



16th Global Conference on
Sustainable Manufacturing

October 2-4, 2018

Sustainable Manufacturing for Global Circular Economy

University of Kentucky
Lexington, KY USA



Conference Program





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Welcome Message

The Organizing Committee of the 16th Global Conference on Sustainable Manufacturing (GCSM) warmly welcomes you to the city of Lexington, KY, USA. This conference is jointly organized and hosted by the Institute for Sustainable Manufacturing (ISM) at the University of Kentucky, Technical University of Berlin IWF, and Fraunhofer IPK.

The GCSM serves as a forum for academics, researchers, and specialists from international universities, research institutes and industry working on topics related to sustainable manufacturing to share recent research advances and engage in intellectual dialogue. The conference includes keynote speeches by over a dozen prominent international researchers and industry leaders, panel discussions with industry leaders and Manufacturing USA Institute directors, and technical presentations in parallel sessions on current and emerging topics relevant to advancing Sustainable Manufacturing for Global Circular Economy. Within the theme of Circular Economy, technical presentations will focus on manufactured products, manufacturing processes and systems, and crosscutting technological topics including sustainable manufacturing education, innovation and technology development, and deployment. A total of over 135 papers will be presented in four parallel sessions for over 2.5 days. These papers are authored and co-authored by researchers/application specialists from over 34 countries representing all continents of the globe (North and South America, Europe, Asia, Africa and Australia), thus truly reflecting the true global nature of the conference.

A unique feature of this conference series is that it integrates industrial engineering perspectives, sustainable manufacturing applications in emerging and developing countries, and education and workforce development for sustainable manufacturing. This year's conference introduces a special industry session beginning with a keynote presentation and an industry panel, with case studies and success stories in implementing sustainable manufacturing presented by several industry groups. Also, a uniquely crafted and moderated panel discussion session with three directors and chief technology officers of Manufacturing USA Institutes will present the national and international strategic needs in sustainable manufacturing applied to topics of these institutes.

We welcome you to GCSM 2018 and look forward to your participation.

Best regards,



**Professor
Günther Seliger**
(Founding Chairman)



I.S. Jawahir
(Conference Chair)



**Fazleena
Badurdeen**
(Conference Co-chair)



Holger Kohl
(Conference Co-chair)





Keynote Speakers



Prof. Günther Seliger

*Professor and Founding Chair, Sustainable Manufacturing,
Technical University of Berlin, Germany*

Presentation Title:

The Challenge of Sustainable Manufacturing

Abstract:

The series of CIRP-sponsored annual Global Conferences on Sustainable Manufacturing (GCSM) is coined by the spirit of coping with the challenge of sustainable manufacturing as fundamental means for value creation. Since 2003, 13 different countries together counting for half of global population, 40 percent of global land, and almost 60 percent of global GDP have hosted these conferences under the local organization of respective local academic institutions with support of industry and civil initiatives. The complex interrelations of manufacturing technological means to cope with challenges of sustainability in economic, environmental and social dimensions have been considered under international perspectives in local national environment. Essential issues dealt with in 15 years of GCSM will be presented in an overview keynote presentation.

Bio:

Günther Seliger made his university education after school and service in the German navy in economics and mechanical engineering at the Technical University of Berlin (TU Berlin). In 1983 he obtained his PhD in industrial engineering with a thesis on "Economical Planning of Automated Production Systems". From 1975 to 1988 he was research assistant and chief engineer for computer aided manufacturing at Production Technology Center (PTZ) of Institut für Werkzeugmaschinen und Fabrikbetrieb (IWF) TU Berlin and Fraunhofer Institut für Produktionsanlagen und Konstruktionstechnik (IPK) Berlin.

From 1988 to 2016 he was university professor for assembly technology and factory management at IWF TU Berlin. From 1995 to 2006, Prof. Seliger was initiator and head of the Collaborative Research Center (Sonderforschungsbereich) on "Disassembly Factories Regaining Resources in Product and Material Cycles." From 2012 to 2015 he initiated and led his second Collaborative Research Center on "Sustainable Manufacturing – Shaping Global Value Creation" each supported by the German National Science Foundation (DFG) and comprising annually 20 full-time research assistants and 40 part-time master students supervised by eight tenured professors. In his academic career he has contributed to more than 500 scientific publications in conferences, specialized journals and books. More than 100 national and international dissertations have been completed under his supervision, over half of them within research projects of his own chair. From 1997 to 1999 he was Vice President of the TU Berlin. Since 1991 he is member of CIRP (International Academy for Production Engineering Science). Since 2009 he is member of acatech German Academy of Engineering. From 1998 to 2016 he was Dean of the international study program of Global Production Engineering (GPE) at TU Berlin. Since 2012 he is foreign Dean of the faculty of engineering at the Turkish-German University in Istanbul. From 1998 to 2003 he directed the program area of production management at the Institute for Management and Technology (IMT) Berlin. He is the founder of the annual CIRP sponsored Global Conference on Sustainable Manufacturing (GCSM) which has been held since 2003.

Keynote Speakers

Mike Molnar

*Founding Director, Interagency Advanced
Manufacturing National Program*

Chief, Advanced Manufacturing Programs, NIST, USA



Presentation Title:

**Manufacturing USA: Bridging the Gap
to a Sustainable Future**

Abstract:

A key challenge to restoring U.S. leadership in advanced manufacturing is building bridges across the so-called “missing middle” – the technical and business barriers of scaling-up (and speeding up) an innovative new material, process, or technology for robust production use. The Manufacturing USA program is now in its fourth year with 14 innovation institutes. Each institute is a federally sponsored public-private partnership designed to accelerate U.S. innovation through applied research and advanced workforce skills development. These manufacturing institutes are places where industry and academia partner on industry-relevant challenges. This presentation provides an overview of the program, explains how an institute works, and covers recent highlights along with developments ahead. To illustrate institute operations, the REMADE institute on sustainable manufacturing will be profiled.

REMADE, short for Reducing Embodied Energy and Decreasing Emissions, focuses on materials manufacturing and energy efficiency. In partnership with industry, academia,

and national labs, the REMADE Institute enables early-stage applied research and development of technologies that could dramatically reduce the embodied energy and carbon emissions associated with industrial-scale materials production and processing. Efficiencies gained from these technologies have the potential to save billions in energy costs, improve U.S. economic competitiveness through innovative new manufacturing techniques, and offer new training and jobs for American workers.

Bio:

Mike Molnar is the founding director of the interagency Advanced Manufacturing National Program Office, with a mission to foster industry-led partnerships and to form a “whole of government” approach to strengthen competitiveness and innovation in U.S. manufacturing. This interagency team is responsible for Manufacturing USA, the public name for the National Network for Manufacturing Innovation. Manufacturing USA is a bipartisan initiative with fourteen institutes launched. For more information, please see www.ManufacturingUSA.com. Mike also leads the NIST Office of Advanced Manufacturing, which coordinates extramural programs for the National Institute of Standards and Technology, part of the U.S. Department of Commerce.



Keynote Speakers



Dr. Dean L. Bartles

President, National Tooling and Machining Association

*Founding Executive Director, Digital Manufacturing
and Design Innovation Institute, USA*

Presentation Title:

**Using “Exponential” Technologies to Drive Manufacturing
Towards a Sustainable Future**

Abstract:

The manufacturing industry as we know it is fundamentally changing, with advanced technologies increasingly underpinning global competitiveness and economic prosperity. Many leading 21st-century manufacturers are converging digital and physical worlds in which sophisticated hardware combined with innovative software, sensors, and massive amounts of data and analytics is expected to produce smarter products, more energy efficient processes, and more closely connected customers, suppliers, and manufacturers. As growing numbers of manufacturing companies look to embark on this transformative journey and navigate through a maze of challenges and opportunities, executives—understandably—have questions: What exponential technologies show the most promise? What is the magnitude of impact that can be expected from adopting and deploying these exponential technologies? How is the manufacturing industry leveraging these technologies in new and distinctive ways to solve current business issues and/or transform our future? What does it really mean to become a Digital Manufacturing Enterprise (DME) of the future, and how might our business model evolve? How can we use these so called “exponential” technologies to drive our organizations towards greener manufacturing processes?

Bio:

Dr. Dean L. Bartles currently serves as the Director of the John Olson Advanced Manufacturing Center at the University of New Hampshire, and was previously the founding Executive Director of the Digital Manufacturing and Design Innovation Institute in Chicago. On August 20, 2018, Dr. Bartles became the new President of the National Tooling and Machining Association based in Cleveland. Dr. Bartles worked for General Dynamics Corporation for 30 years, setting up and running manufacturing operations in Egypt, Turkey, and the US, and prior to that he worked for Fairchild Republic Company. He recently served as the 2016-2017 President of the North American Manufacturing Research Institute, the 2016 President of the Society of Manufacturing Engineers, the founding Chairman of the Smart Manufacturing Leadership Coalition, and the Chairman of the Board of the National Center for Defense Manufacturing and Machining. Dr. Bartles graduated from Indiana State University, earning a Ph. D. in Technology Management with a concentration in Manufacturing Systems.

Keynote Speakers

Prof. Joost R. Duflou

*Head, Industrial Management Division,
Traffic and Infrastructure, KU Leuven*

*Professor, Mechanical Engineering Department,
KU Leuven, Belgium*



Presentation Title:

**Towards Industrial Symbiosis in Discrete Manufacturing:
Opportunities in Alternative Recycling Route
Identification for Industrial Waste Streams**

Abstract:

In terms of resource efficiency strategy in discrete manufacturing, recycling production waste through conventional remelting techniques is often considered the only viable option. However, this approach still implies significant energy consumption and does not allow avoiding substantial material losses. Furthermore, it is no guarantee for material purity preservation. Alternative recycling routes, in which the waste output of one process is considered as potential input resource for other processes, are being studied. In this presentation, a series of examples will be reviewed that demonstrate how specific characteristics of waste streams, typically considered not desirable for conventional recycling purposes, can become assets when appropriate output-input matching can be achieved. The environmental impact that can be avoided by such an industrial symbiosis approach will be illustrated through some representative cases.

Bio:

Joost Duflou holds master degrees in Architectural and Electro-mechanical Engineering and a PhD in Engineering Sciences from KU Leuven, Belgium. After a number of years of industrial experience in different international companies, he has been a faculty member at the Mechanical Engineering Department of KU Leuven since 1997. He became a tenured Full Professor in 2012. His principal research activities are in the field of design support methods and methodologies, with special attention for Ecodesign and Life Cycle Engineering, and Sustainable Manufacturing. As chairholder of the LVD Chair on Sheet Metal Processing, he also leads a research group focusing on sheet metal-oriented manufacturing processes and systems and he supervises the KU Leuven FabLab. He is a CIRP Fellow and has published over 250 international publications. As chair and board member of several spin-off companies and professional associations, he contributes to research valorisation and dissemination. More details can be found at:

<http://www.kuleuven.be/wieiswie/nl/person/00016263>



Keynote Speakers



Prof. Dermot Brabazon

Director, Advanced Processing Technology Research Centre at DCU

Deputy Director, I-Form Advanced Manufacturing Research Centre, Dublin City University, Ireland

Proposed Presentation Title:

Additive Manufacturing - A Game Changer for Sustainable Manufacturing?

Abstract:

Over the last decade in particular, improvements in Additive Manufacturing (AM) technologies have resulted in increased potential to directly print in one step functional components. In order to achieve this in produced parts, a number of important requirements have to be met such as a high-level dimensional accuracy, the availability of an improved range of functional materials, and a supply chain and cost model which is competitive with traditional manufacturing. In recent years, great strides have been made in these areas which enable a new range of applications to avail of AM technologies. The dimensional, physical and chemical integrity of polymer and metal printed parts have improved greatly, allowing a broader range of end applications. There are now over 100 AM equipment suppliers which is mirrored by the increase in the materials supplied for these machines. Production speeds and quality control also continue to improve. The AM process has the ability to produce complex components with integrated functionality requiring less material and fewer production assembly steps. The raw materials for AM can be recycled, particularly for metal AM. The process can also be used to process parts in remote locations, with reduced need for transportation costs. In this talk, an overview of these developments, and in particular their implications for sustainable manufacturing, will be presented.

Bio:

Prof. Dermot Brabazon received his BEng (Mechanical Engineering) and PhD (Materials Science) from University College Dublin. From 1995 to 2000 he worked with Materials Ireland, a state materials science research centre. In 2000 he was appointed as a lecturer at Dublin City University, promoted to Senior Lecturer in 2006, Deputy Head of School in 2007, Associate Dean for Research in 2009, and to Professor in 2014. In recognition of his academic achievements and contributions to development of engineering technologies, he was conferred the President's Award for Research in 2009 and Commercialization Award in 2015 and 2017. Since 2012, he has been Director of the Advanced Processing Technology Research Centre at DCU and is currently Deputy-Director of I-Form, the national centre focused on development of Advanced Manufacturing technologies. He has published over 250 internationally peer reviewed papers. His research is focused in the areas of materials and processing technologies, including Additive Manufacturing, Near Net Shape Forming, Laser Processing and Separation technologies. These overlapping activities are focused toward the development of advanced processing knowledge to enable improved production capability and quality for achieving broad societal benefit. Details of his research can be found at the following links:

<http://www.dcu.ie/apthttps://scholar.google.fr/citations?user=WIPcqhIAAAAJ&hl=fr&oi=ao>

https://www.researchgate.net/profile/Dermot_Brabazon

Keynote Speakers

Prof. Marwan Khraisheh

*Senior Research Director, Hamad Bin Khalifa University,
Qatar Foundation, Qatar*



Presentation Title:

Towards Sustainable Energy: Advancing Solar PV in Harsh Desert Climates

Abstract:

Climate change and energy security are undoubtedly among the most pressing challenges the world faces today. It is critical to adapt sustainable and energy efficient technologies and practices and rely more on renewable energy. Despite recent advancements in the utilization of solar energy as an efficient and sustainable source of energy, major obstacles facing deployment of large solar farms regions still exist. For example, desert-like climates face major challenges such as excessive heat and the presence of soiling which drastically impact the efficiency of solar PV. The first part of the presentation will identify these challenges and highlight the recent research efforts undertaken by researchers at Hamad bin Khalifa University (HBKU) at Qatar Foundation to find innovative solutions. Additionally, another major challenge facing widespread utilization of solar energy is its unpredictable nature making it difficult to correlate with energy demand profiles for optimum use. The second part of the presentation will focus on a prediction algorithm correlating solar PV energy production with demand profiles using support vector machines technique. The algorithm, capable of one-day ahead forecasting of PV output and load profiles, is validated using one-year data collected from a PV array, a weather station and sensors measuring energy consumption.

