kilian Gericke	pp. 865 - 874
Human Behaviour and Design Creativity	
The imperative of assessing negative creativity in design: a multi-dimensional approach <i>Petra Badke-Schaub, Katja Thoring, Harald Schaub and Roland M. Mueller</i>	pp. 875 - 884
Breaking cultural barriers: an integrated methodology for challenge-driven co-creation projects Annika Bastian, Christoph Kempf, Paulin Rudolph and Albert Albers	pp. 885 - 894
Creativity of products as meant by ordinary people: to what extent do novelty and usefulness matter? Aurora Berni, Yuri Borgianni and Demis Basso	pp. 895 - 904
The use of occurrences of ideas for constructing and characterizing the design space <i>Hernan Casakin, Hadas Sopher, John S. Gero and Or Haim Anidjar</i>	pp. 905 - 914
Exploring metacognitive processes in design ideation with text-to-image AI tools <i>Hao-Yu Chang and Jo-Yu Kuo</i>	pp. 915 - 924
Chronobiology of pupil dilation in design students during idea generation Samuele Colombo, John S. Gero, Alessandro Mazza and Marco Cantamessa	pp. 925 - 934
Design strategies to facilitate second-hand clothing acquisition Marie Das, Ingrid Moons and Els Du Bois	pp. 935 - 944
Investigating differences in brain activity between physical and digital prototyping in open and constrained design tasks Henrikke Dybvik, Adam McClenaghan, Mariya Stefanova Stoyanova Bond, Asbjørn Svergja, Tripp Shealy, Chris Snider, Pasi Aalto, Martin Steinert and Mark Goudswaard	pp. 945 - 954
How designers think creatively: an exploratory study in the use of visual and emotional mental imagery <i>Ian Marcus Edgecomb, Ross Brisco and Andrew Wodehouse</i>	pp. 955 - 964
Narrative drives design decision-making Scott Ferguson, Lisa Retzlaff, Kris Bryden and Kenneth Mark Bryden	pp. 965 - 974
The influence of culture on creativity in ideation: a review Zhengya Gong, Milene Gonçalves, Vijayakumar Nanjappan and Georgi V. Georgiev	pp. 975 - 984
Evaluating design approaches for encouraging behavior change in editors: exploring a digital nudging strategy in a non-personalized recommender system to promote adoption of augmented analytics <i>Tanja Heinrich and Oliver Szasz</i>	pp. 985 - 994
Unravelling experiences, barriers, and design strategies for encouraging reusable takeaway cup usage <i>Laure Herweyers, Els Du Bois and Ingrid Moons</i>	pp. 995 - 1004
Possession and dispossession: a dual phenomenon in digital artefacts Pranati Kompella and Neelakantan Keshavan	pp. 1005 - 1014
The EmotionProbe: an exploration of design students' emotions when designing Hazar Taissier Marji, Paul Rodgers and Ross Brisco	pp. 1015 - 1024
Mediators of the relationship between physical indoor spaces and individual creativity <i>Chris McTeague and Katja Thoring</i>	pp. 1025 - 1034

DS-Viz: a method for visualising design spaces <i>Esdras Paravizo and Nathan Crilly</i>	pp. 1035 - 1044
Exploring gesture generation for smartwatches: is user elicitation enough? Saugata Pramanik, Sahil Pabbathi and Shakuntala Acharya	pp. 1045 - 1054
Design to fail? The reasonably foreseeable failure and misuse Harald Schaub and Petra Badke-Schaub	pp. 1055 - 1064
Towards cycling engagement by mapping design interventions to observed barriers: an example from Glasgow's bike share programme <i>Mia Shepherd, Tripp Shealy, Lewis Urquhart, Deirdre Harrington and Anja Maier</i>	pp. 1065 - 1074
Characteristics of paralinguistic communication indicating pre-resonance during co-creative design grasped by decision tree analysis <i>Karen Shichijo and Akane Matsumae</i>	pp. 1075 - 1084
Assessment of structuredness of problems in design Sanjay Singh and Amaresh Chakrabarti	pp. 1085 - 1094
Effect of team diversity on teams' design space: a computational approach Marija Majda Škec, Mario Štorga and John S. Gero	pp. 1095 - 1104
"Ideas are really" - supporting collaborative dialogues and community of practice for innovation via CO:RE cards Safia Najwa Suhaimi, Andrew Walters and Jo Ward	pp. 1105 - 1114
Co-design in virtual environments with 3D scanned childcare rooms in social virtual reality Yuki Taoka, Momoko Nakatani, Takumi Sato, Kaho Kagohashi, Fuyumi Iwasawa, Shouichi Hasegawa, Shigeru Owada and Shigeki Saito	pp. 1115 - 1124
Gender differences in design creativity Virginia Tiradentes Souto, Luciane Maria Fadel and Carla Galvão Spinillo	pp. 1125 - 1134
Exploring designers' cognitive abilities in the concept product design phase through traditional and digitally-mediated design environments Muhammad Tufail, Shahab Zaib, Sahr Uzma, Raja Mubashar Karim and KwanMyung Kim	pp. 1135 - 1146
An EEG study to understand semantic and episodic memory retrieval in creative processes <i>Yuan Yin and Peter Childs</i>	pp. 1147 - 1156
Design for Sustainability	
Interpretation of sustainability philosophies into product design for awareness, cohesion,	
and equity Laura Isabel Acevedo, Daniela C. A. Pigosso and Tim C. McAloone	pp. 1157 - 1168
