

Conference Secretariat

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Conference Venue

stias STELLENBOSCH INSTITUTE FOR ADVANCED STUDY
STELLENBOSSE INSTITUUT VIR GEVORDERDE NAVORSING

Marais Street, Stellenbosch, 7600
GPS: 33°56'6.00"S; 18°52'24.00"E



Stellenbosch
UNIVERSITY
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forward together
sonke siya phambili
saam vorentoe



INTERNATIONAL CONFERENCE ON COMPETITIVE MANUFACTURING

COMA'22

Smart, Sustainable Manufacturing in an ever-changing world

Final Programme

9 March 2022 to 10 March 2022
Stellenbosch, South Africa



Organised by
Department of Industrial Engineering
Stellenbosch University

ACKNOWLEDGEMENTS

Sincere thanks to our distinguished supporters and sponsors, whose generosity made possible the success of this Conference



Conference Chair

Von Leipzig K, Stellenbosch University, South Africa

Co-Chair

Hummel V, Reutlingen University, Germany

Sacks N, Stellenbosch University, South Africa

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Rationale

In a small world where trade is the new global driving force conquering countries and continents alike, international competitiveness is becoming the ultimate challenge. It requires high quality products manufactured with state-of-the-art technologies at low cost under the assumption of highly efficient operations management as well as clear corporate goals and strategy. This in turn is based on improved engineering training and education, relevant applied research, and an active interaction between academia and industry. The conference theme is: *“Smart, Sustainable Manufacturing in an ever-changing world”*

The International Conference on Competitive Manufacturing (COMA '22) is taking place for the eighth time. The main objective of the conference is to present recent developments, research results and industrial experience related to Smart, Sustainable Manufacturing. A further objective of the conference is to be a generator of innovative ideas and fruitful collaboration both locally and abroad.

Topics

The following areas are relevant to the conference theme:

Product Design and Realisation:

Design for manufacturing and assembly, reverse engineering, CAD/CAE, concurrent engineering, design for additive manufacturing, biologically inspired design approaches, virtual prototyping, networks in product development, open design

Production Technologies:

Expert systems in manufacturing, CAD/CAM Systems, HSC, EDM, forming, additive manufacturing, casting, metrology, mechatronics, precision manufacturing, bio-manufacturing, robotics, sensing, assembly, automation, intelligent manufacturing, biologically inspired manufacturing processes, non-conventional machining, environmental aspects, machining of materials, abrasive processes, hybrid processes, laser-based manufacturing, green manufacturing, coating technology

Production Systems and Organisations:

Production planning and control, logistics, modelling and simulation, SW-applications, communication networks, 5G network applications, social manufacturing, learning factory, digital factory, biological transformation in production systems, cyber-physical approaches, big data, predictive maintenance, asset management, human-machine collaboration, employee qualification, human resource management, IoT in manufacturing, manufacturing digitization challenges, augmented and virtual reality, lean manufacturing, sustainable manufacturing

Enterprise Design and Integration:

Knowledge management, product life cycle, human interface, integrated design and manufacturing, technology and innovation management, total quality management, distributed control systems, socio-economic and environmental issues, artificial intelligence and machine learning, digital twins, virtual setup, subscription vs selling.

Supply Chain Management:

Supply chain track and tracing; digital supply networks, blockchain in supply chains, circular economy, artificial intelligence for supply chains, biological transformation in supply chains

Covid-19: Manufacturing and Supply Chain:

Post-pandemic business models, Supply chain localisation, Manufacturing as a service, Rapid medical device manufacturing, Distributed manufacturing, Constrained supply chains, Resilient supply chains

Materials and Manufacturing

Smart materials, Recycling, Remanufacturing, Future materials, Biomaterials, Sustainable materials, Nanomaterials, Coatings, Metal matrix composites

COMA support Team

Registration Desk:

Anèl de Beer
Karina Smith
Dean Johnson
Michelle McClelland

Presentation and IT Support:

Philip Hugo
Martin Bezuidenhout
Moritz Hoffmann
Tim Holzapfel
Serkan Mert
Jannis Rapp
Michael Weltin
Felicia Schweitzer

COVID19 regulations

To assist in the detection and prevention of the spread of the Covid19 infection, the arrival of our staff, delegates, and exhibitors at the venues, include:

- ✓ Travel declaration and completion of a self-assessment form will be required by guests on registration
- ✓ Temperature checks conducted at point of entry
- ✓ Sanitizer stations installed at all entry points into the buildings
- ✓ Entry to the building and conference sessions will not be permitted without a mask
- ✓ Daily staff briefings reinforcing hygiene and the safety protocols and processes

Please upload your presentation at the registration desk at least 2 hours before your presentation.