Bio:

Dr. Khraisheh is the Senior Research Director at Hamad bin Khalifa University at Qatar Foundation overseeing a number of portfolios spanning research strategy, policy, and administration, innovation, and strategic partnerships. He led a research staff of more than 150 to address energy, water and environment grand challenges. Prior to joining Qatar Foundation, Dr. Khraisheh was the Acting Provost and Founding Dean of Masdar Institute (in partnership with MIT) and a member of the MIT-Masdar Joint Executive Committee. At Masdar Institute, he led the development of eight MS and PhD degrees focused on advanced energy and sustainable technologies and recruited more than 70 faculty members from around the world.

Prior to joining Masdar Institute, Dr. Khraisheh was an Endowed Professor at the Department of Mechanical Engineering and the Director of Undergraduate Studies at the University of Kentucky (USA).

Dr. Khraisheh is a recipient of the US National Science Foundation CAREER Award, the SME Eugene Merchant Outstanding Young Manufacturing Engineer Award, the NAMRI Outstanding Research Paper Award and the Henry Mason Lutes Award for Excellence in Engineering Education.

He is an ASME Fellow, AAAS Fellow and a CIRP Member. He served as the Associate Technical Editor of the ASME Transactions Journal of Engineering Materials and Technology (2009-2018) and serves as the Associate Editor of the new International Energy Transitions Journal published by Springer.



Keynote Speakers



Prof. Holger Kohl

Vice-Director, Fraunhofer Institute for Production Systems and Design Technology IPK

Director, Division Corporate Management, Fraunhofer Institute for Production Systems and Design Technology IPK

Professor, Sustainable Corporate Development, Technical University of Berlin, Germany

Presentation Title:

International Case Studies for Innovative Learning Approaches by Learnstruments and MakerSpaces for Fostering Sustainable Manufacturing

Abstract:

The fast and disruptive changes in global value creation networks towards highly digital integrated production environments and the growing challenge of sustainability are setting new demands on engineering education. Meeting the future needs for teaching, learning and in-work training requires the development of new learning-conducive technologies, approaches and intercultural soft skills.

To address these challenges, a perspective of problem- and experience-based teaching and learning in industrial engineering as a tool in research and education is given. A morphology for the structure of Learnstruments and exemplary learning-conducive applications are presented. Furthermore, it is shown how MakerSpaces can be used to rapidly develop and manufacture these Learnstruments as well as prototypes for study courses related to sustainable manufacturing and entrepreneurship.

Keywords: Sustainability, Engineering education, Learnstruments, Industry 4.0, MakerSpaces

Bio:

Prof. Dr. Holger Kohl is Vice-Director of Fraunhofer Institute for Production Systems and Design Technology IPK and Director of the Division Corporate Management at Fraunhofer IPK, Berlin, as well as Professor for Sustainable Corporate Development at the Technical University of Berlin. He finished his studies in Business Engineering at the Technical University of Berlin and at the Haas School of Business at the University of California, Berkeley, in 1998. In 1999, Prof. Kohl joined the Division of Corporate Management at Fraunhofer IPK as a Senior Researcher. Since then he has initiated and conducted several national and international projects on Strategic Planning, Knowledge Management, Intellectual Capital, Benchmarking and Business Process Reengineering and was responsible for their realisation. Beside projects all over Europe, Prof. Kohl has managed large-scale projects in Brazil, Indonesia, Vietnam, Malaysia, UAE, Egypt, China, etc. Since 2015, he is the Dean of the international master's degree program on Global Production Engineering (GPE) at Technische Universität Berlin and Chairman of the GPE examination board. Since 2015, he is a Chairman of the Global Conference on Sustainable Manufacturing (GCSM). His primary research interests are in the area of Sustainable Manufacturing, Strategic Planning and Implementation of Innovation Systems, Intellectual Capital Management, and Benchmarking, in both the public and private sectors, as well as in the industry and service sectors.

Keynote Speakers

Prof. Mohamed El-Mansori

*Professor and Director, Materials Processing Labs,
Arts et Métiers Paris Tech, France*



Presentation Title:

Smart Manufacturing of Natural Fiber Composites

Abstract:

Natural fiber reinforced plastic (NFRP) composites are attractive materials for sustainable manufacturing since natural fibers are renewable, have low production cost, low density, and high in-service performance. These characteristics enhance energy efficiency, minimize negative environmental impacts, and promote a circular economy. To further improve the sustainability of NFRP manufacturing in terms of energy efficiency, especially during the machining step, it is necessary to perform an in-depth energy investigation during the cutting operation that should consider the multiscale structure of natural fibers inside NFRP composites. This talk presents the work of the authors in smart manufacturing of NFRP composite materials, as well as the implications of their approach in gaining a better understanding of the cutting energy contribution of each NFRP component and to the optimization of the energy dissipated during the process.

Bio:

Mohamed EL-Mansori is a Professor at the Department of Mechanical, Material Science and Manufacturing Engineering, Arts et Métiers ParisTech (France) where he leads the Mechanics, Surfaces and Material Processing Laboratory (MSMP-EA-7350)/Engineering. He is appointed as TEES Research Professor at Texas A&M University (USA). He is a co-Director of TEES-TAMU-ENSAM joint research cluster. He served as Deputy General Director in Charge

of Research & Innovation at the Arts et Métiers ParisTech, France. He also chaired the Mechanical Engineering and Manufacturing Research Group (LMPF-EA4106) at the Châlons-en-Champagne campus. He was a founder and head of project of the creation of the MSMP laboratory, which is a multi-campus laboratory of the same institution including at Aix-en-Provence, Châlons-en-Champagne and Lille. Mohamed EL-Mansori received B.Sc degree in Physics from the University of Hassan II (Casablanca, Morocco:1993), and Ph.D in Mechanical Engineering from the Institut National Polytechnique de Lorraine (Nancy, France: 1997). Following a post-doctoral appointment at the Center for Advanced Friction Studies of the Southern Illinois University, USA, he joined, before ParisTech, the research group at the ERMES (Nancy, France) for five years. His current research interests include the interface of thermo-mechanic characteristics of both metallic and composite materials and physics behind their tribological and manufacturing performance, and multiscale advanced manufacturing processes. These activities have led to the formation of a new research team which conceived and developed the concept of multi-scale process signature in conjunction with a new tribo-energetic approach for the fundamental understanding of advanced and sustainable manufacturing processes involving lightweight synthetic and/or natural reinforced composite materials, energy-efficient manufacturing processes, advanced tribological studies and new process development for improved product performance and sustainability, etc. He has published more than 160 papers in JCR referenced international journals and more than 200 international and national conference proceedings.



Keynote Speakers



Prof. Wilfried Sihm

Academic Director, Transnational MBA 'Automotive Management', TU Wien

Managing Director, Fraunhofer Austria Research GmbH

Head, Industrial and System Engineering Department, TU Wien, Austria

Presentation Title:

Digitized, Optimized, Ecologized? Can Digitization Promote Sustainable Manufacturing?

Abstract:

Digital representations of production systems are a powerful way to achieve optimized operations. This is especially true when not only economic, but also ecological goals are to be pursued with a sustainable production.

This keynote will present an insight into approaches utilizing a simulation-based optimization of production systems and the potential of such planning methods concerning energy and resource efficiency, plus the chances and challenges against the backdrop of the ongoing energy transition. The effect of temporal aspects – i.e., different planning horizons from short-term to long-term planning, as well as different levels of the synchronization frequency of digital representations with the corresponding real-life systems, will be explored.

Bio:

In September 2004 Prof. Dr. Ing. Wilfried Sihm joined the TU Wien as a professor for industrial and system engineering at the Institute of Management Sciences, and has since been head of this Institute twice, according to rotation. In November 2008, he was appointed Managing Director of the newly founded Fraunhofer Austria Research GmbH and manages the Division Production and Logistics Management in Vienna.

He has been active in the field of applied research for more than 30 years now, taking part in more than 300 industrial projects. His areas of expertise include production management, corporate organization, enterprise logistics, factory planning, order management, life-cycle management, maintenance, modelling and simulation, and business process reengineering. His current focus is on implementing Industry 4.0 concepts, such as Smart Maintenance.

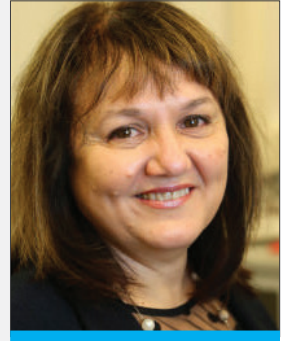
Besides being part of advisory and administrative boards, he also holds several positions in various organizations, such as the board member of the International Federation of Production Research (IFPR) as well as the German Chamber of Commerce (DHK) in Vienna, member of the European Academy for Industrial Management (AIM) and Fellow Member of the International Academy for Production Engineering (CIRP).

Keynote Speakers

Prof. Rossi Setchi

*Professor and Director, Cyber-Physical
Systems Programs, Cardiff University*

*Leader, High-Value Manufacturing Research Group,
Cardiff University, United Kingdom*



Presentation Title:

**Integrated Decision-Making for Sustainable Design
and Manufacturing**

Abstract:

This talk highlights the main challenges in industrial sustainability from the point of view of the decision makers and the importance of having computational tools to compare alternatives in terms of cost and environmental implications. The talk presents an eco-design decision-making methodology that integrates life cycle assessment, process modelling and quality function deployment and provides opportunities to consider alternatives at different stages of product design. All product sustainability considerations are conducted within a special eco-design house of quality. This brings together the analysis of factors relating to manufacturing processes, product usage and end-of-life strategy; it insures that product sustainability is central to any design development and that the implications of change are fully identified and justified. The talk will demonstrate the complexity of the decision-making process and the need for knowledge-based and semantic tools to support the decision-making process.

Bio:

Professor Rossi Setchi leads High-Value Manufacturing at the School of Engineering of Cardiff University. She received her Double Honours degree in Mechanical and Electrical Engineering (first class, Summa Cum Laude) from Moscow Technological University in Russia, and her PhD from Cardiff University, UK. Professor Setchi joined the School of Engineering as a Lecturer in 2000; she was promoted to Senior Lecturer in 2007 and Chair in 2011. Professor Setchi has a distinguished track record of research in a range of areas including advanced manufacturing, AI, robotics, and Industry 4.0. She has completed research projects with many companies including Airbus, BAE Systems, Bosch, Continental, Fiat, Hewlett Packard, Panalpina, Renishaw and Sandvik. Professor Setchi is Fellow of three Professional Institutions (IMechE, IET and BCS), and Senior Member of IEEE. She is member of several IFAC/IFIP/IEEE technical committees and editorial boards. Professor Setchi is a Visiting Professor at Nanjing University of Aeronautics and Astronautics, China and recipient of the prestigious Tan Chin Tuan Senior Fellowship in Engineering at Nanyang Technological University, Singapore.



Keynote Speakers



Prof. Rafi Wertheim

Professor, Fraunhofer IWU, Germany

Presentation Title:

The Great Convergence: Biologicalisation, Digitalization, Sustainability and Future Manufacturing

Abstract:

Today, biological transformation is considered a new emerging frontier in the evolution of digitalization and the Fourth Industrial Revolution (Industry 4.0). The principle of biologically-inspired intelligent manufacturing is proposed to be a driver and factor for sustainable development of new materials, design concepts, processes and equipment as well as production systems. The potential of utilizing biological principles can be considered for innovative lightweight environmentally-friendly and energy efficient industrial products, mainly by using, being inspired by or by imitating biological elements, solutions, phenomena, materials, or living creatures. The combination of biological principles with digitalization, new technologies and new processes provide an excellent tool for sustainable and resource-efficient production. This presentation will discuss examples of research and development directions as well as industrial products. Few examples of multifunctional metal-based parts, molds and dies with optimized and efficient cooling channels, inspired by nature, were designed and produced, including new processes such as additive manufacturing.

Keywords: Biologicalization; digitalization; resource efficient production

Bio:

Dr. Ing. Rafi Wertheim is Professor for Mechanical

Engineering at the IWU Fraunhofer Institute in Germany since 2009. Since 2015 he has served as the Fraunhofer Senior Advisor in Israel and has been teaching in the Mechanical Engineering program at the Braude College, Karmiel, Israel since 2014. He has served as Head of Machining Technology Department at Chemnitz University of Technology and Head of Metal Cutting Department at IWU-Fraunhofer. He served also as an Adjunct Professor of Mechanical Engineering and Industrial Management at the Technion, Israel Institute of Technology. He was ISCAR LTD Manager of engineering from 1975 to 2003, including production, legal proprietary, international conferences, R&D, and more. He is very active in The International Academy for Production Engineering (CIRP). He served as the CIRP President in 2001-2002 and is a prestigious Honorary Fellow of CIRP since 2007.