Interdisciplinary Transition Innovation, Management, and Engineering (InTIME) Design: an intersection analysis of design approaches for whole-system sustainability <i>Florian Ahrens, Susan Krumdieck and Daniel Kenning</i>	pp. 1169 - 1178
Remanufacturing as a circular design strategy in healthcare: integrating socio-technical and environmental-economic assessments Amanda Worsøe Andersen, Siri Fritze Jørgensen, Wendy Gunn and Monia Niero	pp. 1179 - 1188
Uncovering rebound effects of sufficiency-oriented product-service systems: a systematic review Elise Marie Andrew, Jeroen van den Bergh and Daniela C. A. Pigosso	pp. 1189 - 1198
Circular products: the balance between sustainability and excessive margins in design <i>Arindam Brahma, Sophie I. Hallstedt, David C. Wynn and Ola Isaksson</i>	pp. 1199 - 1208
Product-service systems in large automotive OEMs: characterising the decision-making process when developing and introducing vehicle sharing/pooling schemes <i>Lucia C. Burtnik Urueta and Elies Dekoninck</i>	pp. 1209 - 1218

Durability as a techno-socio-economic concept Felician Campean and Claudia Eckert	pp. 1219 - 1228
Understanding a SPSS-aided packaging-free shopping practice Ruihua Chen and Xueqing Miao	pp. 1229 - 1238
Developing readiness levels for risk assessment in green transition engineering projects Andy Mattulat Filipovic, Torgeir Welo and Josef Oehmen	pp. 1239 - 1248
Assessing the disassembly performance of washing machines through the design for circular disassembly methodology Giovanni Formentini, Thorvald Alrø Martiny, Christian Møller, Teodor Vernica and Devarajan Ramanujan	pp. 1249 - 1258
Design and collaboration strategies for circular economy implementation across the value chain <i>Giovana M. Gomes, Daniela C. A. Pigosso and Tim C. McAloone</i>	pp. 1259 - 1268
What Italian furniture companies do towards sustainable transition? Design actions and strategies showcased during Milan Design Week 2023 <i>Silvia Maria Gramegna, Francesca Mattioli and Xue Pei</i>	pp. 1269 - 1278
Identifying rebound effects in product-service systems: actors, mechanisms, triggers and drivers Daniel Guzzo and Daniela C. A. Pigosso	pp. 1279 - 1288
Scenario building guidelines for sustainable innovation François Haeberle, Giácomo Parolin and Daniela C. A. Pigosso	pp. 1289 - 1298
Operationalizing leverage points in business model design for sustainable systems change <i>Cadence Hsien and Steve Evans</i>	pp. 1299 - 1308
Modelling an ecosystem of business models in a circular value chain: the circular business ecosystem model canvas Avyay Jamadagni, Marco Aurisicchio and Lars Nybom	pp. 1309 - 1318
Systems thinking towards holistic, sustainability-oriented assessment and decision-making for lightweighting Katharina Johnston-Lynch, Robert Ian Whitfield and Dorothy Evans	pp. 1319 - 1328
Alignment of the functional structure with sustainability aspects in product development - combining the strengths of the functional structure with the MECO matrix <i>Björn Kokoschko, Laura Augustin, Michael Schabacker and Christiane Beyer</i>	pp. 1329 - 1338
Data-driven life cycle assessment for mechatronic systems: a comparative analysis of environmental impact assessments Artur Krause, Steffen Wagenmann, Katharina Ritzer, Albert Albers and Nikola Bursac	pp. 1339 - 1348
Navigating complexity: visualising sustainable product development knowledge through dynamic heatmaps Gerald Kremer, Sarah Aboumorra and Rainer Stark	pp. 1349 - 1358
Sustainability criteria for introducing new technologies in low-income contexts Adam Mattias Mallalieu, Amanda Jonasson, Sara Petersson, Marlene Rosendal, Sophie I. Hallstedt, Lars Almefelt and Ola Isaksson	pp. 1359 - 1368
Selecting sustainability indicators for smart product design based on industry 4.0/5.0 technologies: analysis and proposal of a methodological framework Bertrand Marconnet, Raoudha Gaha, Carla Assuad, Kristian Martinsen and Benoît Eynard	pp. 1369 - 1378
Design strategies for consumers' continued usage of reusable packaging systems (RPSS) Xueqing Miao, Lise Magnier and Ruth Mugge	pp. 1379 - 1388
Assessing sustainable recyclability of battery systems: a tool to aid design for disassembly <i>Fabio Marco Monetti, Pablo Zaguirre Martínez and Antonio Maffei</i>	pp. 1389 - 1398

What's the catch? Trade-off challenges in early design for sustainability <i>Giácomo Parolin, Tim C. McAloone and Daniela C. A. Pigosso</i>	pp. 1399 - 1408
Designing products for material simplifiers: antinomy or prospective for design? <i>Céline Perea and Cédric Masclet</i>	pp. 1409 - 1416
Consumer behaviour in the context of circular economy: a systematic literature review <i>Nicole Sofia Rohsig Lopez and Jérémy Legardeur</i>	pp. 1417 - 1426
Driving sustainable mobility: a study of electric vehicle adoption in rural India Aniruddh Dnyandeo Satpute, Parinita Rai and Prasad Onkar	pp. 1427 - 1436
Incorporating sustainability into product lifecycle management: a systematic literature review <i>Anne Seegrün, Louis Hardinghaus, Theresa Riedelsheimer and Kai Lindow</i>	pp. 1437 - 1446
