

**“INDUSTRIE 4.0: Towards the Future of Manufacturing”**  
**1<sup>st</sup> – 2<sup>nd</sup> November 2016**

**“Session 1” (30 mins)**

**“Challenges in Industry 4.0 and Smart Data”**

***Prof. Dr.-Ing. Birgit Vogel-Heuser***

*Head of Chair and Director of Institute  
Chair of Automation and Information Systems  
Department of Mechanical Engineering  
Technical University of Munich (TUM)*

**Abstract**

This talk will give a short introduction of Industry 4.0 and Smart Data. It will also discuss the selected successful cases and requirements for collaboration as well as introduce the basic platforms and technologies used in Germany.

**“Session 2” (30 mins)**

**“Future of Manufacturing – Challenges and Opportunities”**

***Dr. David Low***

*Chief Executive Officer  
Advanced Remanufacturing and Technology Centre (ARTC)  
Agency for Science, Technology and Research (A\*STAR)*

Dr David Low is the Chief Executive Officer of the Advanced Remanufacturing and Technology Centre (ARTC) of the Agency for Science, Technology and Research (A\*STAR). He is responsible for managing the ARTC, a centre that rapidly transforms best-in-class capabilities and innovations into high value added customer solutions for manufacturing & remanufacturing applications.

Prior to his current role, David was the Chief of Manufacturing Technology, Singapore of RollsRoyce Singapore where he set up and led the development of Manufacturing Technology capabilities in Singapore and in the region. In 2012, David won the prestigious Sir Henry Royce Team Award for Engineering Excellence. Prior to joining Rolls-Royce in 2007, David worked in the Singapore Institute of Manufacturing Technology (SIMTech), a unit of A\*STAR, where his last role was the Group Manager for Machining Technology, which focused on the R&D of machining and laser materials processing technologies.

As a researcher, David has conducted industrial research for numerous companies and published over 50 journals, books and patent publications in the field of laser materials processing. David is a member of the Materials Science and Engineering Departmental Consultative Committee at the National University of Singapore (NUS). He is a member of the Editorial Board for the International Journal Lasers in Engineering. David received his PhD and First Class Honours Bachelor degree in Mechanical Engineering from the University of Manchester Institute of Science & Technology – UMIST (now The University of Manchester). He also holds a Masters of Business Administration from the Tsinghua-INSEAD Executive MBA (TIEMBA) programme. David is a Chartered Engineer and a Fellow of the Institution of Mechanical Engineers (IMechE).

**Abstract**

The talk will introduce the advanced manufacturing trend happening globally and how it may affect Singapore’s manufacturers. It will introduce the A\*STAR Future of Manufacturing initiatives, which will include the development of Model Factories to work with industry. The talk will end with the current challenges Singapore Manufacturers faces and what need to be done to turn challenges to opportunities.

“Session 3” (25 mins)

### **“Festo Technology Plant Scharnhausen on its way towards a digital factory – an adopters view on Industry 4.0”**

**Dr. Lutz Seidenfaden**

*Head of Competence Center Asia  
Festo Pte Ltd*

Dr. Lutz Seidenfaden has been the Head of IT Competence Center Pacific, Festo Pte. Ltd. Singapore since April 2015. In previous positions, Dr. Seidenfaden gained experience in manufacturing and food industry. As Head of Inf. Mgmt. Global Factories at Festo, he was responsible for the IT landscape in Festo plants worldwide and led the project team for the buildup of the new Festo technology plant in Scharnhausen, Germany. He is the coordinator for Industry 4.0 topics within Festo Global IT.

#### **Abstract**

The Technology Plant in Scharnhausen, Germany was planned as a state-of-the-art manufacturing facility and considers aspects of industry 4.0. Since its opening in 2015 it continues to develop towards a smart factory using modern communication technologies and cloud services. In the talk current I 4.0 projects will be presented and their potential and current challenges discussed.

“Session 4” (25 mins)

### **“Material-critical Sensors and Transducers for Intelligent Manufacturing”**

**Dr. Yao Kui**

*Program Manager, Principal Scientist  
Institute Of Materials Research And Engineering (IMRE)  
Agency for Science, Technology and Research (A\*STAR)*

Yao Kui received the bachelor degree in electronics engineering, master degree in technical physics, and the Ph.D in electronic materials and devices. Currently, he is a Principal Scientist, and the Program Manager for the material-critical Sensors and Transducers Programme at IMRE, A\*STAR. He is also an Adjunct Professor in School of Material Science and Engineering (MSE), Nanyang Technical University. During 1998 - 1999, he worked in the Materials Research Laboratory (MRL), The Pennsylvania State University, USA. Previously, he was a postdoctoral fellow in Microelectronics Center, Nanyang Technological University (NTU), Singapore, during 1995-1997. His research areas cover smart materials, and the sensors and transducers enabled with the smart materials, including their applications. The sensors and transducers demonstrated by his research team with smart materials at IMRE, including energy autonomous sensors and direct-write embedded transducers, have demonstrated their application potential in intelligent condition monitoring through industry collaboration and technical licensing.