He has been honored by the coveted SME Frederick W. Taylor Research Medal for his significant published research leading to a better understanding of materials, facilities principles and operations and their application to improving the manufacturing process. He has authored 7 books, 7 patents, and over 200 papers in these areas.

In addition to academia, Dr. Wertheim is also very active social and political activates in Israel and Germany. He was Mayor of Qiryat Bialik in Israel from 2003 to 2008 and is a member of town council since 1987.

He received his Dr -Ing. in production engineering from RWTH Aachen, Germany in 1975, M.Sc. and B.Sc. in mechanical engineering from The Technion, Israel, in 1970 and 1968, respectively.

Keynote Speakers

John Davies

Vice President and Senior Analyst, GreenBiz, USA



Presentation Title:

From Here to Circularity: A model for Restorative and Regenerative Enterprise

Abstract:

The circular economy involves a fundamental rethinking of products, materials and systems of commerce. Most importantly, it will require new partnerships and alliances among business, government, and civil society. Approached correctly, circular business strategies can unleash an economic revolution that is both restorative and regenerative. The challenge comes in driving these efforts to scale.

Mr. Davies will present examples of the challenges faced by businesses as they seek to transform current operations to take advantage of new opportunities. This will require innovative approaches to design, materials science, manufacturing, supply chain management, product strategy, logistics, procurement and other business functions. It will also require a new level of collaboration with customers, suppliers, and competitors as new business models and financing strategies evolve to support circular solutions.

Bio:

John Davies is vice president and senior analyst at GreenBiz Group, heading up independent research regarding green strategies and business operations and the sustainability profession. Davies also leads the GreenBiz Executive Network, a member-based, peer-to-peer learning forum for sustainability professionals. The network consists of senior executives from \$1B+ corporations working together to share best practices and lessons learned for implementing sustainable development programs. Davies is an experienced entrepreneur and innovator who has applied his business and management skills to launching start-ups as well as improving the operations of existing businesses. Davies is a frequent keynote speaker at international events, is well-known for his supply chain and sustainability expertise and is the author of numerous articles in business, industry, and educational publications. Davies received his BA from SUNY at Fredonia and his MA from the University of Delaware.



Luncheon Speakers



Dr. Ömer Sahin Ganiyusufoglu

*Chairman, Corporate Members Advisory Group (CMAG),
International Academy for Production Engineering (CIRP)*

*Consultant to Chairman, Shenyang
Machine Tool (Group) Co., Ltd., China*

Presentation Title:

**Global Sustainable Development Goals - An Obligation
for All of Us!**

Abstract:

In our daily life we get plenty of news about political and economic issues, sports, cultural events, but also about poverty and natural disasters. We spend too much time dealing with daily issues instead of thinking about the background of poverty and national disasters. In our western world, we enjoy a prosperous life without being aware of what are the consequences of our high living standard and our wastefulness. Academic studies show that the way of our living style will lead to a disastrous future. We will consume the resources, we will damage the environment and we will destroy eco-systems. We all do not take notice of these facts. In 1987, the United Nations, after comprehensive studies, took an initiative, and defined 17 Sustainable Development Goals (SDGs) for preventing our earth and mankind from further damage. In this presentation, the SDGs will be introduced and how the SDGs could be put into reality will be presented. Furthermore, proposals will be made on how each of us could contribute to SDGs in daily life by simple changes in our lifestyle.

Bio:

Ömer Sahin Ganiyusufoglu received his Bachelor of Science degree in 1979 and his Ph.D. degree in Mechanical Engineering (with a focus on machine tools and manufacturing technology) in 1984, both from the Technical

University of Berlin, Germany, working as a research associate (Wissenschaftlicher Mitarbeiter) in the Institute for Machine Tools and Manufacturing Technology and Fraunhofer Institute for Production Technology and Design (IPK – Berlin), directed by Prof. Dr. Spur. Between 1985 and 1989, he worked at the German CNC lathe manufacturer Traub, as Head of Automation. In 1990 he joined Yamazaki Mazak Germany, and worked there until 2005 as the Managing Director. He joined the German CNC lathe manufacturer Index-Werke in 2006, and moved to China as the General Manager of Index Dalian Machine Tool Ltd., which is a Joint Venture between Dalian Machine Tool Group and Index-Werke Germany. In 2011, he joined Shenyang Machine Tool Group (SYMG) Co., Ltd. in Shenyang, China. As a senior consultant to the Chairman of the Group, he currently supports the company in terms of strategy, globalization and international cooperation.

Ömer Sahin Ganiyusufoglu is a Visiting Professor of Mechanical Engineering at Tongji University in Shanghai, China. Within the International Academy for Production Engineering (CIRP), he is representing SYMG as a Corporate Member. Since 2016 he has been serving as the Chairman of the Corporate Members Advisory Group (CMAG) of CIRP. He has been a member of the German Engineers' Association (VDI) since 1977. He is a recipient of the "Best Labor Award" of the City of Dalian, the "Rose Prize" of the City of Shenyang, the "Friendship Award" of Liaoning Province in China and the "Friendship Award" of the Chinese government in 2018, which is the highest honor awarded to a foreigner in China.

Luncheon Speakers

James George

*Business Development Lead,
Ellen MacArthur Foundation, United Kingdom*



Presentation Title:

Circular Economy and the Ellen MacArthur Foundation

Abstract:

The Ellen MacArthur Foundation's (EMF) mission is to accelerate the transition to the circular economy. Looking beyond the current "take, make and dispose" extractive industrial model, the circular economy is restorative and regenerative by design. Relying on system-wide innovation, it aims to redefine products and services to design waste out, while minimizing negative impacts. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural and social capital. EMF's five interlinking focus areas include: Learning - developing the vision, skills and mindsets needed to transition to a circular economy; Business and Government - catalyzing circular innovation and creating the conditions for it to reach scale; Insight and Analysis - providing robust evidence about the benefits and implications of the transition; Systemic Initiatives - transforming key material flows to scale the circular economy globally; and Communications - engaging a global audience around the circular economy. In this talk, the EMF guiding principles will be explained via a series of examples that will illustrate how the circular economy works with manufacturing, products, business models and innovation.

Bio:

James George is responsible for identifying and engaging with new businesses and corporate members who wish to join the CE100 Programme. As part of the business team at the Ellen MacArthur Foundation, George's focus is telling the story around Circular Economy and helping organisations connect with various programmes and projects at the Foundation.

George has recently relocated back to the Isle of Wight after a 15 year hiatus. During this time, he spent 2 years working in the commercial sector and 12 years as a mine clearance diving officer with the Royal Navy, travelling the world and enjoying the adventure.

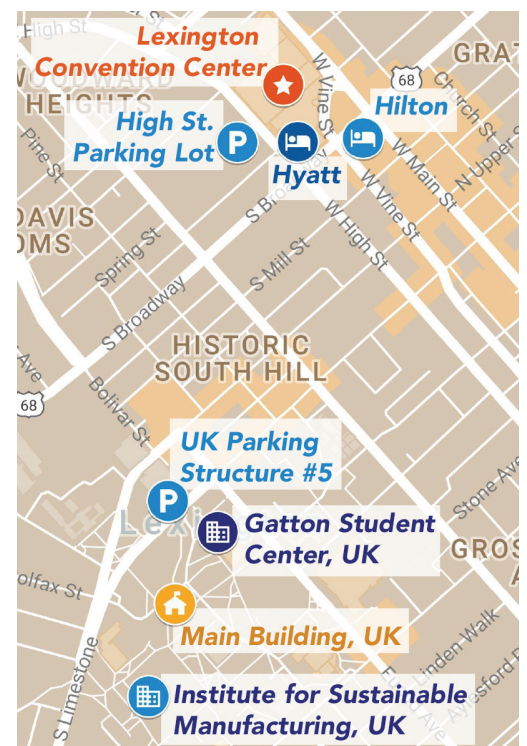


Pre-conference Program

October 1st 2018, Monday

09:00 – 13:00	Workshop: “Introduction to Sustainable Manufacturing: Recent Trends, Metrics and Methodologies for Evaluation” <i>University of Kentucky Student Center, Room No: 330AB</i>		
13:00 – 14:00	Lunch for Workshop Attendees <i>Champions Kitchen, University of Kentucky Student Center</i>		
14:00 – 16:00	University of Kentucky Lab Tours		
	Sustainable Machining Research Laboratory	Electron Microscopy Center (EMC)	Center for Nanoscale Science and Engineering (CeNSE)
15:30 – 17:00	Registration Open at Convention Center <i>Thoroughbred Pre-function Area</i>		
18:00 – 20:00	Welcome Reception <i>Hilton Grand Kentucky Ballroom: Salon D</i>		

Event locations



Pre-conference Workshop

Introduction to Sustainable Manufacturing:

Recent Trends, Metrics and Methodologies for Evaluation

October 1, 2018

Overview

This workshop will present an overview of current trends in sustainable manufacturing, and tools and methods for evaluation. Topics will include: sustainable manufacturing metrics, sustainable value stream mapping, sustainable supply chain management, and assessment methods, as well as an overview of the latest global trends in sustainable manufacturing.

Presenters

Dr. Fazleena Badurdeen

(University of Kentucky)

Dr. I.S. Jawahir

(University of Kentucky)

Dr. Tao Lu

(5ME)

Workshop Venue:

*Room 330AB,
Bill Gatton Student Center,
University of Kentucky*

Workshop Coordinator:

Dr. Julius Schoop

(julius.schoop@uky.edu)