A virtual reality experience to raise sustainability awareness within the fashion industry Elena Spadoni, Andrea Fiocca, Gianluca Zoni, Lina Maria Useche Infante, Lidia Cerutti, Paolo Maccarrone, Marina Carulli and Monica Bordegoni	pp. 1447 - 1456
Comparison of e-scooter tyre performance using rolling resistance trailer <i>George Stilwell, Shayne Gooch and Martial Lafitte</i>	pp. 1457 - 1466
Tactility in perception of biobased composites Manu Thundathil, Nicholas John Emerson, Ali Reza Nazmi, Bahareh Shahri, Jörg Müssig and Tim Huber	pp. 1467 - 1476
A transition approach for reuse and repair of manufactured products Flore Vallet, Benjamin Tyl, François Cluzel and Cédric Masclet	pp. 1477 - 1486
Using the low-tech concept to create scenarios: an analysis of its potential to design for sustainable urban future <i>Flore Vallet and Tjark Gall</i>	pp. 1487 - 1496
Explaining the rebound effects of sustainable design: a behavioural perspective <i>Imke G. H. Van der Loo and Daniela C. A. Pigosso</i>	pp. 1497 - 1506
Towards a unified absolute environmental sustainability decoupling indicator <i>Manon Villers, Daniela C. A. Pigosso, Thomas J. Howard and Tim C. McAloone</i>	pp. 1507 - 1516
Integration of sustainability into product development: insights from an industry survey <i>Sachira Vilochani, Tim C. McAloone and Daniela C. A. Pigosso</i>	pp. 1517 - 1526
Assessment of empowerment via inclusion of people in product lifecycle processes Naz Yaldiz and Amaresh Chakrabarti	pp. 1527 - 1536
Design measures to address carbon emissions in products' lifecycle: an empirical analysis Thayla Zomer, Eduardo de Senzi Zancul, Paulo Augusto Cauchick-Miguel and Eloiza Kohlbeck	pp. 1537 - 1546
Design for Healthcare	
Requirements elicitation in board game design for children with developmental language disorder (DLD) <i>Edward Abela, Emanuel Balzan, Philip Farrugia, Donia Stellini and Daniela Gatt</i>	pp. 1547 - 1556
Bridging the gap: a multidisciplinary approach to integrated care solutions for the aging population <i>Max John Bateson and Yonghun Lim</i>	pp. 1557 - 1566
Design of a healthcare ecosystem to improve user experience in pediatric urotherapy Lola Bladt, Rose-Farah Blomme, Anka J. Nieuwhof-Leppink, Alexandra Vermandel, Gunter De Win and Lukas Van Campenhout	pp. 1567 - 1576
Implementing the model-based systems engineering (MBSE) approach to develop an assessment framework for healthcare facility design <i>Tahere Golgolnia, Timoleon Kipouros, P. John Clarkson, Gesine Marquardt and Maja Kevdzija</i>	pp. 1577 - 1586

Surveying factors that influence healthcare personnel in the transition to reusable surgical gowns <i>Charlotte Harding, Ingrid Moons, Regan Watts, Gunter De Win and Els Du Bois</i>	pp. 1587 - 1596
Designing remote patient and family centred interventions: an exploratory approach Julian Houwen, Ragini S. Karki, Veronica R. Janssen, Valeria Pannunzio, Douwe E. Atsma and Maaike S. Kleinsmann	pp. 1597 - 1606
Design as a practice for implementing complex digital health: preliminary results from an interview study in the Netherlands <i>Fredrik K. Karlsson, Valeria Pannunzio, Dirk Snelders and Maaike S. Kleinsmann</i>	pp. 1607 - 1616
Emotional design of medical devices: exoskeletons and post-stroke recovery devices Frederik Kiersgaard Lund, Luke Edward Eric Feast, Milo Marsfeldt Skovfoged, Hendrik Knoche, Mostafa Mohammadi, Lotte N. S. Andreasen Struijk and Linda Nhu Laursen	pp. 1617 - 1626
Towards designing for health outcomes: implications for designers in eHealth design <i>Hosana Cristina Morales Ornelas, Maaike S. Kleinsmann and Gerd Kortuem</i>	pp. 1627 - 1636
Designing healthcare systems for earlier diagnosis and prevention of dementia Coco Newton, Jiwon Jung, Maaike S. Kleinsmann and P. John Clarkson	pp. 1637 - 1646
StudyWell: a co-design project for enhancing student mental health and wellbeing through service design and relational welfare Brita Fladvad Nielsen, Nina Petersen Reed, Ottar Ness, Mari Bjerck, Arnfrid Farbu Pinto, Ipar Memet and Katie Aurora Lineer	pp. 1647 - 1656
Co-designing for the NHS: the development of sustainable theatre garments <i>Paul Rodgers, Euan Winton, Lewis Urquhart, Jonathan O'Reilly and Carole Anderson</i>	pp. 1657 - 1666
Toward a design methodology for configuring assistive wearables David W. Rosen, Christina Youngmi Choi and Anoop Kumar Sinha	pp. 1667 - 1676
Considerations in the testing of a minimum viable product in healthcare <i>Komal Shah and Manish Arora</i>	pp. 1677 - 1686
Evaluating a web-based guide for designing digital patient experiences: preliminary results of a user test with design students <i>Tingting Wang, Yun Wang, P. John Clarkson, Judith Rietjens and Marijke Melles</i>	pp. 1687 - 1696
Designing positive emotional experiences of wearable medical technology for type 1 diabetes <i>Ryan Charles Williams and Yonghun Lim</i>	pp. 1697 - 1706
Design for Additive Manufacturing	
Play well, print well: using LEGO bricks as an intuitive benchmarking tool for 3D printers <i>Alan Air and Andrew Wodehouse</i>	pp. 1707 - 1716