Free Conference Wifi

Network: **Stias2** Password: **Conference22!**

TUESDAY, 8th March 2022

16:30 – 19:30 **Registration**
Wallenberg Centre
(Stellenbosch Institute for Advanced
Study, STIAS), Marais Street



Wallenberg Centre (STIAS)

WEDNESDAY, 9th March 2022

07:30 – 09:00 **Registration**
Wallenberg Centre (STIAS)

Plenary Session	Auditorium 1
Opening Address Session Chair: Mr K von Leipzig	

09:00	Introduction K von Leipzig, Conference Chair <i>Stellenbosch University, Stellenbosch, South Africa</i>
09:10	Welcome of Guests Prof W De Villiers, Rector and Vice-Chancellor <i>Stellenbosch University, Stellenbosch, South Africa</i>
09:15	Opening Address Prof JL van Niekerk, Dean of Faculty of Engineering <i>Stellenbosch University, South Africa</i>



K von Leipzig



Prof W De Villiers



Prof JL van Niekerk



WEDNESDAY, 9th March 2022

Plenary Session **Auditorium 1**
Advanced Manufacturing – State-of-the-Art
Session Chair: Prof N du Preez

09:30	<p>Prof Dimitri Dimitrov Memorial Lecture: Manufacturing Systems of Tomorrow – Smart, Efficient and Sustainable</p> <p>Prof R Neugebauer <i>President of the Fraunhofer-Gesellschaft</i></p>
10:15	<p>BMW Digitalisation – Revealing the best kept secret</p> <p>K von der Osten-Sacken <i>Vice President of the BMW Group and BMW Group South Africa Director for Digital and Global Solutions</i></p>

PLENARY SPEAKERS



Professor Reimund Neugebauer, born 1953 in Thuringia, Germany, is since 2012 the 10th President of the Fraunhofer-Gesellschaft. With his profound management and R&D background, he is responsible for research, science policy and international affairs. During his presidency, the Fraunhofer-Gesellschaft grew by around 10,000 employees and increased its research budget to almost three billion euros.

Professor Neugebauer is a fellow of the International Academy for Production Engineering (CIRP) and a member of acatech – National Academy of Science and Engineering in Germany.



Klaus von der Osten-Sacken first joined BMW in 2004 and, over the years, has held various roles including Softlab Head of Automotive, Head of Process IT OtD and ItO, Project eDiscovery, Project GDPR, Head of Customer Data, and Head of New Organisational Structures for the DevOps business.

Today he is leading the Global Development and IT Operations Hub South Africa which provides IT services for core BMW Group processes such as production and logistics, finance and sales to more than 50 countries. With more than 1,600 experts, the Hub designs, creates and operates digital solutions as an internal partner of the BMW Group



WEDNESDAY, 9th March 2022

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Session A1 **Auditorium 1**
Production Systems and Organisations
Session Chair: Prof A van der Merwe

Session B1 **Auditorium 2**
Covid-19: Manufacturing, Services, Business Models
Session Chair: Prof D Blaine

11:30	23 - Identification of residual development efforts in agile ramp-up production T Bergs, S Apelt, M Becker, A Beckers, S Barth <i>RWTH Aachen University, Germany</i>
11:50	24 - Cross-Process Modeling for the Design of Manufacturing Process Sequences under Consideration of Model Uncertainties T Bergs, A Beckers, S Apelt, T Hommen, S Barth <i>RWTH Aachen University, Germany</i>
12:10	51 - Modeling Interactions and Dependencies in PPC. An Approach to a Holistic Description A Muetze, S Lebbing, S Hillnhagen, M Schmidt, P Nyhuis <i>Leibniz University Hannover, German</i>
12:30	87 - ARTI-based Holonic Manufacturing Execution System Using the BASE Architecture: A Case Study Implementation A Wasserman, K Kruger, A Basson <i>Stellenbosch University, South Africa</i>

