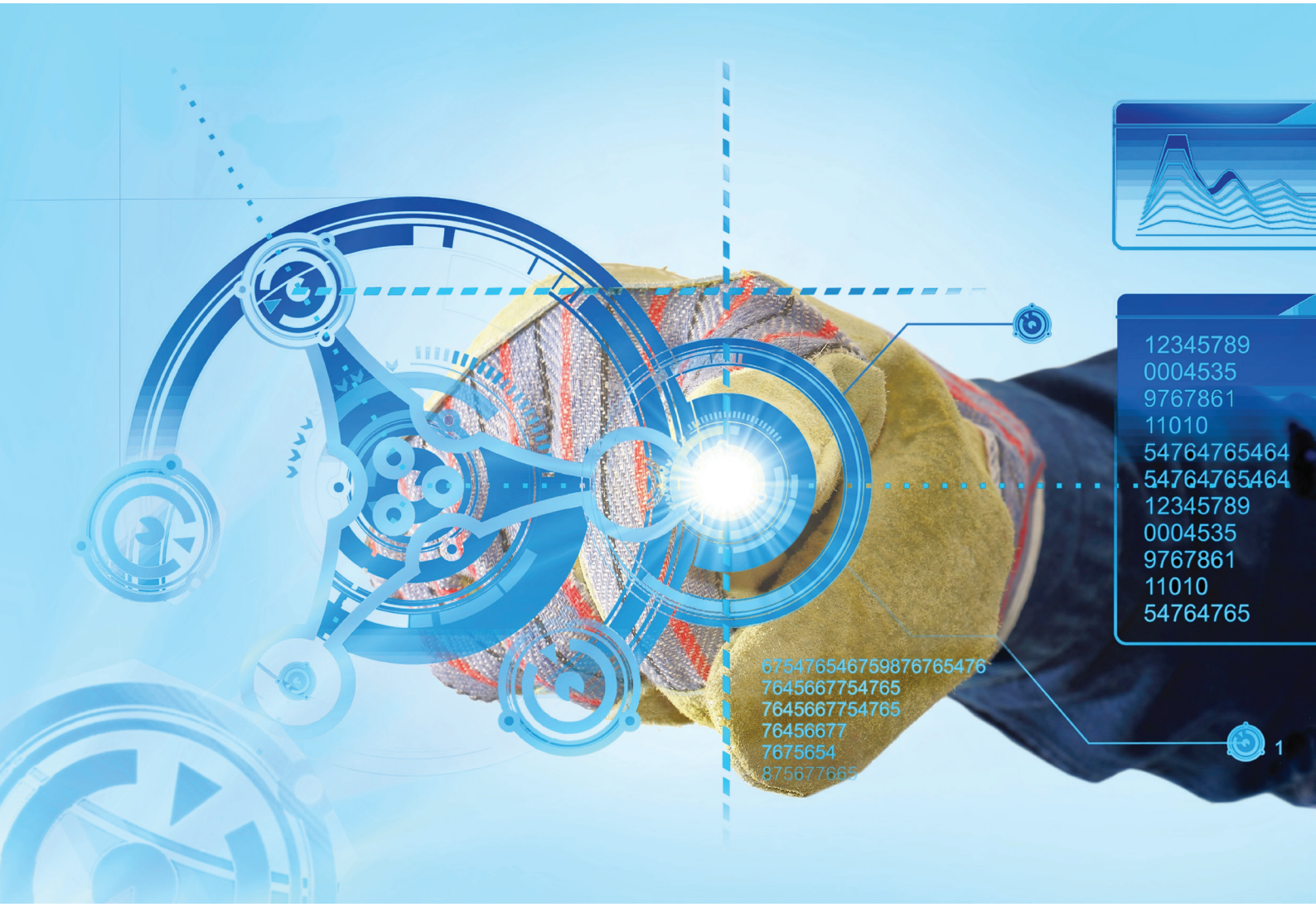
Industrie 4.0
As A Disruptive Innovation



TUM ASIA SUMMER SCHOOL

24TH - 30TH August 2017
9:00AM - 5:00PM

Organised by:

TUM Asia

In Corporation With:

Collaborative Research Center
CRC / SFB 768

Technical University of Munich

Why Is Industrie 4.0 Disruptive?

Widely discussed as the 4th Industrial Revolution, Industrie 4.0 could boost productivity in the manufacturing sector worldwide. Singapore is tackling challenges with increasing labour costs, stagnant productivity and a slow global economy. The opportunities from Industrie 4.0 will bring about changes in Singapore's manufacturing sector and lead to a revitalization of the industry.

This **5-Day Summer School Programme** will comprise of a series of lectures, case studies and discussions conducted and facilitated **by leading faculties in the "Industrie 4.0" domain** from the Technical University of Munich (TUM) and the Otto von Guericke University Magdeburg.