Additively manufactured 3D micro scarf adhesive joints <i>Michael Ascher and Ralf Späth</i>	pp. 1717 - 1726
Design and evaluation of non-planar material extrusion on a 3-axis printer <i>Samuel Bengtsson, Axel Nordin and Jože Tavčar</i>	pp. 1727 - 1736
Design challenges in leveraging binder jetting technology to innovate the medical instrument field Lorenzo Cocchi, Marco Mariani, Serena Graziosi, Roberto Viganò and Nora Lecis	pp. 1737 - 1746
A knowledge-driven, integrated design support tool for additive manufacturing Claudius Ellsel and Rainer Stark	pp. 1747 - 1756
Additive manufacturing of individual bone implants made of bioresorbable calcium phosphate cement using the example of large skull defects <i>Stefan Holtzhausen, Philipp Sembdner, Martin Pendzik, Holger Wilhelm Rudolf Schmidt and</i> <i>Kristin Paetzold-Byhain</i>	pp. 1757 - 1768

The energy performance assessment method to establish the best part build orientation in additive manufacturing <i>Marco Mandolini, Mikhailo Sartini, Marta Rossi, Claudio Favi and Marco Marconi</i>	pp. 1769 - 1778
Investigating designers' preferred learning media to design for additive manufacturing <i>Martins Obi, Patrick Pradel, Matt Sinclair, Richard Bibb and Mark Evans</i>	pp. 1779 - 1788
Stress concentrations and design for additive manufacturing: a design artefact approach to investigation Didunoluwa Obilanade, Owen Rahmat Peckham, Adam McClenaghan, James Gopsill and Peter Törlind	pp. 1789 - 1798
Exploring high-stiffness pellets as filaments in fused filament fabrication Martin Lilletvedt Rasmussen, Simen Gjethammer Grønvik, Henrik H. Øvrebø, Ben Hicks, Chris Snider, Martin Steinert, Christer W. Elverum and Sindre Wold Eikevåg	pp. 1799 - 1808
A Bayesian expert system for additive manufacturing design assessment Benedict Alexander Rogers, Neill Campbell, Mandeep Dhanda, Alexander James George Lunt, Elise Catherine Pegg and Vimal Dhokia	pp. 1809 - 1818
An analytic cost model for bound metal deposition Mikhailo Sartini, Iacopo Bianchi, Alessio Vita, Michele Germani and Marco Mandolini	pp. 1819 - 1828
A proposal for guiding the selection of suitable DfAM support based on experiential knowledge <i>Pascal Schmitt, Lisa Siewert and Kilian Gericke</i>	pp. 1829 - 1838
Optical and mechanical testing of 3D printed parts made of high-viscosity silicone to identify process parameters and design advice for 3D printing and printer development <i>Joel Schön, Robin Löffler and Michael Koch</i>	pp. 1839 - 1848
Printing study and design guideline for small hollow structures in medical technology Eve Sobirey, Marie Wegner, Fabian Niklas Laukotka and Dieter Krause	pp. 1849 - 1858
Democratising dry adhesion development with consumer-grade AM Vegar Stubberud, Martin Steinert and Håkon Jarand Dugstad Johnsen	pp. 1859 - 1868
Providing a knowledge-based design catalog as an approach to support the development of design for additive manufacturing skills <i>Gregory-Jamie Tüzün, Daniel Roth and Matthias Kreimeyer</i>	pp. 1869 - 1878
Topology optimisation of multiple robot links considering screw connections Tobias Wanninger, Jintin Frank and Markus Zimmermann	pp. 1879 - 1888
Additive manufacturing in fluid power with novel application to hydraulic pump design Anton Wiberg, Liselott Ericson, Johan A. Persson and Johan Ölvander	pp. 1889 - 1898
Analysing shrinkage compensation in additive manufacturing: a comparative study of reverse engineering and gauge-based methods <i>Alessio Zanini, Marco Marconi and Gianluca Rubino</i>	pp. 1899 - 1908
Artificial Intelligence and Data-Driven Design	
Machine learning-based virtual sensors for reduced energy consumption in frost-free refrigerators <i>Alejandro Alcaraz, Dennis Ilare, Alessandro Mansutti and Gaetano Cascini</i>	pp. 1909 - 1918
Datasets in design research: needs and challenges and the role of AI and GPT in filling the gaps Mohammad Arjomandi Rad, Tina Hajali, Julian Martinsson Bonde, Massimo Panarotto, Kristina Wärmefjord, Johan Malmqvist and Ola Isaksson	pp. 1919 - 1928
Critical component detection in assemblies: a graph centrality approach Robert Ballantyne, Adam McClenaghan, Oliver Schiffmann and Chris Snider	pp. 1929 - 1938

Stimulating design ideation with artificial intelligence: present and (short-term) future Aurora Berni, Yuri Borgianni, Federico Rotini, Milene Gonçalves and Katja Thoring	pp. 1939 - 1948
Extending the function failure modes taxonomy for intelligent systems with embedded AI components <i>Felician Campean, Unal Yildirim, Aleksandr Korsunovs and Aleksandr Doikin</i>	pp. 1949 - 1958
Generative large language models in engineering design: opportunities and challenges Filippo Chiarello, Simone Barandoni, Marija Majda Škec and Gualtiero Fantoni	pp. 1959 - 1968
Assessing text-image patent datasets with text-based metrics for engineering design applications Marco Consoloni, Vito Giordano and Gualtiero Fantoni	pp. 1969 - 1978
Towards the digital factory twin - design guide for creating a 3D factory model Jan-Philipp Disselkamp, Robin Grothe, Jonas Lick, Ben Schütte, Sascha Brüne, Luca Schröder and Roman Dumitrescu	pp. 1979 - 1988