Schedule

8:30 A M – 9:00 AM

Registration and Continental Breakfast

9:00 AM – 9:05 AM

Welcome

Dr. Julius Schoop

9:05 AM – 9:35 AM

Current Trends in Sustainable Manufacturing

Dr. I.S. Jawahir

9:35 AM – 10:00 AM

Metrics-based Evaluation of Sustainable Products

Dr. I.S. Jawahir

10:00 AM – 10:50 AM

Metrics-based Evaluation of Sustainable Manufacturing Processes

Dr. Tao Lu

10:50 AM – 11:00 AM

Break

11:00 AM – 11:50 AM

Metrics-based Evaluation of Sustainable Systems

Dr. Fazleena Badurdeen

11:50 AM – 12:40 AM

Sustainable Value Stream Mapping

Dr. Fazleena Badurdeen

12:40 AM – 1:00 PM

Summary and Wrap up

1:00 PM – 2:00 PM

Lunch



Conference Venue

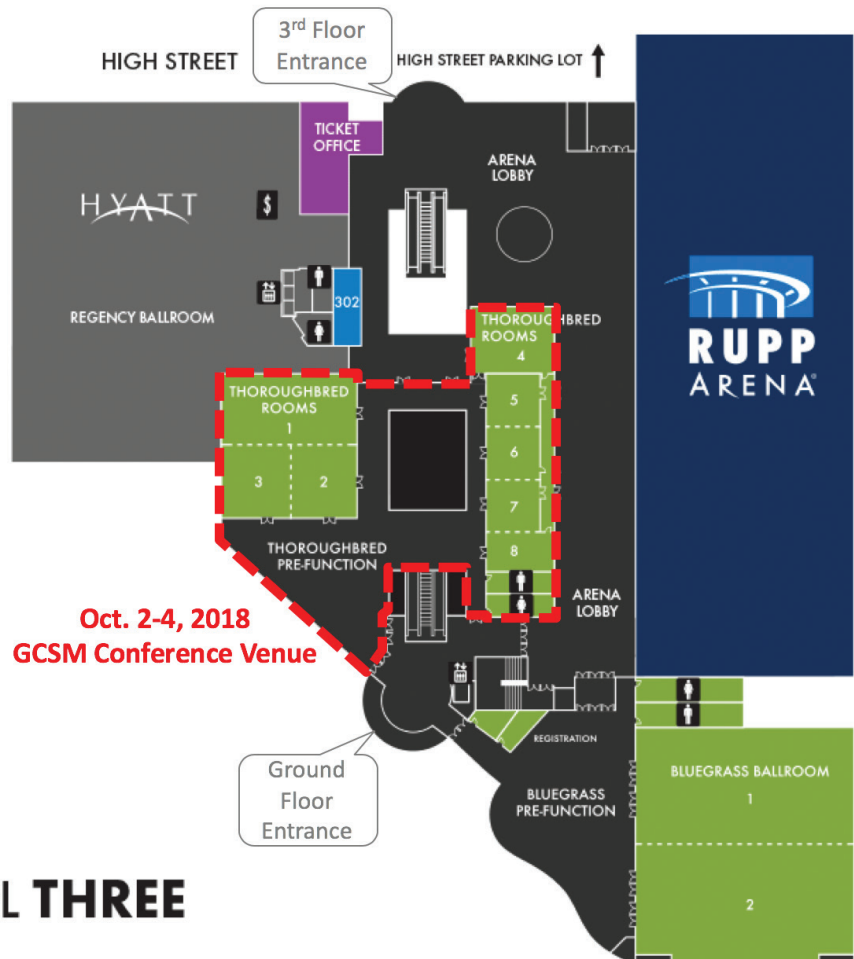
Lexington Convention Center

Address:
417 West High Street,
Lexington, KY

Sky-bridges 

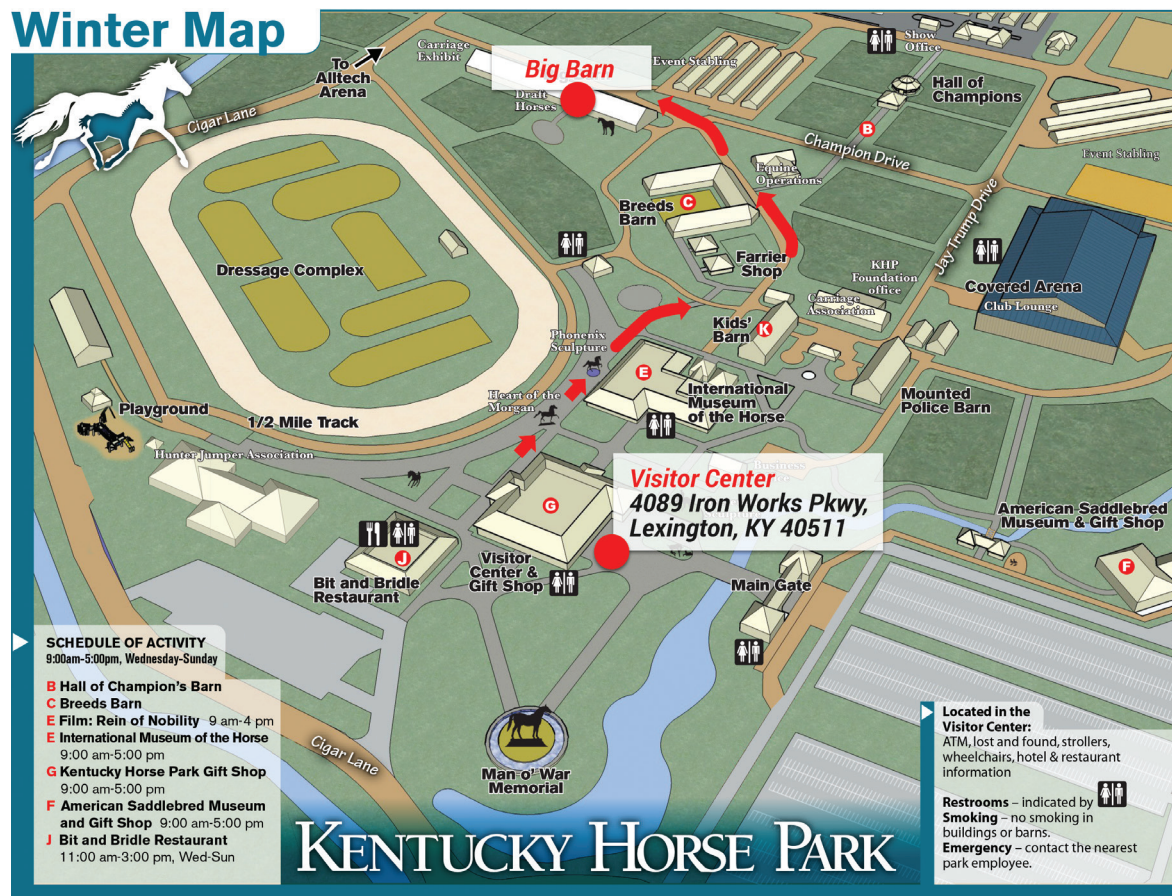


GCSM 2018 Wifi
GCSM18
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Conference Banquet Venue

Kentucky Horse Park



Banquet Program

6:00 - 6:30 PM

Arrival

6:00 - 9:30 PM

International Museum of the Horse Open

6:15 - 7:00 PM

Gift Shop open

6:30 - 7:00 PM

Horse Meet and Greet

7:15 PM

Welcome message from Banquet Host

7:45 PM

Dinner in Big Barn

9:30 PM

Departure from Big Barn

08:00 – 08:30	Registration at conference site			
08:30 – 09:00	Opening and Welcoming Speeches Moderation: Fazleena Badurdeen, Co-Chair, GCSM 2018 <i>Room: Thoroughbred Ballroom</i> Eli Capilouto, President – University of Kentucky I.S. Jawahir, Chair, GCSM 2018			
09:00 – 10:00	Keynote Session Moderation: I.S. Jawahir <i>Room: Thoroughbred Ballroom</i>			
09:00 – 09:30	Günther Seliger <i>Technical University of Berlin, Germany</i>	The Challenge of Sustainable Manufacturing		
09:30 – 10:00	Dean L. Bartles <i>National Tooling and Machining Association, USA</i>	Using “Exponential” Technologies to Drive Manufacturing Towards a Sustainable Future		
10:00 – 10:30	Coffee Break			
10:30 – 11:30	Keynote Session Moderation: Fazleena Badurdeen <i>Room: Thoroughbred Ballroom</i>			
10:30 – 11:00	Joost R. Duflou <i>Catholic University of Leuven (KU), Belgium</i>	Towards Industrial Symbiosis in Discrete Manufacturing: Opportunities in Alternative Recycling Route Identification for Industrial Waste Streams		
11:00 – 11:30	John Davies <i>GreenBiz, USA</i>	From Here to Circularity: A Model for Restorative and Regenerative Enterprise		
11:30 – 13:00	Sessions and Industry Presentations			
	Session 1: Sustainable Products <i>Room Thoroughbred 5</i>	Session 2: Sustainable Manufacturing Processes <i>Room Thoroughbred 6</i>	Session 3: Sustainable Manufacturing Systems <i>Room Thoroughbred 7</i>	Session 4: Industry Presentations <i>Room Thoroughbred 8</i>
13:00 – 14:00	Lunch <i>Thoroughbred Ballroom</i>			
	Luncheon Speaker: O. S. Ganiyusufoglu, <i>Shenyang Machine Tool (Group) Co.</i>	Global Sustainable Development Goals - An Obligation For All Of Us!		
14:00 – 14:30	Keynote Session Moderation: Julius Schoop <i>Room: Thoroughbred Ballroom</i>			
	Dermot Brabazon <i>Dublin City University (DCU), Ireland</i>	Additive Manufacturing - A Game Changer for Sustainable Manufacturing?		
14:30 – 16:00	Sessions and Industry Presentations			
	Session 5: Sustainable Products <i>Room Thoroughbred 5</i>	Session 6: Sustainable Manufacturing Processes <i>Room Thoroughbred 6</i>	Session 7: Cross-Cutting Topics in Sustainable Manufacturing <i>Room Thoroughbred 7</i>	Session 8: Industry Presentations <i>Room Thoroughbred 8</i>
16:00 – 16:30	Coffee Break			
16:30 – 17:30	Panel Discussion			

11:30 – 13:00 (90 minutes) Sessions and Industry Presentations			
Session 1: Sustainable Products <i>Product (Re)Design for Circular Economy</i>	Session 2: Sustainable Manufacturing Processes <i>Manufacturing Processes, Tools and Equipment</i>	Session 3: Sustainable Manufacturing Systems <i>Energy Efficiency in Manufacturing Systems</i>	Session 4: Industry Presentations <i>Industry Panel Discussion</i>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Joost Duflo	Session Chair: Shreyes Melkote	Session Chair: Mike Li	Moderator: Lee Lingo
Quantitative Risk Modeling for Evaluating Sustainable Product Designs (ID: 119) <u>Christian Enyoghasi</u> (University of Kentucky, USA, Institute for Sustainable Manufacturing, USA), Adam Brown, Ridvan Aydin (Institute for Sustainable Manufacturing, USA), Fazleena Badurdeen (University of Kentucky, USA, Institute for Sustainable Manufacturing, USA)	Investigating the Microstructure and Morphology of Chips in Dry, Flood Coolant and MQL Machining of Ti-6Al- 4V Alloy (ID: 146) <u>Ashutosh Khatri</u> , <u>Muhammad Jahan</u> (Miami University, USA)	Energy Flexibility – A new Target Dimension in Manufacturing System Design and Operation (ID: 103) <u>Lena Pfeilsticker</u> , <u>Eduardo Colangelo</u> (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany), Alexander Sauer (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany, University of Stuttgart, Germany)	Opportunities and Challenges in Sustainable Manufacturing Jessica Sanderson (Novelis Inc.), Jon Doyle (Lexmark International), Adam Schafer (Intel Corp.), Kevin Bell (Toyota Motor North America)
Integrated Additive Product Development for Multi- Material Parts (ID: 34) <u>Jerome Kaspar</u> , Stephan Bechtel (Saarland University, Germany), Tobias Häfele (University of Applied Sciences Saarland, Germany), Franziska Herter, Jan- Henrik Schneberger, Dirk Bähre (Saarland University, Germany), Jürgen Griebsch (University of Applied Sciences Saarland, Germany), Hans-Georg Herrmann, Michael Vielhaber (Saarland University, Germany)	Sustainability of Friction Stir Welded AA6082 Plates through Post-weld Solution Heat Treatment (ID: 214) Sarafadeen Azeez, Madindwa Mashinini, <u>Esther T. Akinlabi</u> (University of Johannesburg, South Africa)	Strategic Energy Management in Mechanical Series Production: An Industrial Use- case (ID: 135) <u>Matthias Hacksteiner</u> (Vienna University of Technology, Austria), G. Fuchs (BMW Group Plant Steyr, Austria), F. Bleicher (Vienna University of Technology, Austria)	
A Total Life Cycle Approach for Developing Predictive Design Methodologies to Optimize Product Performance (ID: 191) <u>Buddhika M. Hapuwatte</u> , I.S. Jawahir (University of Kentucky, USA)	Road Map to Sustainability of Friction Stir Welded Al-Si-Mg Joints using Bivariate Weibull Analysis (ID: 215) Sarafadeen Azeez, <u>Esther T. Akinlabi</u> (University of Johannesburg, South Africa)	Dynamic Design and Management of Reconfigurable Manufacturing Systems (ID: 138) Marco Bortolini (University of Bologna, Italy), Francesco <u>Gabriele Galizia</u> (University of Padova, Italy), Cristina Mora (University of Bologna, Italy)	

11:30 – 13:00 (90 minutes) Sessions and Industry Presentations (cont.)			
Session 1: Sustainable Products Product (Re)Design for Circular Economy	Session 2: Sustainable Manufacturing Processes Manufacturing Processes, Tools and Equipment	Session 3: Sustainable Manufacturing Systems Energy Efficiency in Manufacturing Systems	Session 4: Industry Presentations Industry Panel Discussion
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Joost Duflou	Session Chair: Shreyes Melkote	Session Chair: Mike Li	Moderator: Tony Elam
Constructive Methods to Reduce Thermal influences on the Accuracy of Industrial Robots (ID: 25) <u>Christian Mohnke</u> , Sascha Reinkober, Eckart Uhlmann (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany)	Performance Assessment of CaF2 Solid Lubricant Assisted Minimum Quantity Lubrication in Turning (ID: 174) <u>Mayurkumar A Makhesana</u> , Kaushik Patel (Nirma University, India)	Simulation-based Analysis of Energy Flexible Factories in a Regional Energy Supply System (ID: 252) <u>Stefan Roth</u> (Fraunhofer Research Institution for Casting, Composite and Processing Technology IGCV, Germany), Markus Thimmel (Fraunhofer Institute for Applied Information Technology FIT, Germany), Jasmin Fischer (Fraunhofer Research Institution for Casting, Composite and Processing Technology IGCV, Germany), Michael Schöpf (Fraunhofer Institute for Applied Information Technology FIT, Germany), Eric Unterberger (Fraunhofer Research Institution for Casting, Composite and Processing Technology IGCV, Germany), Stefan Braunreuther (Fraunhofer Research Institution for Casting, Composite and Processing Technology IGCV, Germany, Augsburg University of Applied Sciences, Germany), Hans Ulrich Buhl (Fraunhofer Institute for Applied Information Technology FIT, Germany), Gunther Reinhart (Fraunhofer Research Institution for Casting, Composite and Processing Technology IGCV, Germany)	(Cont.) Opportunities and Challenges in Sustainable Manufacturing Jessica Sanderson (Novelis Inc.), Jon Doyle (Lexmark International), Adam Schafer (Intel Corp.), Kevin Bell (Toyota Motor North America)
Demand-oriented Barriers and Potentials for Remanufacturing in Vietnam (ID: 124) Thomas Guidat, <u>Aleksandra Wewer</u> , Holger Kohl, Günther Seliger (Technische Universität Berlin, Germany)	A Fracture Mechanics Approach to Wire Design for Reduced Damage in Diamond Wire Sawn Silicon Wafers (ID: 276) Arkadeep Kumar, <u>Shreyes N. Melkote</u> (Georgia Institute of Technology, USA)	Methodology for the Sustainability-related Evaluation of Human-Robot Collaborations (ID: 92) Uwe Götze, M. Schildt (Chemnitz University of Technology, Germany), <u>Barbara Mikus</u> (Leipzig University of Applied Sciences (HTWK), Germany)	
13:00 – 14:00	Lunch		