11:30	43 - Did the Covid-19 Pandemic Improve Engineering Education? – A South African – German Perspective C Fussenecker, K Wolff, D Blaine, J Niemann <i>University of Applied Sciences Düsseldorf, Germany</i>
11:50	112 - Typology and Implications of Equipment-as-a-Service Business Models in the Manufacturing Industry L Holst, V Stich <i>RWTH Aachen University, Germany</i>
12:10	114 - Investigating the Shuttering Index of Coal Fines Briquettes Produced with Natural Binders R Nemukula, D Madyira <i>University of Johannesburg, South Africa</i>
12:30	48 - Kanban in software development – the role of leadership and metrics C Fagarasan, C Cristea, C Mihele, O Popa, D Ciceo, A Pisla <i>Technical University in Cluj-Napoca, Romania</i>

13:00 – 14:00 **LUNCH BREAK**

13:00 – 14:00 **LUNCH BREAK**



WEDNESDAY, 9th March 2022

WEDNESDAY, 9th March 2022

Session C1 **Auditorium 3**
Manufacturing Technologies I
Session Chair: Prof T van Niekerk

Session A2 **Auditorium 1**
Production Systems and Organisations
Session Chair: Prof V Hummel

11:30	9 - A Force Controlled Polishing Process Design, Analysis and Simulation Targeted for the Selective Laser Sintered Aero-Engine Components R Kuppuswamy, Q de Jongh, M Titus <i>University of Cape Town, South Africa</i>
11:50	66 - An overview of additive manufacturing opportunities in transport equipment manufacturing R Muvunzi, K Mpofu, I Daniyan <i>Tshwane University of Technology, South Africa</i>
12:10	83 - Dimensional stability of mineral cast for precision machinery E Relea, L Weiss, K Wegener <i>IWF ETH Zürich, Switzerland</i>
12:30	115 - Effect of Mercerization on Coconut Fiber Surface Condition S Simelane, D Madyira <i>University of Johannesburg, South Africa</i>

14:00	104 - Bridging the gap between digital human simulation to standard performance with Human Work Design P Kuhlant, M Benter, M Neumann <i>MTM ASSOCIATION e. V, Germany</i>
14:20	102 - Interface Holons in the BASE architecture for human-system integration in Cyber-Physical Systems D van Niekerk, K Kruger, A Basson <i>Stellenbosch University, South Africa</i>
14:40	63 - Design and construction framework to enable the modular block building methodology to broaden South African Oceans Economy H Theunissen, T Van Niekerk, J Pretorius <i>Nelson Mandela University, South Africa</i>
15:00	69 - Production Controlling Governance to Ensure Homogenous Information Systems and Targeted Decision-Making Processes T Demke, A Mütze, P Nyhuis <i>Leibniz University Hannover, Germany</i>

13:00 – 14:00 **LUNCH BREAK**

15:30-16:00 **TEA / COFFEE BREAK**



WEDNESDAY, 9th March 2022

WEDNESDAY, 9th March 2022

Session B2	Auditorium 2
Extended Reality Session Chair: Dr W Jooste	

Session C2	Auditorium 3
Manufacturing Technologies II Session Chair: Dr K Kruger	

14:00	17 - Application of Augmented Reality for the Training in the Field of Refrigeration and Air-Conditioning F Bellalouna, R Langebach <i>University of Applied Sciences Karlsruhe, Germany</i>
14:20	36 - Moving towards Industry 4.0: Instructional Videos as CAM Software Training Tool for SMEs L Niebuhr, E Jakobs <i>RWTH Aachen University, Germany</i>
14:40	89 - Augmented Reality for Operators in Smart Manufacturing Environments: A Case Study Implementation T Gramberg, K Kruger, J Niemann <i>University of Applied Sciences Düsseldorf, Germany</i>
15:00	100 - Augmented Reality Combined with Machine Learning to Increase Productivity in Fruit Packing M van der Westhuizen, K von Leipzig, V Hummel <i>Stellenbosch University, South Africa</i>