Sketch2Prototype: rapid conceptual design exploration and prototyping with generative AI <i>Kristen M. Edwards, Brandon Man and Faez Ahmed</i>	pp. 1989 - 1998
Benchmarking AI design skills: insights from ChatGPT's participation in a prototyping hackathon Daniel Nygård Ege, Henrik H. Øvrebø, Vegar Stubberud, Martin Francis Berg, Martin Steinert and Håvard Vestad	pp. 1999 - 2008
Automatic identification of role-specific information in product development: a critical review on large language models Dominik Ehring, Ismail Menekse, Janosch Luttmer and Arun Nagarajah	pp. 2009 - 2018
Integrating large language models for improved failure mode and effects analysis (FMEA): a framework and case study Ibtissam El Hassani, Tawfik Masrour, Nouhan Kourouma, Damien Motte and Jože Tavčar	pp. 2019 - 2028
Surrogate-based design optimization of the binder cover combining performance and production cost Pavel Eremeev, Hendrik Devriendt, Alexander De Cock and Frank Naets	pp. 2029 - 2038
A survey on the industry's perception of digital twins - a follow-up to the digital twin workshop at the DESIGN Conference 2022 Michel Fett, Julius Zwickler, Fabian Wilking, Stefan Goetz, Sebastian Schweigert-Recksiek, Ben Hicks, Oscar Nespoli, Kristina Wärmefjord, Sandro Wartzack and Eckhard Kirchner	pp. 2039 - 2048
Towards an automatic contradiction detection in requirements engineering Alexander Elenga Gärtner and Dietmar Göhlich	pp. 2049 - 2058
Towards the extraction of semantic relations in design with natural language processing <i>Vito Giordano, Marco Consoloni, Filippo Chiarello and Gualtiero Fantoni</i>	pp. 2059 - 2068
A low-cost non-intrusive spatial hand tracking pipeline for product-process interaction James Gopsill, Aman Kukreja, Christopher Michael Jason Cox and Chris Snider	pp. 2069 - 2078
The digital thread for system lifecycle management with a native graph database in a polyglot architecture <i>Nico Kasper, Michael Pfenning and Martin Eigner</i>	pp. 2079 - 2088
Improving sustainability of additive manufacturing processes based on digital twins - a case study Jessica Kos, Philipp Schröder, Jakob Trauer, Felix Endress, Markus Mörtl and Markus Zimmermann	pp. 2089 - 2098
Challenges for capturing data within data-driven design processes Christopher Langner, Yevgeni Paliyenko, Benedikt Müller, Daniel Roth, Matthias R. Guertler and Matthias Kreimeyer	pp. 2099 - 2108

D <sup>3</sup> IKIT: data-driven design innovation kit Boyeun Lee and Saeema Ahmed-Kristensen	pp. 2109 - 2118
Navigating from data-driven design to designing with ML: a case study of truck HMI system design Yi Luo, Dimitrios Gkouskos, Nancy L. Russo and Minjuan Wang	pp. 2119 - 2128
Nature's lessons, AI's power: sustainable process design with generative AI Mas'udah Mas'udah and Pavel Livotov	pp. 2129 - 2138
Minimizing occupant loads in vehicle crashes through reinforcement learning-based restraint system design: assessing performance and transferability <i>Janis Mathieu, Parul Gupta, Michael Di Roberto and Michael Vielhaber</i>	pp. 2139 - 2148
The DHSmart model for smart product-service system (smart PSS): dynamic, data-driven, human-centred Nadia Mirshafiee, Ji Han and Saeema Ahmed-Kristensen	pp. 2149 - 2158
Self-optimizing digital factory twin: an industrial use case Christian Nigischer, Florian Reiterer, Sébastien Bougain and Manfred Grafinger	pp. 2159 - 2168
From human-centred to humanity-ecosystem centred design. How can we dialogue with AI? Zeynep Oğrak and Yener Altıparmakoğulları	pp. 2169 - 2178
Automating the assembly planning process to enable design for assembly using reinforcement learning Rafael Parzeller, Dominik Koziol, Tizian Dagner and Detlef Gerhard	pp. 2179 - 2186
An AI-based prosthesis framework fostering an adaptive amputee healthcare service Nicholas Patiniott, Jonathan C. Borg, Emmanuel Francalanza, Joseph P. Zammit, Pierre Vella, Alfred Gatt and Kristin Paetzold-Byhain	pp. 2187 - 2196
Large language models in complex system design Alejandro Pradas Gomez, Petter Krus, Massimo Panarotto and Ola Isaksson	pp. 2197 - 2206
Inspiration or indication? Evaluating the qualities of design inspiration boards created using text to image generative AI <i>Charlie Ranscombe, Linus Tan, Mark Goudswaard and Chris Snider</i>	pp. 2207 - 2216
Automatic movement pattern analysis for data-driven system optimisation - an example for fattening livestock farming monitoring system <i>Gurubaran Raveendran, Sören Meyer zu Westerhausen, Johanna Wurst and Roland Lachmayer</i>	pp. 2217 - 2226
Concept for enhanced intuition in development management through exploratory data analysis using an extended factor analysis of mixed data Michael Riesener, Maximilian Kuhn, Benjamin Nils Johannes Lender and Günther Schuh	pp. 2227 - 2236
Towards a process for the creation of synthetic training data for AI-computer vision models utilizing engineering data Sebastian Schwoch, Maximilian Peter Dammann, Johannes Georg Bartl, Maximilian Kretzschmar, Bernhard Saske and Kristin Paetzold-Byhain	pp. 2237 - 2246