14:30 – 16:00 (90 minutes) Sessions and Industry Presentations			
Session 5: Sustainable Products Product (Re)Design	Session 6: Sustainable Manufacturing Processes Additive Manufacturing	Session 7: Crosscutting Topics in Sustainable Manufacturing Strategies and Business Models	Session 8: Industry Presentations Industry Case Studies
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Dermot Brabazon	Session Chair: Claes Fredriksson	Session Chair: Stefan Hoyer	Moderator: Tony Elam
<p>Conceptual Model of Life Cycle Assessment based Generic Computer Tool towards Eco-Design in Manufacturing Sector (ID: 163) Rajitha L. Peiris, Asela K. Kulatunga, K.B.S.N. Jinasdasa (University of Peradeniya, Sri Lanka)</p>	<p>Improving Sustainability and Cost Efficiency for Spare Part Allocation Strategies by Utilisation of Additive Manufacturing Technologies (ID: 212) Karl Ott (Fraunhofer Austria Research GmbH, Austria, Technical University of Vienna, Austria), Heimo Pascher (Fraunhofer Austria Research GmbH, Austria), Wilfried Sihn (Fraunhofer Austria Research GmbH, Austria, Technical University of Vienna, Austria)</p>	<p>Benchmarking the sustainable manufacturing paradigm via Automatic analysis and clustering of scientific literature: an Italian Technologist perspective (ID: 277) Michele Dassisti (Polytechnic University of Bari, Italy), Filippo Chiarello (University of Pisa, Italy), Gualtiero Fantoni (University of Pisa, Italy), Paolo C. Priarone (Politecnico di Torino, Italy), Giuseppe Ingarao (Università di Palermo, Italy), Giampaolo Campana, Barbara Cimatti (University of Bologna, Italy), Andrea Matta, Marcello Colledani, Nicla Frigerio (Polytechnic University of Milan, Italy), Archiemed Forcellese, Michela Simoncini (Polytechnic University of Marche, Italy)</p>	<p>Featured Case Study: Circular Economy-Real-World Success John Gagel (Lexmark International), Ingrid Sinclair (Simms (SRS)), Jean-Luc Lavergne (Lavergne)</p>
<p>Development of an Electric Drive Train for Cycles as a Sustainable Means of Transportation for a Green Environment (ID: 70) Simon Chinguwa, Wilson R. Nyemba (University of Johannesburg, South Africa), Emmanuel Ngondo (University of Zimbabwe, Zimbabwe), Charles Mbohwa (University of Johannesburg, South Africa)</p>	<p>Improving the R&D Process Efficiency of the Selective Laser Sintering Industry through Numerical Thermal Modeling (ID: 53) Carlo Martin Olivier, Gert Adriaan Oosthuizen (University of Stellenbosch, South Africa), Natasha Sacks (University of the Witwatersrand, South Africa)</p>	<p>A Conceptual Framework to Create Shared Value in Base of the Pyramid Communities with Micro-Containerised Factories (ID: 27) Zviemurwi J. Chihambakwe, Gert Adriaan Oosthuizen, Stephen Matope, Emad H. Uheida (Stellenbosch University, South Africa)</p>	
<p>Stepping Valve Actuator Algorithm for a Camless IC Engine (ID: 136) Ishmael Zibani, Rapelang Marumo (University of Botswana), Joseph Chuma (Botswana International University of Science and Technology), I. Ngebani, K. Tsamaase (University of Botswana)</p>	<p>Sustainability of Metal Powder Additive Manufacturing (ID: 233) Claes Fredriksson (University West, Sweden)</p>	<p>Designing and Redesigning Products, Processes, and Systems for a Helical Economy (ID: 159) Ryan Bradley, I.S Jawahir (University of Kentucky, USA)</p>	

14:30 – 16:00 (90 minutes) Sessions (cont.)			
Session 5: Sustainable Products Product (Re)Design	Session 6: Sustainable Manufacturing Processes Additive Manufacturing	Session 7: Crosscutting Topics in Sustainable Manufacturing Strategies and Business Models	Session 8: Industry Presentations Industry Case Studies
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Dermot Brabazon	Session Chair: Claes Fredriksson	Session Chair: Stefan Hoyer	Moderator: Tony Elam
A Study on the Role of Oil-air Mist Lubrication on a Ultrahigh-speed Bio-generator (ID: 5) Ramesh Kuppuswamy, Colin Richmond , Azeem Khan (University of Cape Town, South Africa)	Optimisation of Build Orientation to Achieve Minimum Environmental Impact in Stereo-lithography (ID: 97) Mattia Mele , Giampaolo Campana , Fabio Lenzi (University of Bologna, Italy), Barbara Cimatti (University of Bologna, Italy, Research Development Division (ARIC), Italy)	Using the Sharing Economy Approach to Provide Sustainable Mobility (ID: 267) Semih Severengiz (Bochum University of Applied Sciences, Germany)	Sustainable Value Creation through Remanufacturing Adam Trebolo (Springfield Remanufacturing Corp (SRC))
	Guidelines to Compare Additive and Subtractive Manufacturing Approaches under the Energy Demand Perspective (ID: 41) Giuseppe Ingarao (University of Palermo, Italy), Paolo Priarone (Politecnico di Torino, Italy), Rosa Di Lorenzo (University of Palermo, Italy), Luca Settineri (Politecnico di Torino, Italy)	Non-linear Autoregressive Neural Network (NARNET) with SSA Filtering for a University Energy Consumption Forecast (ID: 217) Paul Adedeji, Stephen Akinlabi (University of Johannesburg, South Africa), Oluseyi Ajayi (Covenant University, Nigeria), Nkosinathi Madushele (University of Johannesburg, South Africa)	Measuring Sustainable Performance in an Environment Where Every Product is Unique John Cross (American Institute of Steel Construction)
15:30 – 16:00		Coffee Break	

16:30 – 17:30 (60 minutes) Panel Discussion	
<i>Room Thoroughbred Ballroom</i>	
Panel Moderators: Dean Bartles and Günther Seliger	
<p>Manufacturing USA: National Institutes for Manufacturing Innovation Alan Taub, Chief Technology Officer, Institute for Lightweight Innovations for Tomorrow (LIFT) Uday Vaidya, Chief Technology Officer, Institute for Advanced Composites Manufacturing Innovation (IACMI) Jim Davis, Senior Advisor, Clean Energy Smart Manufacturing Innovation Institute (CESMII)</p>	

08:00 – 08:30	Registration at conference site			
08:30 – 10:00	Keynote Session Moderation: Günther Seliger Room: Thoroughbred Ballroom			
08:30 – 09:00	Mike Molnar Advanced Manufacturing Programs, National Institute for Standards and Technology, USA	Manufacturing USA: Bridging the Gap to a Sustainable Future		
09:00 – 09:30	Holger Kohl Technical University of Berlin, Germany	International Case Studies for Innovative Learning Approaches by Learnstruments and MakerSpaces for Fostering Sustainable Manufacturing		
09:30 – 10:00	Marwan Khraisheh Qatar Research Foundation, Doha, Qatar	Towards Sustainable Energy: Advancing Solar PV in Harsh Desert Climates		
10:00 – 10:15	Coffee Break			
10:15 – 13:00	Sessions			
10:15 – 11:30	Session 9: Sustainable Products Room Thoroughbred 5	Session 10: Sustainable Manufacturing Processes Room Thoroughbred 6	Session 11: Sustainable Manufacturing Systems Room Thoroughbred 7	Session 12: Crosscutting Topics in Sustainable Manufacturing Room Thoroughbred 8
11:30 – 11:45	Break/ Transition Between Sessions			
11:45 – 13:00	Session 13: Sustainable Products Room Thoroughbred 5	Session 14: Sustainable Manufacturing Processes Room Thoroughbred 6	Session 15: Sustainable Manufacturing Systems Room Thoroughbred 7	Session 16: Sustainable Manufacturing Processes Room Thoroughbred 8
13:00 – 14:00	Lunch Thoroughbred Ballroom			
13:00 – 14:00	Luncheon Speaker: James George Ellen MacArthur Foundation	Circular Economy and the Ellen MacArthur Foundation		
14:00 – 14:30	Keynote Session Moderation: Joost R. Duflou Room: Thoroughbred Ballroom			
	Rossi Setchi Cardiff University, United Kingdom	Integrated Decision-Making for Sustainable Design and Manufacturing		
14:30 – 15:45	Sessions			
	Session 17: Sustainable Manufacturing Processes Room Thoroughbred 5	Session 18: Sustainable Manufacturing Processes Room Thoroughbred 6	Session 19: Sustainable Manufacturing Systems Room Thoroughbred 7	Session 20: Crosscutting Topics in Sustainable Manufacturing Room Thoroughbred 8
15:45 – 16:00	Coffee Break			
16:00 – 17:15	Sessions			
	Session 21: Sustainable Manufacturing Systems Room Thoroughbred 5	Session 22: Sustainable Manufacturing Processes Room Thoroughbred 6	Session 23: Sustainable Manufacturing Processes Room Thoroughbred 7	Session 24: Crosscutting Topics in Sustainable Manufacturing Room Thoroughbred 8
17:30 – 18:30	Bus Transfer to Kentucky Horse Park			
18:30 – 21:30	Conference Banquet			
21:30 – 22:30	Bus Transfer to Downtown			

10:15 – 11:30 (75 minutes)			
Sessions			
<p>Session 9: Sustainable Products <i>Product Recovery, Reuse and Remanufacturing</i></p>	<p>Session 10: Sustainable Manufacturing Processes <i>Manufacturing Processes, Tools and Equipment</i></p>	<p>Session 11: Sustainable Materials <i>Composites and Plastics</i></p>	<p>Session 12: Crosscutting Topics in Sustainable Manufacturing <i>Industry 4.0 and Sustainable Manufacturing</i></p>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Tetsuo Yamada	Session Chair: Franci Pušavec	Session Chair: Giuseppe Ingarao	Session Chair: Wilfried Sihm
<p>Solving the Disassembly-to-Order Problem for Components and Materials under Stochastic Yields, Limited Supply, and Quantity Discount using Linear Physical Programming (ID: 231) <u>Yuki Kinoshita</u>, Tetsuo Yamada (The University of Electro-Communications, Japan), Surendra M. Gupta (Northeastern University, USA)</p>	<p>Investigation of the Solubility of Liquid CO2 and Liquid Oil to Realize an Internal Single Channel Supply in Milling of Ti6Al4V (ID: 20) Thomas Bergs (RWTH Aachen University), Franci Pušavec (University of Ljubljana), <u>Matthias Koch</u> (RWTH Aachen University), Damir Grguraš (University of Ljubljana), Benjamin Döbbeler, Fritz Klocke (RWTH Aachen University)</p>	<p>Highly Rigid Assembled Composite Structures with Continuous Fiber-Reinforced Thermoplastics for Automotive Applications (ID: 250) Lothar Kroll (Chemnitz University of Technology, Germany, Opole University of Technology, Poland), <u>Marcel Meyer</u> (Chemnitz University of Technology, Germany, Cetex Institut für Textil- und Verarbeitungsmaschinen gemeinnützige GmbH, Germany), W. Nendel, M. Schormair (Chemnitz University of Technology, Germany)</p>	<p>Identification and Structuring of Benefits and Expenses for Evaluating the Profitability of Investments in Digitalization within Production (ID: 22) <u>Robert Joppen</u>, Julian Tekaats, Arno Kuehn (Fraunhofer-Institut für Entwurfstechnik Mechatronik IEM, Germany)</p>
<p>Application of Fuzzy Logic in Selection of Remanufacturing Technology (ID: 144) <u>John Mbogo Kafuku</u> (University of Dar es Salaam, Tanzania), Muhamad Zamari Mat Saman, Shar'i Mohd Yusof (Universiti Teknologi Malaysia (UTM)), Mohd Fahrul Hassan (Universiti Tun Hussein Onn Malaysia)</p>	<p>Multi-criteria Decision-making for the Life Cycle of Sustainable High Pressure Die Casting Products (ID: 126) <u>Emanuele Pagone</u>, Konstantinos Salonitis, Mark Jolly (Cranfield University, UK)</p>	<p>Increasing the Sustainability of Composite Manufacturing Processes by using Algorithm-based Optimization and Evaluation for Process Chain Design (ID: 28) Florian Brillowski, <u>Christoph Greb</u>, Thomas Gries (RWTH Aachen University, Germany)</p>	<p>Development of an Intelligent Tool Condition Monitoring System to Identify Manufacturing Tradeoffs and Optimal Machining Conditions (ID: 232) <u>Wo Jae Lee</u>, Gamini P. Mendis, John W. Sutherland (Purdue University, USA)</p>
<p>Decentralized Identification of Used Exchange Parts with a Mobile Application (ID: 133) <u>Jan Lehr</u>, Marian Schlüter (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany), Jörg Krüger (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany, Technische Universität Berlin, Germany)</p>	<p>A Thermal FEA Modeling of Multiple Machining Processes for Practical Machining Process Optimization (ID: 143) <u>Tao Lu</u> (SME Tech Center, USA)</p>	<p>Feasibility Study for Manufacturing CF/Epoxy – Thermoplastic Hybrid Structures in a Single Operation (ID: 82) <u>Hakan Kazan</u>, Saeed Farahani, Srikanth Pilla (Clemson University, USA)</p>	<p>Digitalization Technologies for Industrial Sustainability (ID: 111) <u>Melissa Demartini</u> (University of Genoa, Italy), Steve Evans (University of Cambridge, UK), Flavio Tonelli (University of Genoa, Italy)</p>

10:15 – 11:30 (75 minutes) Sessions (cont.)			
Session 9: Sustainable Products Product Recovery, Reuse and Remanufacturing	Session 10: Sustainable Manufacturing Processes Manufacturing Processes, Tools and Equipment	Session 11: Sustainable Materials Composites and Plastics	Session 12: Crosscutting Topics in Sustainable Manufacturing Industry 4.0 and Sustainable Manufacturing
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Tetsuo Yamada	Session Chair: Franci Pušavec	Session Chair: Giuseppe Ingarao	Session Chair: Wilfried Sihn
	Design of a Photovoltaic System with Ultracapacitor Energy Buffer (ID: 195) <u>Ishmael Zibani</u> , Bakary Diarra, Adamu Murtala Zungeru, Samikannu Ravi, Joseph Chuma, Bokamoso Basutli (Botswana International University of Science and Technology, Botswana)	Energy- and Ecologically-oriented Selection of Plastic Materials (ID: 48) <u>Heiko Dunkelberg</u> , Tim Weiß, F. Mazurek (University of Kassel, Germany)	