14:00	105 - Understanding the Structural Integrity and Post-processing of LPBF as-built Ti-6Al-4V Parts: A Literature Review W Makhetha, G Haar, T Becker, N Sacks <i>Stellenbosch University, South Africa</i>
14:20	106 - Towards a Virtual Optical Coordinate Measurement Machine Z Luthuli, K Schreve, O Kurger <i>Stellenbosch University, South Africa</i>
14:40	44 - Coefficient of static friction of turn-milled high-friction surfaces – investigations on the influence of joint pressure and load direction R Funke, A Schubert <i>Chemnitz University of Technology, Germany</i>
15:00	13 - The Development and Inverse Kinematics of a 5 DOF Parallel Kinematic Architecture Machining System W Dharmalingum, J Padayachee, J Collins, G Bright <i>University of KwaZulu-Natal, South Africa</i>

15:30-16:00	TEA / COFFEE BREAK
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15:30-16:00	TEA / COFFEE BREAK
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WEDNESDAY, 9th March 2022

WEDNESDAY, 9th March 2022

Session A3 **Auditorium 1**
Automation, Human Machine Interaction, Interfaces
Session Chair: Prof O Damm

Session B3 **Auditorium 2**
Enterprise Design
Session Chair: Prof I de Kock

16:00	20 - Sustainable utilization of industrial robotic systems by facilitating programming through a human- and process-centered declarative approach T Komenda, J Garcia, M Schelle, F Leber, M Brandstötter <i>Fraunhofer Austria Research GmbH, Austria</i>
16:20	68 - Productivity driven dynamic task allocation in human-robot-collaboration for assembly processes M Euchner, V Hummel <i>Reutlingen University, Germany</i>
16:40	27 - Artificial Intelligence based robotic automation of manual assembly tasks for intelligent manufacturing A Simeth, P Plapper <i>University of Luxembourg, Luxembourg</i>
17:00	75 - Development of an AI-based method for dynamic affinity-based warehouse slotting using indoor localisation data J Schuhmacher, V Hummel <i>Reutlingen University, Germany</i>

16:00	21 - Development of a system simulation of the sustainable impact of product service systems D Kretschmar, J Niemann, C Deckert, A Pisla <i>University of Applied Sciences Düsseldorf, Germany</i>
16:20	76 - People, Process, Master Data, Technology: Data-centric Engineering of Manufacturing Management Systems T Gittler, L Plümke, F Silani, P Moro, L Weiss, K Wegener <i>inspire AG, Switzerland</i>
16:40	96 - Derivation of Requirements for the Formation of Collective Target Systems for Technology-based Cooperation between Manufacturing Corporates and Startups G Schuh, B Studerus <i>RWTH Aachen University, Germany</i>
17:00	6 - Resources collaboration and optimization in industry 4.0 environments E Ocakci, J Niemann <i>Continental Teves AG & Co. oHG, Germany</i>

17:20 **END OF DAY**

17:20 **END OF DAY** 

WEDNESDAY, 9th March 2022

WEDNESDAY, 9th March 2022

Session C3 **Auditorium 3**
Smart data
Session Chair: Prof E Lutters

16:00	101 - Driving big data capabilities and sustainable innovation in organisations T von Leipzig, J du Toit, F Ortmann <i>Stellenbosch University, South Africa</i>
16:20	92 - Indoor positioning using a single PTZ camera J Hermann, A Basson, K von Leipzig, V Hummel <i>Reutlingen University, Germany</i>
16:40	80 - Data Analytics in Industrial Engineering for Economic Sustainability: A Use Case on Planning and Controlling of Rework R Hensel, T Mayr, M Keil <i>AUDI AG, Germany</i>
17:00	70 - Design and Finite Element Analysis of a Novel Brake Beam of a Railcar I Daniyan, K Mpofo, F Ale, R Muvunzi <i>Tshwane University of Technology, South Africa</i>

17:20 **END OF DAY**

18:30 for 19:00 **Conference Gala Dinner**
Nooitgedacht Estate
R304, Koelenhof,
Stellenbosch

Guest Speaker **Josh Romisher**
CEO of LaunchLab, Stellenbosch

Dress Code Business Casual



THURSDAY, 10th March 2022

Plenary Session	THEME	Auditorium 1
Session Chair: Prof N du Preez		

09:00	Digital Twins for optimizing deep level mines in RSA Dr Jan Vosloo <i>North-West University</i>
09:45	The vision of the maintenance-free smart factory Prof Wilfried Sihm <i>Fraunhofer Austria / TU Wien</i>

PLENARY SPEAKERS



Dr Jan Vosloo is a registered professional engineer and holds a PhD in electrical and electronic engineering. He has also completed a master's degree in business administration. Jan has more than 16 years' worth of experience in the mining industry and has been involved in various mine optimisation research and development initiatives. He is currently a Senior Lecturer at the North-West University.