Human-AI collaboration by design Binyang Song, Qihao Zhu and Jianxi Luo	pp. 2247 - 2256
A conceptual MCDA-based framework for machine learning algorithm selection in the early phase of product development Sebastian Sonntag, Erik Pohl, Janosch Luttmer, Jutta Geldermann and Arun Nagarajah	pp. 2257 - 2266
Designers' perceptions of a sensor-enabled diary method for enhancing user research Yuki Taoka, Tomoyuki Tanaka, Momoko Nakatani and Shigeki Saito	pp. 2267 - 2276
Digital twins to increase sustainability throughout the system life cycle: a systematic literature review Malte Trienens, Rik Rasor, Aschot Kharatyan, Roman Dumitrescu and Harald Anacker	pp. 2277 - 2286

Harmonizing human-AI synergy: behavioral science in AI-integrated design <i>Dirk Van Rooy and Kristof Vaes</i>	pp. 2287 - 2296
Towards digital representations for brownfield factories using synthetic data generation and 3D object detection Javier Villena Toro, Lars Bolin, Jacob Eriksson and Anton Wiberg	pp. 2297 - 2306
How good is ChatGPT? An exploratory study on ChatGPT's performance in engineering design tasks and subjective decision-making <i>Wanyu Xu, Maulik Chhabilkumar Kotecha and Daniel A. McAdams</i>	pp. 2307 - 2316
Industrial Design	
Application of universal design principles on computer mouse interface: developing a universal mouse pointing and control system to provide affordance to the left-handed users <i>Abhinav Basak and Shatarupa Thakurta Roy</i>	pp. 2317 - 2326
An integrated survey-simulation approach for exoskeleton performance estimation Niccolò Becattini, Luca Patriarca, Diego Scaccabarozzi, Paolo Parenti, Andrea Dal Prete and Marta Gandolla	pp. 2327 - 2336
Research story telling: using the research journey map to communicate information, data, systems, and artifacts Jonathan Cagan	pp. 2337 - 2342
Crisis: a driver for tourism innovation and service design? Åsa Ericson, Johan Lugnet, Maria Ek Styvén and Thomas Zobel	pp. 2343 - 2352
Characterising the low-tech approach through a value-driven model Alexandre Gaultier, Cédric Masclet and Jean-François Boujut	pp. 2353 - 2362
The connection between impressions, user experience and design specifications in technology-driven products <i>Fatma Nur Gokdeniz Zeynali and Ekrem Cem Alppay</i>	pp. 2363 - 2372
Empathic empowerment: an exploration and analysis of a situated interaction through empathic modelling and role-play Amy Grech, Andrew Wodehouse and Ross Brisco	pp. 2373 - 2382
Territorial design: ethological design or political design or both? <i>Stéphanie Hémon and Annie Gentès</i>	pp. 2383 - 2394
Empowering design literacy: a toolkit for promoting the design of positive experiences through rules of thumb <i>Björn Kokoschko and Martin Wiesner</i>	pp. 2395 - 2404
Into the wonder - exploring the design of playables Jesper Falck Legaard	pp. 2405 - 2412
The aesthetics of robot design: towards a classification of morphologies Dean Aaron Ollah Mobed, Andrew Wodehouse and Anja Maier	pp. 2413 - 2422
User involvement in the design of complex digital tools for employees in a large organisation <i>Anya Petyaeva, Joy Goodman-Deane and P. John Clarkson</i>	pp. 2423 - 2432
Analyzing the dimensional aspects of 3D volumetric spaces: a product-oriented perspective <i>Vighneshkumar Rana and Vishal Singh</i>	pp. 2433 - 2442
Demystifying the design process of demonstrators: contextual inquiry of two cases <i>Aleksandra Sviridova and Jouke Casper Verlinden</i>	pp. 2443 - 2452
Unveiling key user experience issues to facilitate user-centred design of inertial motion capture systems Charu Tripathi, Manish Arora and Amaresh Chakrabarti	pp. 2453 - 2462

The balance between a usable and emotional product design - a comparison of different methods for prioritising relevant influencing factors Judith van Remmen, Dennis Horber, Jonas Händel, Jörg Miehling and Sandro Wartzack	pp. 2463 - 2472
Exploring the barriers to innovation adoption in the UK construction industry <i>K-M White and P. John Clarkson</i>	pp. 2473 - 2482
Addressing cultural inertias for co-design: exploring Chinese participants' perceptions of design games Ziheng Zhang, Rui Patricio, Tengjia Zuo, Wa An and Ruoqing Huang	pp. 2483 - 2492
Systems Engineering and Design	
Justice-Embedded Requirements Engineering (JERE) for system design <i>Bettina K. Arkhurst and Katherine Fu</i>	pp. 2493 - 2502
Product changes from various viewpoints along the product lifecycle - an empirical study <i>Julia Beibl and Dieter Krause</i>	pp. 2503 - 2512
Supporting modular product family representations by methodically utilising meta-models Markus Christian Berschik, Fabian Niklas Laukotka, Marc Züfle and Dieter Krause	pp. 2513 - 2522
Systems engineering in design practice: a guideline for development service providers Maximilian Burkhardt, Tilman Warns, Sebastian Endepols, Nikola Bursac and Katharina Ritzer	pp. 2523 - 2532