The Summer School is conducted in collaboration with the Collaborative Research Center CRC / SFB 768 Committee at TUM.

Programme Overview

Through this Summer School Programme, participants will be able to gain an in-depth understanding on the key elements of the various technical aspects and socio-technical impact of Industrie 4.0.

The Programme will also address how these concepts can be applied across various industry verticals and participants will be able to demonstrate how this knowledge can be integrated and implemented at their own workplace.

Programme Objective

- Equip senior management of local industries with key knowledge and insights relevant to Industrie 4.0.
- Encourage local industries to take the next step towards digitization and optimization of their manufacturing processes.
- Appreciate key Industrie 4.0 concepts, relate to their individual businesses and engage the trainers in effective discussions on the next steps to be adopted.

Who Should Attend

- Engineers, Professionals, Managers and Executives (PMEs)
- Middle – Senior Management Decision Makers

Programme Fees & Application Dates

Individual Sign-Up:
$1,500 (SMEs) / $1,750 (Non-SMEs)

Group Sign-Up (3 and above):
$1,000 (SMEs) / $1,250 (Non-SMEs) per pax

Application opens from
10th July - 18th August 2017

Date & Time

24th – 30th August 2017
9:00AM – 5:00PM

(Lunch & Refreshments are included)

Location

SIT@SP Building,
Level 5
510 Dover Road
Singapore 139660

Single Day Passes are available.
To find out more, you may contact us at exd@tum-asia.edu.sg.

Speakers

Prof. Arndt Lüder
Chair for Factory Operation and Manufacturing Systems
Institute of Ergonomics, Manufacturing Systems and Automation (IAF)

Otto von Guericke University Magdeburg

Prof. Birgit Vogel-Heuser
Chair of Automation and Information Systems
Department of Mechanical Engineering

Technical University of Munich

Module Synopsis

Part I & II: Digital Twin

Information related to production systems have been distinguished between engineering and runtime information. But nowadays these information sets are coalescing more and more. The life cycle of a production system is initially sketched and based on this life cycle, students will learn which types of production system related information exists and are relevant within which phase of the life cycle of the production system. The mechatronic viewpoint will be strongly addressed and different levels of modularisation in production systems will also be discussed in this module.

Part I – IV: Automation ML

AutomationML is one of the new developed XML based data formats applied to enable a lossless information exchange along the complete engineering chain of production systems. Therefore AutomationML provides an object oriented and modular structure. Students will gain knowledge about the a) Semantical explicit modelling of plant topologies, b) Modelling of geometry and kinematic and their integration in the plant topology description, c) Modelling of different behaviour types und their integration in the plant topology description, and d) Modelling of different types of networks and their integration in the plant topology description.

OPC-UA for Engineering

Runtime information of production systems are often represented by OPC UA. Students will get knowledge about basic concepts of OPC UA and the modelling of information in OPC UA systems using node sets. Based on an IEC 61131 OPC UA profile, a special case study of OPC UA for factory control will be explored and discussed.

Runtime Description of Industrie 4.0 Components

Students will gain knowledge about the current state of specification of general structure of Industrie 4.0 component covering especially the structure of the management shell. Using the examples taught in OPC UA and AutomationML, students will explore and discuss possible ideas for implementation strategies for Industrie 4.0 components and a will be required to sketch a prototype.

Comparison of Industry 4.0, IoT, Smart Factory, Smart Data, Enabling Technologies I & II, Case Studies & Successful Demonstrators: Applying Enabling Technologies, Smart Data Enabled Learning During Operation, Security and Human in the Loop

Engineering concepts of Industrie 4.0, human machine interaction systems and intervention of smart data approaches will be discussed in these modules. These subjects will equip students with the skills to judge and evaluate what an Industrie 4.0 system is, its components, capabilities and the necessity of the underlying models and technologies like agents and data analytics. After the module, students will be able to identify beneficial use cases for their companies and the necessary prerequisites. Students will also learn to model the knowledge of an Industrie 4.0 system as a prerequisite for increased reliability and overall equipment effectiveness.

Speakers

Prof. Dr. Sabine Maasen
Chair of Friedrich Schiedel Endowed Chair in the Sociology of Science
Department of TUM School of Governance

Technical University of Munich (TUM)

Dr. Uli Meyer
Research Group Leader
Munich Center for Technology in Society (MCTS)

Technical University of Munich (TUM)

Prof. Samarjit Chakraborty
Chair of Real-Time Computer Systems
Department of Electrical and Computer Engineering

Technical University of Munich (TUM)

Industrie 4.0 Socio-Technical Framework I : Societal Impacts of Industrie 4.0

Industrie 4.0 is expected to bring disruptive innovation. But what exactly are the implications of that? This module will cover the larger societal implications of this kind of innovation. It will tackle questions like: How will society change? How can a society profit from this and what are the possible risks and dangers? In particular, students will learn what engineers can do to promote the first and prevent the latter.