Professor Wilfried Sihm - In September 2004 Univ. Prof. Dr. Ing. DI Prof eh. Dr. h.c. 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, e.g. 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)



THURSDAY, 10th March 2022

THURSDAY, 10th March 2022

Session A4 **Auditorium 1**
Enterprise Design and Digital Twins
Session Chair: Prof P Plapper

Session B4 **Auditorium 2**
Production Systems and Maintenance
Session Chair: Prof V Hummel

11:00	73 - A framework for leveraging twin transition in the manufacturing industry L Stratmann, G Hoeborn, V Stich, R Conrad, F Optehostert, M Phong <i>RWTH Aachen University, Germany</i>
11:20	90 - Virtual Reality for Interacting with Manufacturing System Digital Twins Y Haile-Melekot, K Kruger, J Niemann <i>University of Applied Sciences Düsseldorf, Germany</i>
11:50	97 - Accuracy in Digital Twinning; an exploration based on asset location E Lutters, R Damgrave <i>University of Twente, Netherlands</i>
12:10	99 - Simultaneous multi-stakeholder digital twinning for anticipated production environments R Damgrave, E Lutters <i>University of Twente, Netherlands</i>

11:00	4 - Investigation of Predictive Maintenance algorithms for rotating shafts under various bending loads C Basson, G Bright, J Padayachee, S Adali <i>University of KwaZulu-Natal, South Africa</i>
11:20	84 - Analysis and Modelling of the Track Quality Index of Railways S Laubscher, W Jooste <i>Stellenbosch University, South Africa</i>
11:50	85 - A project management framework for the modernisation of passenger railway depots in developing countries A Masikati, W Jooste, C Fourie <i>Stellenbosch University, South Africa</i>
12:10	93 - A gamified learning approach based on systems modelling for understanding the effects of asset management decision-making I van Breda, W Jooste, V Hummel <i>Stellenbosch University, South Africa</i>

12:30 – 13:30 **LUNCH BREAK**

12:30 – 13:30 **LUNCH BREAK**



THURSDAY, 10th March 2022

THURSDAY, 10th March 2022

Session C4 **Auditorium 3**
Manufacturing Technology and Materials
Session Chair: Prof N Sacks

Session A5 **Auditorium 1**
Novel Engineering concept and Innovation
Session Chair: Mr K von Leipzig

11:00	2 - A Kinematics Study of Diamond Abrasives and Nickel-Ions on an Electroplating Process towards Enhancing the Quality of a Super-abrasive Grinding Wheel R Kuppuswamy, S Eljzoli <i>University of Cape Town, South Africa</i>
11:20	26 - The effect of minimum quantity lubrication on selected surface integrity attributes when machining grade 4 titanium alloy A Maponya, R Laubscher <i>University of Johannesburg, South Africa</i>
11:50	77 - Laser shock peening: A NbC based cermet enhancement alternative for improved GCI interrupted face-milling R Genga, D Glaser, P Rokebrand, L Cornish, M Woydt, A Janse van Vuuren, C Polese <i>University of the Witwatersrand, South Africa</i>
12:10	57 - Evaluating the relationship between powder characteristics, defects, and final build properties for LPBF WC-Co P Govender, D Blaine, N Sacks, D Hagedorn-Hansen <i>Stellenbosch University, South Africa</i>

13:30	5 - Development of an academic training course for future service engineers J Niemann, D Kretschmar, C Fussenecker, M Schlösser <i>Hochschule Düsseldorf, Germany</i>
13:50	46 - Modern Approaches in Shortening the Lead Time in Innovation for Young Emerging Companies A Pislă, L Nae, C Vaida, E Oprea, B Gherman, M Deriaz, D Pislă <i>Technical University in Cluj-Napoca, Romania</i>
14:10	50 - Opportunities Presented by Industrial 4.0 Revolution to Revitalize the Railway Sector: A Review S Tshabalala, K Mpofu <i>Tshwane University of Technology, South Africa</i>
14:30	29 - Hybrid approach on the project development management within automotive industry O Popa, C Mihele, R Felician, C Fagarasan, A Pislă <i>Technical University of Cluj-Napoca, Romania</i>