11:45 – 13:00 (75 minutes) Sessions			
Session 13: Sustainable Products Product Recovery, Reuse and Remanufacturing	Session 14: Sustainable Manufacturing Processes Manufacturing Processes, Tools and Equipment	Session 15: Sustainable Manufacturing Systems Manufacturing System Design	Session 16: Sustainable Manufacturing Processes Energy and Resource Efficiency
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Ahmad Mayyas	Session Chair: Uwe Götze	Session Chair: Lothar Kroll	Session Chair: Prahalada K. Rao
Economics and Challenges of Li-Ion Battery Recycling from End-of-Life Vehicles (ID: 243) <u>Darlene Steward</u> , <u>Ahmad Mayyas</u> , Margaret Mann (National Renewable Energy Laboratory, USA)	Design for Eco-efficiency – A System of Indicators and their Application to the Case of Moulds for Injection Moulding (ID: 122) <u>Uwe Götze</u> (Technische Universität Chemnitz, Germany), Paulo Peças (Universidade de Lisboa, Portugal), Fanny Richter (Technische Universität Chemnitz, Germany)	Zero-waste Production: Technology for the In-house Recycling of Technical Elastomers (ID: 129) <u>Lothar Kroll</u> (Chemnitz University of Technology, Germany), <u>Opole University of Technology, Poland</u> , <u>Stefan Hoyer</u> (Chemnitz University of Technology, Germany)	Techno-economic Analysis of Battery Storage Systems for Demand Responds Application in Manufacturing (ID: 224) <u>Carmen Höne</u> , <u>Max Weeber</u> (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany), <u>Fritz Braeuer</u> (Karlsruhe Institute of Technology KIT, Germany), <u>Alexander Sauer</u> (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany, University of Stuttgart, Germany)

11:45 – 13:00 (75 minutes) Sessions (cont.)			
Session 13: Sustainable Products <i>Product Recovery, Reuse and Remanufacturing</i>	Session 14: Sustainable Manufacturing Processes <i>Manufacturing Processes, Tools and Equipment</i>	Session 15: Sustainable Manufacturing Systems <i>Manufacturing System Design</i>	Session 16: Sustainable Manufacturing Processes <i>Energy and Resource Efficiency</i>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Ahmad Mayyas	Session Chair: Uwe Götze	Session Chair: Lothar Kroll	Session Chair: Prahalada K. Rao
Remanufacturing of Electric Vehicles: Challenges in Production Planning and Control (ID: 188) Achim Kampker, Johannes Triebs, Ansgar Hollah , Christoph Lienemann (RWTH Aachen University, Germany)	Assessment of Inflatable Core Assisted Paper Bottle Moulding Process (ID: 100) Prateek Saxena , Giuliano Bissacco (Technical University of Denmark, Denmark)	A Practical Approach to Reduce Energy Consumption in a Serial Production Environment by Shutting Down Subsystems of a Machine Tool (ID: 45) Alperen Can , Gregor Thiele, Jörg Krüger, Jessica Fisch, Carsten Klemm (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany)	Energetic Evaluation of Press Hardening Processes (ID: 237) Enrique Meza-García , Anja Rautenstrauch, Verena Kräusel, Dirk Landgrebe (Technische Universität Chemnitz, Germany)
Evaluation of Environmental Impact and Benefits for Remanufactured Construction Equipment Parts Using Life Cycle Assessment (ID: 99) Yong-Sung Jun , Hong-Yoon Kang, Hyun-Jung Jo, Chun-Youl Baek, Young-Chun Kim (Center for Resources Information & Management (KITECH), Korea)	The Evolution of Molds in Manufacturing: From Rigid to Flexible (ID: 112) Francesco Gabriele Galizia (University of Padova, Italy), Waguih ElMaraghy, Hoda ElMaraghy (University of Windsor, Canada), Marco Bortolini, Cristina Mora (University of Bologna, Italy)	Factors for Effective Implementation of Lean Manufacturing Practice in Selected Industries in Tanzania (ID: 140) John Mbogo Kafuku (University of Dar es Salaam, Tanzania)	Modelling, Simulation and Optimization of the Comminution and Flotation Circuits of Platinum for Sustainable Mineral Processing (ID: 68) Wilson R. Nyemba (University of Johannesburg, South Africa), Zvikomborero B. Kapumha (University of Zimbabwe, Zimbabwe), Tawanda Mushiri, Charles Mbohwa (University of Johannesburg, South Africa)
A Novel Approach for Developing a Flexible Automation System for Rewinding an Induction Motor Stator using Robotic Arm (ID: 172) Alice Matenga, Eriyeti Murena , Givemore Kanyemba, Samson Mhlanga (National University of Science and Technology, Zimbabwe)	Effects of Cooling Lubricant on the Thermal Regime in the Working Space of Machine Tools (ID: 116) Michael Bräunig , Joachim Regel (Technische Universität Chemnitz, Germany), Janine Glänzel (Fraunhofer Institute for Machine Tools and Forming Technology IWU, Germany), Matthias Putz (Technische Universität Chemnitz, Germany, Fraunhofer Institute for Machine Tools and Forming Technology IWU, Germany)		Design Rules for Additive Manufacturing – Understanding the Fundamental Thermal Phenomena to Reduce Scrap (ID: 175) M. Reza Yavari, Kevin D. Cole, Pralhada K. Rao (University of Nebraska-Lincoln, USA)
13:00 – 14:00		Lunch	

14:30 – 15:45 (75 minutes) Sessions			
Session 17: Sustainable Manufacturing Processes Resource Utilization and Waste Reduction	Session 18: Sustainable Manufacturing Processes Energy and Resource Efficiency	Session 19: Sustainable Manufacturing Systems Production Planning, Scheduling and Control	Session 20: Crosscutting Topics in Sustainable Manufacturing Education and Workforce Development
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Julius Schoop	Session Chair: Marwan Khraisheh	Session Chair: Mike Li	Session Chair: Fazleena Badurdeen
Feasibility Study of the Materials Handling and Development of a Sustainable Conveying System in Plastics Recycling and Manufacture (ID: 69) <u>Simon Chinguwa</u> , Wilson R. Nyemba (University of Johannesburg, South Africa), Kudzai Boora (University of Zimbabwe, Zimbabwe), Charles Mbohwa (University of Johannesburg, South Africa)	A Practical Framework for the Optimization of Production Management Processes (ID: 75) <u>Robert Joppen</u> , Sebastian von Enzberg, Arno Kühn (Fraunhofer- Institut für Entwurfstechnik Mechatronik IEM), Roman Dumitrescu (University of Paderborn)	Mathematical Model for Proactive Resequencing of Mixed Model Assembly Lines (ID: 187) <u>Achim Kampker</u> , Kai Kreiskoether, <u>Marius Schumacher</u> (RWTH Aachen University, Germany)	Augmented Learning Environment for Industrial and Higher Education (ID: 3) <u>Jan Menn</u> , <u>Mustafa Severengiz</u> , <u>Andrea Lorenz</u> , <u>Günther Seliger</u> (Technische Universität Berlin, Germany)
Value Addition to Plastic Solid Wastes: Informal Waste Collectors' Perspective (ID: 51) <u>Bupe Mwanza</u> , <u>Charles Mbohwa</u> , <u>Arnesh Telukdarie</u> , <u>Chucks Medoh</u> (University of Johannesburg, South Africa)	Framework for Energy Efficiency Optimization of Industrial Systems based on the Control Layer Model (ID: 58) <u>Gregor Thiele</u> , <u>Oliver Heimann</u> (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany), <u>Knut Grabowski</u> (ÖKOTEC Energiemanagement GmbH, Germany), <u>Jörg Krüger</u> (Fraunhofer Institute for Production Systems and Design Technology IPK, Technische Universität Berlin, Germany)	User-Centric Process Management System for Digital Transformation of Production (ID: 117) <u>Nicole Oertwig</u> , <u>Patrick Gering</u> , <u>Thomas Knothe</u> (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany), <u>Sven O. Rimmelpacher</u> (Pickert&Partner GmbH, Germany)	Sustainable Engineering Master Module – Insights from three Cohorts of European Engineering Team (ID: 275) <u>Bartlomiej Gladysz</u> (Warsaw University of Technology, Poland), <u>Marcello Urgo</u> (Politecnico di Milano, Italy), <u>Tim Stock</u> (Technische Universität Berlin, Germany), <u>Cecilia Haskins</u> (Norwegian University of Science and Technology (NTNU), Norway), <u>Felix Sieckmann</u> (Technische Universität Berlin, Germany), <u>Elzbieta Jarzebowska</u> (Warsaw University of Technology, Poland), <u>Holger Kohl</u> (Technische Universität Berlin, Germany), <u>Jan Ola Strandhagen</u> (Norwegian University of Science and Technology (NTNU), Norway), <u>Tulio Tollio</u> (Politecnico di Milano, Italy)

14:30 – 15:45 (75 minutes) Sessions (cont.)			
Session 17: Sustainable Manufacturing Processes <i>Resource Utilization and Waste Reduction</i>	Session 18: Sustainable Manufacturing Processes <i>Energy and Resource Efficiency</i>	Session 19: Sustainable Manufacturing Systems <i>Production Planning, Scheduling and Control</i>	Session 20: Crosscutting Topics in Sustainable Manufacturing <i>Education and Workforce Development</i>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Julius Schoop	Session Chair: Marwan Khraisheh	Session Chair: Mike Li	Session Chair: Fazleena Badurdeen
A Data Architecture to Aid Life Cycle Assessment in Closed-loop Reusable Plastic Container Networks (ID: 101) <u>Giulia Baruffaldi</u> (University of Padua, Italy), <u>Riccardo Accorsi</u> , <u>Luca Volpe</u> , <u>Riccardo Manzini</u> (University of Bologna, Italy)	Improving the Energy Efficiency of Industrial Drying Processes: A Computational Fluid Dynamics Approach (ID: 90) <u>Christoph T. Hoffmann</u> (Bayreuth University, Germany), <u>Julian Praß</u> (Friedrich-Alexander-University Erlangen-Nürnberg, Germany), <u>Thomas Hans-Joachim Uhlemann</u> (Bayreuth University, Germany), <u>Jörg Franke</u> (Friedrich-Alexander-University Erlangen-Nürnberg, Germany)	Inventory Management and Performance of SMEs in the Manufacturing Sector of Harare (ID: 258) <u>Wiseman Muchaendepi</u> , <u>Charles Mbohwa</u> (University of Johannesburg, South Africa), <u>Chimbiluni Hamandishe</u> , <u>James Kanyepe</u> (Chinhoyi University of Technology, Zimbabwe)	Circular Economy in Integrated Product and Production Development Education (ID: 139) <u>Minna Lanz</u> , <u>Hasse Nylund</u> , <u>Timo Lehtonen</u> , <u>Tero Juuti</u> (Tampere University of Technology, Finland), <u>Kaisu Rättyä</u> (University of Tampere, Finland)
	Methodology for the Early Analysis and Evaluation of the Resource Efficiency of Process Chains for Manufacturing Hybrid Structures (ID: 107) <u>C. Symmank</u> , <u>J. Boll</u> , <u>A. Rautenstrauch</u> , <u>A. Graf</u> , <u>L. Markov</u> , <u>R. Decker</u> , <u>A. Schmidt</u> , <u>U. Götze</u> , <u>B. Awiszus</u> , <u>V. Kräusel</u> (Chemnitz University of Technology, Germany), <u>D. Landgrebe</u> , <u>L. Kroll</u> (Chemnitz University of Technology, Germany), <u>Fraunhofer Institute for Machine Tools and Forming Technology IWU</u> , Germany)	Web-based Process Planning System Concept Selection using Weighted Decision Matrix and Analytical Hierarchy Process: A Case Study of Sheet Metal Bending Operations (ID: 105) <u>Eriyeti Murena</u> , <u>Khumbulani Mpofu</u> , <u>Olasumbo Makinde</u> , <u>John Alfred Trimble</u> (Tshwane University of Technology, South Africa), <u>Tshwane Xi Wang</u> (KTH Royal Institute of Technology, Sweden)	An Online Education Model for Next Generation Sustainable Manufacturing Workforce Development (ID: 278) <u>Fazleena Badurdeen</u> , <u>Keith Rouch</u> and <u>I.S. Jawahir</u> (University of Kentucky, USA)
15:45 – 16:00	Coffee Break		