Leveraging design thinking in MBSE: mitigating data and information uncertainties - an integration model approach <i>Emir Gadzo, Marvin Michalides and Alexander Koch</i>	pp. 2533 - 2544
Tailored metrics for assessing the quality of MBSE models Iris Graessler, Dominik Wiechel, Deniz Oezcan and Patrick Taplick	pp. 2545 - 2554
A matrix-based approach to step-wise assess the safety of collaborative robots in manufacturing <i>Matthias R. Guertler, Philipp Bauer and Alan Burden</i>	pp. 2555 - 2564
Principles for the design of system of systems exemplified using modularisation <i>Matthias Günther, Tobias Seidenberg, Harald Anacker and Roman Dumitrescu</i>	pp. 2565 - 2574
Service centric design methodology for integrated robot-infrastructure systems Abhishek Gupta and Dietmar Göhlich	pp. 2575 - 2584
Towards an ontology to capture human attributes in human-robot collaboration <i>Stephanie Hall, Mandeep Dhanda and Vimal Dhokia</i>	pp. 2585 - 2594
A proposed framework using systems engineering to design human-centric manufacturing systems for novel products to reduce complexity and risk <i>Malin Hane Hagström and Dag Bergsjö</i>	pp. 2595 - 2604
Utilization of the system architecture in the context of validation in the business-to- business (B2B) sector Lynn Humpert, Daria Wilke, Sarah Brueggemann, Harald Anacker and Roman Dumitrescu	pp. 2605 - 2614
Tool support for implementing a methodology in magnet development projects at CERN Jens Kaeske, Erik Wagner, Albert Albers and Stephan Russenschuck	pp. 2615 - 2624
AI-based analysis and linking of technical and organisational data using graph models as a basis for decision-making in systems engineering Sebastian Katzung, Hüseyin Cinkaya, Umut Volkan Kizgin, Alexander Savinov, Julian Baschin and Thomas Vietor	pp. 2625 - 2634
Variability in complex product/system design: case study in automotive industry José Lameh, Alexandra Dubray and Marija Jankovic	pp. 2635 - 2644

Supporting circular economy strategies for design of sustainable mechatronic systems using MBSE	pp. 2645 - 2654
Zvonimir Lipšinić, Stephan Husung, Neven Pavković and Christian Weber	
A tradespace exploration approach for changeability assessment from a system-of-systems perspective: application from the construction machinery industry <i>Raj Jiten Machchhar, Carl Nils Konrad Toller Melén and Alessandro Bertoni</i>	pp. 2655 - 2664
Reviewing the suitability of ICT-centered design methods for smart PSS development <i>Yevgeni Paliyenko, Daniel Roth and Matthias Kreimeyer</i>	pp. 2665 - 2674
Exploring indicators of system-of-systems resilience: outcomes of a health systems design workshop at an international conference Valeria Pannunzio, Alexander Komashie, Sebastian Walsh, Richard Milne, Timoleon Kipouros, Guillaume Lamé, Anja Maier, Carol Brayne and P. John Clarkson	pp. 2675 - 2684
Designing for systems-of-systems resilience: from the individual to the planet Valeria Pannunzio, Timoleon Kipouros, Amber Khan, Laurie Friday, Carol Brayne and P. John Clarkson	pp. 2685 - 2694
Using product profiles for retrospective case studies in SGE - system generation engineering Felix Pfaff, Michael Schlegel, Thomas Alexander Völk, Karl Thomas Reinheckel and Albert Albers	pp. 2695 - 2704
Bridging simulation granularity in system-of-systems: conjunct application of discrete element method and discrete event simulations in construction equipment design <i>Mubeen Ur Rehman, Raj Jiten Machchhar and Alessandro Bertoni</i>	pp. 2705 - 2714
Design for robotic disassembly Lykke Margot Ricard, Emilie Folkmann, Lars Carøe Sørensen, Sofie Bach Hybel, Roberto de Nóbrega and Henrik Gordon Petersen	pp. 2715 - 2724
Automatic derivation of use case diagrams from interrelated natural language requirements Simon Schleifer, Adriana Lungu, Benjamin Kruse, Sebastiaan van Putten, Stefan Goetz and Sandro Wartzack	pp. 2725 - 2734
Investigation of advantages of models and the modelling process by introducing a model evaluation concept <i>Thomas Schumacher and David Inkermann</i>	pp. 2735 - 2744
Enabling the design for circularity through circularity measures: breaking down the R-strategies into useful design measures <i>Marie Schwahn, Thomas Potinecke, Lukas Block, Maximilian Jakob Werner and</i> <i>Florian Stephan Tarlosy</i>	pp. 2745 - 2754
Merging agent-based simulation and vehicle dynamics: a hybrid approach for value exploration in the mining industry Carl Nils Konrad Toller Melén, Raj Jiten Machchhar and Alessandro Bertoni	pp. 2755 - 2764
Interdisciplinary system lifecycle management - a systematic literature review Fabian Wyrwich, Aschot Kharatyan and Roman Dumitrescu	pp. 2765 - 2774
Design Education	
Design for the real world: a problem-based learning approach <i>Shakuntala Acharya</i>	pp. 2775 - 2784
Incorporating transition design in the education of an established design subject to empower design students with systems thinking <i>Qingfan An and Pedro Sanches</i>	pp. 2785 - 2794
Approach of a virtual reality didactic toolkit - implementation and reflection <i>Hans-Patrick Balzerkiewitz, Carsten Stechert and David Inkermann</i>	pp. 2795 - 2804