12:30 – 13:30

LUNCH BREAK

14:50-15:30

TEA / COFFEE BREAK



THURSDAY, 10th March 2022

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Session B5	Auditorium 2
Supply Chain Session Chair: Prof D Palm	

Session C5	Auditorium 3
Manufacturing Systems Session Chair: Prof R Genga	

13:30	86 - Opportunities for Visualising Complex Data by Integrating Virtual Reality and Digital Twins G da Silva, A Basson, K Kruger <i>Stellenbosch University, South Africa</i>
13:50	56 - Prototypical blockchain solution for mapping complex products in dynamic supply chains F Dietrich, L Louw, D Palm <i>Stellenbosch University, South Africa</i>
14:10	42 - Development of a Procedure Model to Compare the Picking Performance of Different Layouts in a Distribution Centre D Struckmann, C Cevirgen, J Becker, O Arian, P Nyhuis <i>Leibniz University Hannover, Germany</i>
14:30	58 - Feasibility assessment of 5G use cases in intralogistics F Dietrich, M Mediavilla, D Palm, A Turgut, T Lackner, W Jooste <i>Stellenbosch University, South Africa</i>

13:30	71 - An overview of the manufacturing systems: a literature survey N Dlamini, K Mpofo, I Daniyan, B Ramatsetse <i>Tshwane University of Technology, Pretoria, South Africa</i>
13:50	3 - Research Endeavors Towards Development of an Intelligent Grinding System R Kuppuswamy, S Naidoo, F Jani, Q de Jongh <i>University of Cape Town, South Africa</i>
14:10	8 - Towards configuration and development of an Augment Reality (AR) enhanced Intelligent Grinding System (IGS) for Ti6Al4V alloy R Kuppuswamy, F Jani, S Naidoo, Q de Jongh <i>University of Cape Town, South Africa</i>
14:30	25 - Hybrid Production Principles: A Framework for the Integration in Aircraft Manufacturing A Wenzel, T Lucht, P Nyhuis <i>Leibniz University Hannover, Germany</i>

14:50-15:30	TEA / COFFEE BREAK
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14:50-15:30	TEA / COFFEE BREAK
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THURSDAY, 10th March 2022

THURSDAY, 10th March 2022

Session A6	Auditorium 1
Human integration	
Session Chair: Prof A van der Merwe	

Session B6	Auditorium 2
Manufacturing	
Session Chair: Prof L Louw	

15:30	95 - The Application of ArchiMate for Planning Implementation and Integration of Manufacturing Management Systems D Gibbons, A van der Merwe <i>Stellenbosch University, South Africa</i>
15:50	107 - Overview of Design Dimensions for Ambidexterity in Manufacturing Innovation Management Q Gärtner, A Dorth <i>Technical University of Munich, Germany</i>
16:10	88 - Possibilities and challenges for human-system integration in the South African manufacturing context T Defty, K Kruger, A Basson <i>Stellenbosch University, South Africa</i>
16:30	91 - Systematization of Technological Capabilities for the Connected Adaptive Production G Schuh, T Scheuer, J Herding <i>RWTH Aachen University, Germany</i>

15:30	30 - CCU in Cement Industry - Aspects of the Production of E-Fuels by Upcycling Carbon Dioxide A Wacht, S Kaluza, P Fleiger <i>University of Applied Sciences Duesseldorf, Germany</i>
15:50	103 - An Unorthodox Forming Procedure to Achieve Single Minute Exchange of Die (SMED) – Cold Roll Forming T Pillay, G Bright, C Basson, A Athol-Webb <i>University of KwaZulu-Natal, South Africa</i>
16:10	40 - Machine Learning for Soft Sensors and an Application in Cement Production M Stöhr, T Zielke <i>University of Applied Sciences Düsseldorf, Germany</i>
16:30	67 - Development of a conceptual framework for integrating intelligent-product structures into a flexible manufacturing system A Burkart, G Bitsch, and I de Kock <i>Stellenbosch University, South Africa</i>

16:50	CLOSING ADDRESS Prof N Sacks
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16:50	CLOSING ADDRESS Prof N Sacks
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