16:00 – 17:15 (75 minutes)		Sessions	
Session 21: Sustainable Manufacturing Systems <i>Sustainable Supply Chains</i>	Session 22: Sustainable Manufacturing Processes <i>Manufacturing Processes, Tools and Equipment</i>	Session 23: Sustainable Manufacturing Processes <i>Process Modeling and Improvement</i>	Session 24: Crosscutting Topics in Sustainable Manufacturing <i>Challenges and Strategies in Emerging Countries</i>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Emanuele Pagone	Session Chair: Robert Gao	Session Chair: Yuebin Guo	Session Chair: Asela Kulatunga
Analysis on Sustainable Supply Chain for Circular Economy (ID: 131) Manavalan Ethirajan, Jayakrishna Kandasamy (Vellore Institute of Technology (VIT), India)	Experimental Methods to Study Environmental Sustainability of Silicon-based Lithium Ion Battery Manufacturing (ID: 254) Fenfen Wang (Case Western Reserve University, USA), Lulu Ma (University of Wisconsin-Milwaukee, USA), Chris Yuan (Case Western Reserve University, USA)	Influence of Constitutive Models on Finite Element Simulation of Chip Formation in Orthogonal Cutting of Ti-6Al-4V Alloy (ID: 192) Guang Chen , Lianpeng Lu, Zhihong Ke, Xuda Qin, Chengzu Ren (Tianjin University, China)	Environmental and Social Sustainability of Sri Lankan Tea Industry in the Wake of Global Market Challenges (ID: 161) Nicolas Kassel, Asela Kulatunga (University of Peradeniya, Sri Lanka), N.C. Kassel (University of Bremen, Germany)
The Use of Data Envelopment Analysis in Evaluating Pareto Optimal Solutions of the Sustainable Supply Chain Models (ID: 87) Alperen Bal (Yalova University, Turkey), Sule Itir Satoglu (Istanbul Technical University, Turkey)	Emerging Manufacturing Technologies for Fuel Cells and Electrolyzers (ID: 244) Ahmad Mayyas , Margaret Mann (National Renewable Energy Laboratory, USA)	Fuzzy Multi Criteria Approach for Sustainable Maintenance Evaluation in Rubber Industry (ID: 123) Elita Amrina , Ardy Yulianto, Insannul Kamil (Andalas University, Indonesia)	Industrial Sustainability in a Challenged Economy: The Zimbabwe Steel Industry (ID: 35) Loice Gudukeya, Charles Mbohwa (University of Johannesburg, South Africa), Paul T. Mativenga (The University of Manchester, UK)
Challenges Faced by the Mining Sector in Implementing Sustainable Supply Chain Management in Zimbabwe (ID: 268) Wiseman W. Muchaendepi , Charles Mbohwa (University of Johannesburg, South Africa), James Kanyepe (Chinhoyi University of Technology, Zimbabwe), Michael Mutingi (University of Johannesburg, South Africa)	Evaluating the Usability of Bio Coal from Sugar Cane Bagasse as a Solid Fuel (ID: 64) Musaida M. Manyuchi (University of Johannesburg, South Africa, Manicaland State University of Applied Sciences, Zimbabwe), Charles Mbohwa (University of Johannesburg, South Africa), Edison Muzenda (University of Johannesburg, South Africa, Botswana International University of Science and Technology, Botswana)	Process Sustainability Evaluation for Manufacturing of a Component with the 6R Application (ID: 226) Ana Esther Bonilla Hernández (GKN Aerospace Engine Systems AB, Sweden, University West, Sweden), Tao Lu (University of Kentucky, USA), Tomas Beno, Claes Fredriksson (University West, Sweden), I.S. Jawahir (University of Kentucky, USA)	Innovation Catalysts for Industrial Waste Challenges: Sri Lankan and Thai Cases (ID: 106) Curie Park (University of Cambridge, UK), Kallaya Tantiyaswasdikul (Thammasat University, Thailand), Steve Evans (University of Cambridge, UK), Pusit Lertwattanaruk (Thammasat University, Thailand)
Evolution of Supply Chain Management: A Sustainability Focused Review (ID: 156) Wen Shen (Wuhan University of Technology, China), Dan Hu (Iowa State University, USA), Elif Elçin Günay (Iowa State University, USA, Sakarya University, Turkey), Gül E. Okudan Kremer (Iowa State University, USA)	Perfect Repair Constraints in Manufacturing Firms – A Case Study (ID: 78) Peter Muganyi (University of Johannesburg, South Africa)	Signal-based non-Intrusive Load Decomposition (ID: 44) Tim Weiß , Heiko Dunkelberg, Jan-Peter Seevers (University of Kassel, Germany)	Road to Sustainable Manufacturing: Why Households are not Participating in Recycling Programs in Ndola, Zambia? (ID: 50) Bupe Mwanza, Charles Mbohwa, Arnesh Telukdarie, Chuck Medoh (University of Johannesburg, South Africa)
17:30 – 18:30	Bus Transfer to Kentucky Horse Park		
18:30 – 21:30	Conference Banquet		
21:30 – 22:30	Bus Transfer to Lexington Downtown		

08:00 – 08:30	Registration at conference site			
08:30 – 10:00	Keynote Session Moderation: Holger Kohl <i>Room: Thoroughbred Ballroom</i>			
08:30 – 09:00	Rafi Wertheim <i>Fraunhofer IWU, Germany</i>	The Great Convergence: Biologicalisation, Digitalization, Sustainability and Future Manufacturing		
09:00 – 09:30	Wilfried Sihh <i>Vienna University of Technology, Austria</i>	Digitized, Optimized, Ecologized? Can Digitization Promote Sustainable Manufacturing?		
09:30 – 10:00	Mohamed El-Mansori <i>Arts et Métiers Paris Tech, France</i>	Smart Manufacturing of Natural Fiber Composites		
10:00 – 10:30	Coffee Break			
10:30 – 12:00	Sessions			
	Session 25: Crosscutting Topics in Sustainable Manufacturing <i>Room Thoroughbred 5</i>	Session 26: Sustainable Manufacturing Processes <i>Room Thoroughbred 6</i>	Session 27: Sustainable Manufacturing Processes <i>Room Thoroughbred 7</i>	Session 28: Sustainable Manufacturing Processes <i>Room Thoroughbred 8</i>
12:00 – 13:00	Lunch			
13:00 – 14:15	Session 29: Sustainable Products <i>Room Thoroughbred 5</i>	Session 30: Sustainable Manufacturing Processes <i>Room Thoroughbred 6</i>	Session 31: Sustainable Manufacturing Processes <i>Room Thoroughbred 7</i>	Session 32: Crosscutting Topics in Sustainable Manufacturing <i>Room Thoroughbred 8</i>
14:15 – 14:30	Break/Transition Between Sessions			
14:30 – 15:45	Session 33: Sustainable Manufacturing Processes <i>Room Thoroughbred 5</i>	Session 34: Sustainable Manufacturing Processes <i>Room Thoroughbred 6</i>	Session 35: Student Competition Presentations <i>Room Thoroughbred 7</i>	Session 36: Crosscutting Topics in Sustainable Manufacturing <i>Room Thoroughbred 8</i>
15:45	Farewell and end of the 15th Global Conference on Sustainable Manufacturing <i>Room: Thoroughbred Ballroom</i>			

10:30 – 12:00 (90 minutes) Sessions (cont.)			
Session 25: Crosscutting Topics in Sustainable Manufacturing <i>Strategies and Performance Assessment</i>	Session 26: Sustainable Manufacturing Processes <i>Cutting Technologies</i>	Session 27: Sustainable Manufacturing Processes <i>Energy and Resource Efficiency</i>	Session 28: Sustainable Manufacturing Systems <i>EoL Strategies and Performance Assessment</i>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Rafi Wertheim	Session Chair: I.S. Jawahir	Session Chair: Giampaolo Campana	Session Chair: Mustafa Severengiz
Metrics for Identifying the Most Suitable Strategy for Distributed Localised Food Manufacturing (ID: 160) <u>Pedro Gimenez-Escalante</u> , Shahin Rahimifard (Loughborough University, UK)	Ecological and Functional Optimization of the Pretreatment Process for Plasma-based Coatings of Cutting Tools (ID: 54) <u>Eckart Uhlmann</u> , <u>Hendrik Riemer</u> (Technische Universität Berlin, Germany), <u>Sehoon An</u> , <u>Maik Fröhlich</u> (Leibniz Institute for Plasma Science and Technology (INP), Germany), <u>Hanno Paschke</u> (Fraunhofer Institute for Surface Engineering and Thin Films (IST), Germany), <u>Mirjana Petersen</u> (Albrecht + Schumacher Oberflächentechnik GmbH, Germany)		Economic and Environmental Evaluation of Aluminium Recycling based on a Belgian Case Study (ID: 190) <u>Vi Kie Soo</u> (The Australian National University, Australia), <u>Jef Peeters</u> (Katholieke Universiteit Leuven, Belgium), <u>Paul Compston</u> (The Australian National University, Australia), <u>Matthew Doolan</u> (The Australian National University, Australia), <u>Joost Duflou</u> (Katholieke Universiteit Leuven, Belgium)
Strategic Local Manufacturing Supplier Development Roadmap as a Decision Support Tool (ID: 169) <u>M. Vermeulen</u> , <u>Gert Adriaan Oosthuizen</u> (Stellenbosch University, South Africa)	Constant Surface Roughness over Tool-Lifetime due to Online Process Monitoring and Cutting Parameter Adaption in Turning of Gear Steels (ID: 26) <u>Eckart Uhlmann</u> , <u>Tobias Holznagel</u> , <u>L. Prasol</u> (Technische Universität Berlin, Germany)	On How the Selection of Materials Affects Sustainability (ID: 197) <u>Ana Esther Bonilla Hernández</u> (GKN Aerospace Engine Systems AB, Sweden, University West, Sweden)	A Systems-based Sustainability Assessment Framework to Capture Active Impacts in Product Life Cycle/ Manufacturing (ID: 213) <u>Manish Kumar</u> , <u>Monto Mani</u> (Indian Institute of Science, India)
Data-driven Sustainability in Manufacturing: Selected Examples (ID: 271) <u>Barbara S. Linke</u> , <u>Destiny R. Garcia</u> , <u>Akshay Kamath</u> , <u>Ian C. Garretson</u> (University of California Davis, USA)	Comparison of Abrasive Water Jet Technologies in Terms of Performance and Kerf Geometry Accuracy for Cutting Ceramics (ID: 42) <u>Florian Morczinek</u> (Chemnitz University of Technology, Germany), <u>Matthias Putz</u> (Fraunhofer Institute for Machine Tools and Forming Technology, Germany), <u>Martin Dix</u> (Chemnitz University of Technology, Germany)	Energy Demand Reduction of Aluminum Alloys Recycling through Friction Stir Extrusion Processes Implementation (ID: 57) <u>Giuseppe Ingarao</u> , <u>Dario Baffari</u> (University of Palermo, Italy), <u>Ellen Bracquene</u> (Katholieke Universiteit Leuven, Belgium), <u>Livan Fratini</u> (University of Palermo, Italy), <u>Joost Duflou</u> (Katholieke Universiteit Leuven, Belgium)	Hybrid Exergetic Analysis-LCA Approach and the Industry 4.0 Paradigm: Assessing Manufacturing Sustainability in an Italian SME (ID: 262) <u>Michele Dassisti</u> (Politecnico di Bari, Italy), <u>Concetta Semeraro</u> (MASTER s.r.l., Italy), <u>Michela Chimenti</u> (INRES LAB s.c.a.r.l., Italy)
Sustainability Reporting in German Manufacturing SMEs (ID: 273) <u>Erik Steinhöfel</u> , <u>Mila M. Galeitzke</u> (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany), <u>Holger Kohl</u> (Technische Universität Berlin, Germany)		Material and Process Selection Sustainability Aspects (ID: 166) <u>Mohammed Omar</u> (Khalifa University of Science and Technology, UAE), <u>Ala Qattawi</u> (University of California, USA), <u>Numan Saeed</u> (Khalifa University of Science and Technology, UAE) [Presentation only]	Exploring the Relationships Between Product Innovation Radicality and Extensivity of Flexibility in Sustainable Manufacturing System: How Flexibility affects the Performance of Most Innovative Factories in the USA (ID: 32) <u>Selma Oliveira</u> (Fluminense University, Brazil)

13:00 – 14:15 (75 minutes) Sessions			
Session 29: Sustainable Products Product (Re)Design for Circular Economy	Session 30: Sustainable Manufacturing Processes Energy and Resource Efficiency	Session 31: Sustainable Manufacturing Processes Manufacturing Processes, Tools and Equipment	Session 32: Crosscutting Topics in Sustainable Manufacturing Education and Workforce Development
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Matthew Doolan	Session Chair: Ramsey Hamade	Session Chair: Barbara Cimatti	Session Chair: Holger Kohl
Introducing Product Service System Architectures for realizing Circular Economy (ID: 132) <u>Friedrich Halstenberg</u> , Rainer Stark (Fraunhofer Institute for Production Systems and Design Technology IPK, Germany)	Continuous Trajectory Planning for Welding of Complex Joints Using Bezier Curve (ID: 162) <u>John Ogbemhe</u> , Khumbulani Mpofu, Nkgatho Tlale (Tshwane University of Technology, South Africa)	Aggregating Unit Process Models to Enable Environmental Impact Characterization of Polymer-based Hybrid Manufacturing (ID: 60) <u>Sriram Manoharan</u> , Dustin Scott Harper, Karl R. Haapala (Oregon State University, USA)	Analysis of Industrial Engineering Qualifications for the Job Market (ID: 274) Pinar Bilge, <u>Mustafa Severengiz</u> , Günther Seliger (Technische Universität Berlin, Germany)
A Simulation Model of Consumer Take-Back Decisions Regarding Product Design (ID: 151) <u>Josiah J. Green</u> (Iowa State University, USA), Elif Elçin Günay (Iowa State University, USA, Sakarya University, Turkey), Gül E. Okudan Kremer (Iowa State University, USA)	Rotary Friction Welding versus Fusion Butt Welding of Plastic Pipes – Feasibility and Energy Perspective (ID: 167) <u>Ramsey F. Hamade</u> , Tarek R. Andari (American University of Beirut, Lebanon), Ali H. Ammouri (Lebanese American University, Lebanon), I.S. Jawahir (University of Kentucky, USA)	About the Use of Mineral and Vegetable Oils to Improve the Sustainability of Steel Quenching (ID: 96) <u>Fabio Lenzi</u> , Giampaolo Campana, Antonio Lopatriello Mattia Mele (University of Bologna, Italy), Andrea Zanotti (Proterm S.p.A, Italy)	A Systems Thinking Approach to Collaborations for Capacity Building and Sustainability in Engineering Education (ID: 67) <u>Wilson R. Nyemba</u> (University of Johannesburg, South Africa), Keith F. Carter (University of Leicester, UK), Charles Mbohwa, Simon Chinguwa (University of Johannesburg, South Africa)
Effectiveness of Product Recovery Systems (ID: 227) <u>Matthew Doolan</u> , Brendan Moloney, Vi Kie Soo (The Australian National University, Australia)	Minimizing Carbon Emission with Improved Human Health in Sustainable Machining of Austenitic Stainless Steel through Multi-objective Optimization (ID: 193) Alper Uysal (University of Kentucky, USA, Yıldız Technical University, Turkey), <u>James R. Caudill</u> , I.S. Jawahir (University of Kentucky, USA)	Microstructural Effect of Laser Cladded Ti + TiB2 on Steel Rail (ID: 164) <u>Victor I. Aladesanmi</u> , Samuel Fatoba, Esther T. Akinlabi (University of Johannesburg, South Africa)	