Industrie 4.0 Socio-Technical Framework II : An Interdisciplinary Perspective

Adapting a company to Industrie 4.0 is challenging on a technical level. However, it also poses organizational challenges. New professions are included in the company, power relations change, and new skills are required. Work and tasks become even more heterogeneous and interdisciplinary than before. Students will learn how to analyse and manage interdisciplinary and organizational settings. They will be provided with different tools, which allow them to handle organizational aspects of Industrie 4.0.

Industrie 4.0 Socio-Technical Framework III : An Inter-Organisational Perspective

A large part of a company's environment consists of other companies. These inter-organizational relations a company has change significantly once Industrie 4.0 technologies and practices are introduced. In this module, students will learn how to analyse the inter-organizational network among companies, how it may change with Industrie 4.0 and how to manage these changes.

Introduction to Cyber-Physical Systems

The cornerstone of modern industrial automation and manufacturing systems are intelligent control algorithms. While techniques from control theory for developing control algorithms are well established, as the implementation platforms for these algorithms are becoming more complex, heterogeneous and distributed, traditional implementation techniques are no longer sufficient. In particular, there is a "gap" between controller models and their implementations resulting in unpredictable and incorrect behaviour of the systems being controlled. In order to address this problem, a "cyber-physical systems" (CPS) approach is now being developed that relies on a tighter integration between the models of physical systems being controlled and the computational platforms running the control algorithms. In this module, we will discuss the need for such a CPS approach and trends in this area.

Approaches to Cyber-Physical Systems Design

In this module we will start with recapitulating the basic principles of control systems design. We will then look at emerging trends in distributed computation and communication platforms that are used for implementing control algorithms. This will be followed by concrete examples of why traditional implementation techniques for control algorithms no longer work. Finally, we will present some basic principles of cyber-physical systems design. The module will not assume any previous background in control theory or computer systems design. All the examples and techniques will be developed from first principles.

*For more information, please contact TUM Asia (Office of Executive Development) at **exd@tum-asia.edu.sg** or call **6777 7407** during office hours. This Summer School is brought to you by the Technical University of Munich Asia (TUM Asia), a 100% subsidiary of TUM. All information is accurate at the time of publish and is subject to change without prior notice.*

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www.tum-asia.edu.sg/i4SS

Industry 4.0 As A Disruptive Innovation - TUM Asia Summer School Schedule

24th - 30th August 2017, 9:00AM - 5:00PM

	24th August (Thursday)	25th August (Friday)	28th August (Monday)	29th August (Tuesday)	30th August (Wednesday)
09:00AM – 10:30AM	**PART I: Digital Twin** Prof. Arndt Lüder	**PART III: Automation ML** Prof. Arndt Lüder	**Industrie 4.0 Socio-Technical Framework I** Prof. Dr. Sabine Maasen	**Comparison of Industry 4.0, IoT, Smart Factory, Smart Data** Prof. Dr.-Ing. Birgit Vogel-Heuser	**Case Studies & Successful Demonstrators: Applying Enabling Technologies** Prof. Dr.-Ing. Birgit Vogel-Heuser
10:30AM – 11:00AM	**MORNING TEA BREAK**				
11:00AM – 12:30PM	**PART II: Digital Twin** Prof. Arndt Lüder	**PART IV: Automation ML** Prof. Arndt Lüder	**Industrie 4.0 Socio-Technical Framework II** Prof. Dr. Sabine Maasen	**PART I: Enabling Technologies (Agents, Modeling Notations for Automation)** Prof. Dr.-Ing. Birgit Vogel-Heuser	**Smart Data Enabled Learning During Operation** Prof. Dr.-Ing. Birgit Vogel-Heuser
12:30PM – 01:30PM	**LUNCH BREAK**				
01:30PM – 03:00PM	**PART I: Automation ML** Prof. Arndt Lüder	**OPC-UA for Engineering** Prof. Arndt Lüder	**Industrie 4.0 Socio-Technical Framework III** Prof. Dr. Sabine Maasen	**PART I: Enabling Technologies (Agents, Modeling Notations for Automation)** Prof. Dr.-Ing. Birgit Vogel-Heuser	**Security and Human in the Loop** Prof. Dr.-Ing. Birgit Vogel-Heuser
03:00PM – 03:30PM	**AFTERNOON TEA BREAK**				
03:30PM – 05:00PM	**PART II: Automation ML** Prof. Arndt Lüder	**Runtime Description of Industrie 4.0 Components** Prof. Arndt Lüder	**Introduction to Cyber-Physical Systems** Prof. Samarjit Chakraborty	**Approaches to Cyber-Physical Systems Design** Prof. Samarjit Chakraborty	**Roundtable & Feedback Session**