#### **Abstract**

As crucial technologies for enabling decentralized intelligence demanded by industry, a large quantity of highly distributed sensors and transducers are desired for online functional interactions in the system. Instead of installation of discrete devices, an emerging strategy is introduced with examples from IMRE about directly forming sensors and transducers in machinery and product to realize self-diagnostic and real-time monitoring functions. Wireless and energy autonomous sensors and transducers are also demonstrated by integrating multiple signal conversion and storage functions of smart materials. These advanced sensors and transducers based on material-critical processing and performance are exhibiting important application values for intelligent manufacturing.

**“Session 5” (25 mins)**

**“Visual Computing in Industry 4.0”**

**Dr.-Ing. Marius Erdt**

*Deputy Director*

*Head, Visual and Medical Computing*

*Fraunhofer IDM@NTU*

Dr. Marius Erdt is Deputy Director of Fraunhofer IDM@NTU and head of Visual and Medical Computing. Prior to his engagement at Fraunhofer in Singapore, he worked at Fraunhofer IGD in Germany from 2007 to 2012 in the cognitive computing and medical imaging department as a post-doc and research associate, respectively. He received his PhD in Computer Science from the Technische Universität Darmstadt. His current research interests are in Augmented Reality, Medical Computing and Image Processing.

**Abstract**

Physical and virtual worlds in manufacturing are increasingly converging. More and more physical objects and machines are becoming networked in the evolutionary development of the Internet of Things and the 4th industrial revolution known as Industry 4.0 or Smart Manufacturing. Visual Computing technologies such as Augmented and Virtual Reality as well as data visualisation are keyparts of this revolution allowing the creation of highly flexible and efficient cyber-physical manufacturing processes.

**“Session 6” (25 mins)**

**“In situ programming and program verification for robotic automation”**

**Dr. Martin Saerbeck**

*Senior Scientist, Computing Science*

*Institute of High Performance Computing (IHPC)*

*Agency for Science, Technology and Research (A\*STAR)*

Dr Saerbeck is Senior Scientist and capability group manager within the Computing Science department at the Institute of High Performance Computing. His research focusses on human-machine interaction and interactive system design. In 2009 he received an extra gratification for excellent business results awarded by Philips Research for his work on the popular interface robot iCat. In 2010 he joined IHPC as awardee of the A\*STAR Independent Investigatorship, where he started a team focused on human-robot interaction. Among others, Dr. Saerbeck led the development of a novel tutoring robot concept and developed a robot middleware that distinguishes itself by being verifiable on component level. He published several papers related to human-robot interaction in international conferences and journals. Apart from robotics, his research interests include distributed software architectures, machine learning and verification of cyber-physical systems.

**Abstract**

Utilizing robots for industrial automation incurs significant overhead in terms of manpower and time required for programming and testing. This talk will outline our vision for in-situ programming of small automation tasks. The scenario envisions a user to collaborate with a robot through speech and gesture interaction, similar to instructing co-workers. The input of the user is parsed and verified to automatically generate executable code for the robot. This talk will highlight underlying technology for program generation and verification as well as our work on a verifiable robotic middleware.

“Session 7” (25 mins)

**“Safety, Security, Reliability and Interoperability - Key Aspects for Migration to Industrie 4.0”**

**Dr. Andreas Hauser**  
Director, Digital Service  
TÜV SÜD Asia Pacific Pte Ltd

**Abstract**

Internet of Things (IoT), Big Data, matured Automation and Robotics Technologies drive the deployment of smart, data driven and connected solutions across many sectors. Though many pilot applications do exist and are under development, the acceptance of operators, owners and consumers to adopt such smart solutions is limited, and technology providers are challenged to scale up and roll out these solutions into the markets.

Safety, security, reliability and interoperability are referred to as key risks that need to be addressed. In this contribution we will give some overview of these risks and show specifically the interdependency between safety and security and the corresponding deployment of advanced data analytics.

“Session 8” (25 mins)

**“Two-factor Authentication for IoT Devices”**

**Dr. Zhou Jianying**  
Department Head Institute for Infocomm Research (I2R)  
Agency for Science, Technology and Research (A\*STAR)

Dr. Jianying Zhou is a principal scientist and the head of Infocomm Security Department at Institute for Infocomm Research. He received PhD in Information Security from Royal Holloway, University of London, and has been working on cybersecurity for over 20 years. His research interests are in applied cryptography, computer and network security, cyber-physical security, mobile and wireless security. He has secured over 10 million dollars of research grants as lead PI, and has been managing a number of R&D projects including EU funded project SMEPP-033563, A\*STAR funded project SEDS-0721330047, EMA funded project SecSG-EPD090005RFP(D), and NRF funded project SecUTS-NRF2014NCR-NCR001-031, in close collaboration with academic and industrial partners as well as government agencies.

**Abstract**

With the increasing adoption of remote control and command execution at IoT devices, two-factor entity authentication is increasingly demanded for security compliance, which is challenging for typical IoT devices with the resource constraints. We propose a novel authentication factor based on the historical data exchanged between an IoT device and the backend server. Despite the potentially huge volume of historical data, a constant storage at the IoT device suffices. The novel second factor also demonstrates very good resilience to compromise at the server end. Together with the conventional secret key or password as the first factor, a lightweight two-factor authentication scheme is achieved, which is scalable for different IoT platforms by adjusting the tradeoff between security and computational overhead at the IoT device.