A gamified approach to assessing mental rotation in virtual reality Kristin Alicia Bartlett, Almudena Palacios-Ibáñez and Jorge Dorribo Camba	pp. 2805 - 2814
"This is MY PhD project or is it?" Understanding perceived doctoral project ownership through psychological ownership mapping <i>Michelle Rose Cedeno, Talya Porat and Weston Baxter</i>	pp. 2815 - 2824
VR headset vs. PC screen as virtual learning tour interface for Chinese architecture heritage investigation <i>Yuetong Chen and Min Hua</i>	pp. 2825 - 2834
Conceptualization of an artificial intelligence-assisted tutoring system for teaching technical drawing skills to undergraduate students <i>Jonas Fastabend, Benedikt Müller, Daniel Roth and Matthias Kreimeyer</i>	pp. 2835 - 2844
Understanding the art of design thinking facilitation: a novel instrument for observing instructional strategies used by facilitators <i>Sharon Guaman-Quintanilla, Isabel Alcivar and Katherine Chiluiza</i>	pp. 2845 - 2854
Towards simulation games in engineering design education - design and evaluation of a SE simulation game David Inkermann and Theresa Ammersdörfer	pp. 2855 - 2864
Gaps between reflection frameworks and students' practice: implications for design education <i>Akira Ito, Yuki Taoka, Echo Wan, Malak Sadek, Celine Mougenot and Shigeki Saito</i>	pp. 2865 - 2874
Improving knowledge transfers in student engineering teams through the application of the InKTI - Interdepartmental Knowledge Transfer Improvement method <i>Monika Klippert, Robert Stolpmann and Albert Albers</i>	pp. 2875 - 2884
Engineering design education at German universities: potential for a common basis to create personalized e-learning content <i>Frederike Kossack and Beate Bender</i>	pp. 2885 - 2894
The sustainability and social entrepreneurship fellowship: transdisciplinary and multicultural problem-based engineering education <i>Gordon Krauss, Chris Rennick, Nadine Ibrahim and Sanjeev Bedi</i>	pp. 2895 - 2904
Descriptive study of the integration of sustainability through the doughnut in an engineering training material <i>Alexis Lalevée, Claudine Gillot, Nadège Troussier and Eric Blanco</i>	pp. 2905 - 2914
Challenges in design methods: perspectives of design students Mayank Mayookh and V. Srinivasan	pp. 2915 - 2924
Students' perception of risks in computer-supported collaborative design teams <i>Beth Morman and Ross Brisco</i>	pp. 2925 - 2934
Fostering innovation through bio-inspired projects in engineering design education <i>Jacquelyn Nagel and Ramana Pidaparti</i>	pp. 2935 - 2942
Learning in a digital fabrication course on building tangible artefacts Vijayakumar Nanjappan, Georgi V. Georgiev, Hernan Casakin and Sohail Ahmed Soomro	pp. 2943 - 2952
A generative toolkit to help raise industrial design students' awareness of low metal recycling rates <i>Konrad Schoch, Fabian Hemmert and Christa Liedtke</i>	pp. 2953 - 2962
Analysis of collaborative CAD user actions in design sprint: insights from an educational setting Jelena Šklebar, Tomislav Martinec, Stanko Škec and Mario Štorga	pp. 2963 - 2972
Bridging the green talent gap: a case study of product design education Bernd Michael Weiss, Mohamed Elnourani, Didunoluwa Obilanade, Anna Öhrwall Rönnbäck and Arjoo Arjoo	pp. 2973 - 2982

Proposing an SDGs education model: integrating design thinking and behavioral science "nudges" for high school students Yanfang Zhang, Leon Loh, Moe Shimomura and Noriko Takano	pp. 2983 - 2992
Engineering Design Practice	
A review of hydraulic energy harvester designs - current practice and future improvements <i>Lorenzo Giunta, James Roscow and Jingqi Liu</i>	pp. 2993 - 3002
Challenges in product variant costing - a case study Morten Nørgaard, Jakob Meinertz Grønvald, Carsten Keinicke Fjord Christensen and Niels Henrik Mortensen	pp. 3003 - 3012
Optimization of the potting design using an approach for load path optimized designs of sandwich structures <i>Johann Schellhorn, Lukas Schwan and Dieter Krause</i>	pp. 3013 - 3022
Approaches for exploration, analysis, and visualization of tradespace for engineering decision-making Meredith Sutton, Julia Daniels, Nafiseh Masoudi, David Gorsich and Cameron Turner	pp. 3023 - 3032
Approaches to reducing gear mass and their effects on gearing stresses and deformations Dorian Vlašićek, Daniel Miler, Robert Mašović and Dragan Žeželj	pp. 3033 - 3040
Computing solution spaces for gear box design Klara Ziegler, Kutay Demir, Thomas Luft, Thomas Mucks, Marius Fürst, Michael Otto, Karsten Stahl, Birgit Vogel-Heuser and Markus Zimmermann	pp. 3041 - 3050
A novel heuristic approach to detect induced forming defects using point cloud scans - CORRIGENDUM Muhammad Shahrukh Saeed, Sheharyar Faisal, Boris Eisenbart, Matthias Kreimeyer, Eiman Nadeem, Muhammad Hamas Khan, Muhammad Zeeshan Arshad, Racim Radjef and Markus Wagner	el
Innovation of meaning: design-driven study based on the interpretive theory of new meaning - CORRIGENDUM <i>Shotaro Kushi and Hideyoshi Yanagisawa</i>	e2