13:00 – 14:15 (75 minutes) Sessions (cont.)			
Session 29: Sustainable Products Product (Re)Design for Circular Economy	Session 30: Sustainable Manufacturing Processes Cutting Technologies	Session 31: Sustainable Manufacturing Processes Manufacturing Processes, Tools and Equipment	Session 32: Crosscutting Topics in Sustainable Manufacturing Education and Workforce Development
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Matthew Doolan	Session Chair: Ramsey Hamade	Session Chair: Barbara Cimatti	Session Chair: Holger Kohl
	Drivers and Barriers for the Adoption of Eco-Design Practices in Pulp and Paper Industry: A Case Study of Finland (ID: 150) <u>Shqipe Buzuku</u> , Tuomo Kässi (Lappeenranta University of Technology, Finland)	Enhancing Accuracy and Productivity of Super Precision Turning Machining Centers (ID: 249) E. Kushnir (Hardinge, USA), R. Karadayi (Applied Automation Technologies, USA), W. Clark (Hardinge, USA), A. C. Affer, A. Naga (Applied Automation Technologies, USA)	Promoting STEM Education through Sustainable Manufacturing: Case Study of Photovoltaic Toys (ID: 222) <u>Juliana Machuve</u> , Edward Mkenda (University of Dar es Salaam, Tanzania)
12:00 – 13:00	Lunch		

14:30 – 15:45 (75 minutes) Sessions			
Session 33: Sustainable Manufacturing Processes Manufacturing Processes, Tools and Equipment	Session 34: Sustainable Manufacturing Processes Cutting Technologies	Session 35: Student Competition Presentations	Session 36: Crosscutting Topics in Sustainable Manufacturing Industry 4.0 and Sustainable Manufacturing
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Mohamed El-Mansori	Session Chair: Julius Schoop	Session Chair: Günther Seliger	Session Chair: Barbara Cimatti
Belt Grinding of Cast Iron without Cooling Lubricant (ID: 23) <u>Eckart Uhlmann</u> , <u>Michael Bülter</u> (Technische Universität Berlin, Germany)	Comparison between Elastomeric Passive Isolators and LQR Control in Stone Cutting Process: Modelling and Simulation (ID: 18) <u>Ahmed Abu Hanieh</u> , Ahmad Albalasie (Birzeit University, Palestine)	Development of a software tool to enable companies to detect potentials in remanufacturing <u>Suraj Mani Chaurasiya</u> , Vivin Kumar Sudhakar, Abhirami Isusupillai Gnanavallal, Lovin Antoney, Sriram Suresh (Technische Universität Berlin, Germany)	Induction Motor Condition Monitoring for Sustainable Manufacturing (ID: 220) <u>Jianjing Zhang</u> , Peng Wang, Robert X. Gao (Case Western Reserve University, USA), Chuang Sun, Ruqiang Yan (Xi'an Jiaotong University, China)

14:30 – 15:45 (75 minutes) Sessions (cont.)			
Session 33: Sustainable Manufacturing Processes <i>Manufacturing Processes, Tools and Equipment</i>	Session 34: Sustainable Manufacturing Processes <i>Cutting Technologies</i>	Session 35: Student Competition Presentations	Session 36: Crosscutting Topics in Sustainable Manufacturing <i>Industry 4.0 and Sustainable Manufacturing</i>
<i>Room Thoroughbred 5</i>	<i>Room Thoroughbred 6</i>	<i>Room Thoroughbred 7</i>	<i>Room Thoroughbred 8</i>
Session Chair: Mohamed El-Mansori	Session Chair: Julius Schoop	Session Chair: Günther Seliger	Session Chair: Robert X. Gao
<p>Increasing the Productivity and Quality of Flute Grinding Processes through the Use of Layered Grinding Wheels (ID: 30) Eckart Uhlmann, N. Schröer, Arunan Muthulingam, B. Gülzow (Technische Universität Berlin, Germany)</p>	<p>An Investigation of Buzz Saw Blade Cutting Forces Depending on Tool Geometry for Cutting Frozen Wood (ID: 52) Christoph Schmidt (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany), Hans-Henrik Westermann (Bayreuth University, Germany), Rolf Steinhilper (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany, Bayreuth University, Germany)</p>	<p>(Cont.) Development of a software tool to enable companies to detect potentials in remanufacturing Suraj Mani Chaurasiya (Technische Universität Berlin, Germany), Vivin Kumar Sudhakar, Abhirami Isusupillai Gnanavallal, Lovin Antoney, Sriram Suresh</p>	<p>Machine Learning in Cutting Processes as Enabler for Smart Sustainable Manufacturing (ID: 94) Anli du Preez, Gert Adriaan Oosthuizen (Stellenbosch University, South Africa)</p>
<p>Interaction of Tool and Workpiece in Ultrasonic-assisted Grinding of High Performance Ceramics (ID: 55) Eckart Uhlmann, Joachim Bruckhoff (Technische Universität Berlin, Germany)</p>	<p>Sustainable Cooling and Lubrication Strategies in Machining Processes: A Comparative Study (ID: 141) Hussien Hegab, Hossam Kishawy (University of Ontario Institute of Technology, Canada), B. Darras (American University of Sharjah, UAE)</p>	<p>Structured Approach to Evaluating and Improving Product Sustainability: A Case Study with a 3D Printer Darren Tosh, Peter Hong, Christian Enyoghasi, Brett Crosby, David Omotaya, Hamid Saghaian (University of Kentucky, USA)</p>	<p>Knowledge-based Approach to Managing Industrial Energy (ID: 165) Mohammed Omar (Khalifa University, UAE), Ahmad Mayyas (National Renewable Energy Laboratory, USA), Safa Al Ameri (Khalifa University, UAE)</p>
<p>Tool Life of Coated Cemented Carbide when Machining Inconel 718 under Sustainable Conditions (ID: 76) Muammar Faiq Azhar, Che Hassan Che Haron, Jaharah A. Ghani (Universiti Kebangsaan Malaysia, Malaysia), Nurul Hayati, Abdul Halim (Universiti Kebangsaan Malaysia, Malaysia, Universiti Teknologi MARA, Malaysia)</p>	<p>Effects of Surface Texture Parameters of Cutting Tools on Friction Conditions at Tool-Chip Interface during Dry Machining of AISI 1045 Steel (ID: 211) Sagar Dhage, Anshu Dhar Jayal, Prabir Sarkar (Indian Institute of Technology Ropar, India)</p>		
15:45	Farewell and end of the 15th Global Conference on Sustainable Manufacturing		

Post-conference program

October 4th 2018, Thursday

17:00-21:00	Plant Tour: Toyota Motor Manufacturing Kentucky <i>Georgetown, KY</i>
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October 5th 2018, Friday

08:00-12:00	Plant Tour: Infiltrator Water Technologies <i>Winchester, KY</i>
08:30-15:00	Plant Tour: Novelis Inc. (followed by visit to Berea, KY and lunch on your own) <i>Berea, KY</i>

Plant tour locations



16th Global Conference on Sustainable Manufacturing 2018 Program

Time	Monday Oct. 01, 2018	Tuesday Oct. 02, 2018	Wednesday Oct. 03, 2018	Thursday Oct. 04, 2018	Friday Oct. 05, 2018
8:00 - 8:30	Registration Open at Convention Center	Registration Open at Convention Center	Registration Open at Convention Center	Registration Open at Convention Center	
8:30 - 9:00	Welcome and Conference Opening	keynote	keynote	keynote	
9:00 - 9:30	keynote	keynote	keynote	keynote	
9:30 - 10:00	keynote	keynote	keynote	keynote	
10:00 - 10:15	Coffee Break	Coffee Break	Coffee Break	Coffee Break	
10:15 - 10:30	Workshop: Introduction to Sustainable Manufacturing: Recent Trends, Metrics and Methodologies for Evaluation (University of Kentucky Student Center)	keynote	Session 9: Sustainable Products	Session 25: Crosscutting Topics in Sustainable Manufacturing	Session 28: Sustainable Manufacturing Processes
10:30 - 11:00		Industry keynote	Session 10: Sustainable Manufacturing	Session 11: Sustainable Manufacturing Systems	Session 26: Sustainable Manufacturing Processes
11:00 - 11:30		Industry keynote	Session 12: Crosscutting Topics in Sustainable Manufacturing	Session 13: Sustainable Products	Session 14: Sustainable Manufacturing Processes
11:30 - 11:45	Session 1: Sustainable Products	Session 2: Sustainable Manufacturing Processes	Session 3: Sustainable Manufacturing Systems	Session 4: Industry Presentations	Lunch
11:45 - 12:00	Session 2: Sustainable Manufacturing Processes	Session 3: Sustainable Manufacturing Systems	Session 4: Industry Presentations	Session 15: Sustainable Manufacturing Systems	
12:00 - 12:30	Session 3: Sustainable Manufacturing Systems	Session 4: Industry Presentations	Session 5: Sustainable Products	Session 16: Sustainable Manufacturing Processes	Session 29: Sustainable Products
12:30 - 13:00	Session 4: Industry Presentations	Session 5: Sustainable Products	Session 17: Sustainable Manufacturing Processes	Session 17: Sustainable Manufacturing Processes	Session 30: Sustainable Manufacturing Processes
13:00 - 13:30	Lunch (Workshop Participants)	Lunch (Luncheon Speaker)	Lunch (Luncheon Speaker)	Session 18: Sustainable Manufacturing Processes	Session 31: Sustainable Manufacturing Processes
13:30 - 14:00	Lunch (Workshop Participants)	keynote	keynote	Session 19: Sustainable Manufacturing Systems	Session 32: Crosscutting Topics in Sustainable Manufacturing
14:00 - 14:15	University of Kentucky Lab Tours	Session 5: Sustainable Products	Session 6: Sustainable Manufacturing Processes	Session 20: Crosscutting Topics in Sustainable Manufacturing	Coffee Break
14:15 - 14:30	University of Kentucky Lab Tours	Session 6: Sustainable Manufacturing Processes	Session 7: Crosscutting Topics in Sustainable Manufacturing	Session 21: Sustainable Manufacturing Systems	Session 33: Sustainable Manufacturing
14:30 - 15:00	University of Kentucky Lab Tours	Session 7: Crosscutting Topics in Sustainable Manufacturing	Session 8: Industry Presentations	Session 22: Sustainable Manufacturing Processes	Session 34: Sustainable Manufacturing Processes
15:00 - 15:30	Registration Open at Convention Center	Session 8: Industry Presentations	Session 9: Sustainable Manufacturing Processes	Session 23: Sustainable Manufacturing Processes	Session 35: Student Competition Presentations
15:30 - 15:45	Registration Open at Convention Center	Session 9: Sustainable Manufacturing Processes	Session 10: Sustainable Manufacturing Processes	Session 24: Crosscutting Topics in Sustainable Manufacturing	Session 36: Crosscutting Topics in Sustainable Manufacturing
15:45 - 16:00	Registration Open at Convention Center	Panel Discussion	Session 11: Sustainable Manufacturing Processes	Session 25: Sustainable Manufacturing Processes	Farewell and end of the CCISM 2018
16:00 - 16:30	Registration Open at Convention Center	Panel Discussion	Session 12: Crosscutting Topics in Sustainable Manufacturing	Session 26: Sustainable Manufacturing Processes	Industry Tour 1 (Toyota Motor Manufacturing Kentucky)
16:30 - 17:00	Registration Open at Convention Center	Panel Discussion	Session 13: Sustainable Manufacturing Processes	Session 27: Sustainable Manufacturing Processes	
17:00 - 17:15	Registration Open at Convention Center	Panel Discussion	Session 14: Sustainable Manufacturing Processes	Session 28: Sustainable Manufacturing Processes	Industry Tour 2: Novelis Inc. and Berea City Tour
17:15 - 17:30	Registration Open at Convention Center	Panel Discussion	Session 15: Sustainable Manufacturing Processes	Session 29: Sustainable Manufacturing Processes	
17:30 - 18:00	Registration Open at Convention Center	Panel Discussion	Session 16: Sustainable Manufacturing Processes	Session 30: Sustainable Manufacturing Processes	Industry Tour 3: Infiltrator Water Technologies
18:00 - 18:30	Registration Open at Convention Center	Panel Discussion	Session 17: Sustainable Manufacturing Processes	Session 31: Sustainable Manufacturing Processes	
18:30 - 19:00	Welcome Reception (Hilton Downtown)	Bus Transfer to Horse Park	Session 18: Sustainable Manufacturing Processes	Session 32: Crosscutting Topics in Sustainable Manufacturing	
19:00 - 20:00	Welcome Reception (Hilton Downtown)	Conference Banquet (Kentucky Horse Park)	Session 19: Sustainable Manufacturing Processes	Session 33: Sustainable Manufacturing	
20:00 - 21:00	Welcome Reception (Hilton Downtown)	Conference Banquet (Kentucky Horse Park)	Session 20: Sustainable Manufacturing Processes	Session 34: Sustainable Manufacturing	
21:00 - 21:30	Welcome Reception (Hilton Downtown)	Conference Banquet (Kentucky Horse Park)	Session 21: Sustainable Manufacturing Processes	Session 35: Student Competition Presentations	
21:30 - 22:30	Welcome Reception (Hilton Downtown)	Bus Transfer to Downtown	Session 22: Sustainable Manufacturing Processes	Session 36: Crosscutting Topics in Sustainable Manufacturing	