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IT IS OUR PLEASURE TO WELCOME ALL PARTICIPANTS

… to the IEEE 21st International Conference on Emerging Technologies & Factory Automation held in Berlin, Germany. Since the first edition 1992 in Melbourne, Australia, the ETFA conference series has evolved to one of the largest and most important IEEE conferences dedicated to industrial and factory automation – presenting new research results at the cutting edge of emerging technologies in applications in diverse areas of industrial automation, as well as providing a discussion forum for professionals from academia and industry alike. Technical content of the ETFA conference series reflects rapid evolution of the industrial automation field and the ever increasing impact of the underpinning research and development on the advances in the industrial automation.

This year Berlin is the venue for the 2016 edition of ETFA. As the capital city of Germany and with more than 3,400,000 inhabitants it is also its biggest city. With its 42 public and private universities, Berlin is full of knowledge and culture. And it is a vibrant and booming city too: with 175 museums, Berlin has more museums than rainy days. It also boasts more than 50 theatres and around 300 cinemas. The city has 4,500 restaurants, around 900 bars and 190 clubs and discotheques. Last but not least, it’s OWL”.

The Institute for Industrial Information Technologies (inIT) of the OWL University of Applied Sciences – both situated in Lemgo. The Fraunhofer-Gesellschaft is the leading organization for applied research in Europe. Its research activities are conducted by 67 institutes and research units at locations throughout Germany. It employs a staff of 24,000, who work with an annual research budget totaling more than 2.1 billion euros. The research efforts are entirely oriented towards people’s needs: health, security, communication, energy and the environment.

The Fraunhofer Application Center Industrial Automation (IOSB-INA) in Lemgo is one of the four sites of the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation (IOSB) with more than 450 employees. IOSB-INA empowers its partners for the digital age by offering hard- and software solutions in the fields of Industrial Internet, Intelligent Automation and Usability of Technical Systems. The Institute for Industrial Information Technologies (inIT) of the OWL University of Applied Sciences in Lemgo carries out interdisciplinary research in the field of industrial informatics and industrial automation for Cyber-Physical Systems. Both institutes are core members of the leading edge technology cluster “Intelligent Technical Systems OstWestfalenLippe – it’s OWL “. This edition of the ETFA series again offers a very strong technical program, comprising regular, special sessions and work in progress sessions. In addition, ETFA2016 includes 5 keynote sessions. Following a very successful tradition of ETFA, the conference starts with the Industry and Workshop Day. This year, the Industry Day has a focus on Industrie 4.0 in practice, with strong support from Germany’s leading edge technology cluster it’s OWL, which is considered to be the largest and most concrete public funded project in the context of Industrie 4.0 in Germany.

We would like to acknowledge the contribution of all Program Committee Members and Reviewers. Our appreciation goes to Holger Voss and Roman Obermaisser, Program Committee Chairs, Lukasz Wisniewski and Sebastian Schriegel, Work-in-Progress Chairs, and Alberto Ortiz and Carsten Röcker, Special Session Chairs, for their dedication and excellent organization of the scientific part of the conference. We also wish to acknowledge hard work of Holger Flatt and Marek Miskowicz who managed the Workshop Day.

The social program is also an important part of a conference. The social events are not only fostering the communication between the participants but also offer the organizer the opportunity to present a bit of the flair and culture of Berlin. This year welcome reception will take attendees on a boat trip through Berlins’ famous waterways to be followed by a party at the Fraunhofer Forum. The gala dinner will be held at Tipi am Kanzleramt - the largest fixed pavilion stage in Europe. An event of this size and importance cannot be organized without the help of a large number of volunteers. We would like to thank all of them for their dedicated work. We are especially indebted to the local organizing team lead by Ms. Carolin Schönknecht of Fraunhofer IOSB-INA. Our sincere gratitude goes to the International Program Committee and the Reviewers. Also to the Publication Chair, Keynote Speakers, and all attendees who make this event possible.

ETFA2016 offers a high quality technical program, interesting and important satellite events, and an attractive social program. Please enjoy the conference and your stay in Berlin.

Jürgen Jasperneite and Richard Zurawski
General Co-Chairs
MESSAGE FROM THE PROGRAM CO-CHAIRS AND WIP/IP CO-CHAIRS

Lukasz Wisniewski
Work-in-Progress Co-Chair
Holger Voos
Program Committee Co-Chair
Sebastian Schriegel
Work-in-Progress Co-Chair
Roman Obermaisser
Program Committee Co-Chair

WELCOME TO THE ETFA’2016

On behalf of the Technical Program Committee, welcome to the 21st IEEE International Conference on Emerging Technologies and Factory Automation (ETFA’2016), held in Berlin from September 06 – 09, 2016. Since the beginning in 1992, the ETFA conference has been among the major international events dedicated to industrial automation and related emerging technologies. We believe that ETFA’2016 continues the great success of past conference editions and remains an efficient platform for reporting recent research from both academia and industry. ETFA is traditionally a multi-track conference because of the broad scope of technical subjects and the nine tracks of ETFA’2016 are covering research topics in Information Technology in Automation, Industrial Communication Systems, Real-Time and (Networked) Embedded Systems, Industrial Control, Computational Intelligence and Modern Heuristics in Automation, Intelligent Robots & Systems, Intelligent Sensors, Sensor Networks, Information Processing, as well as Information and Communication Technology in Energy Systems.

In the response to call for papers, we received a total number of 217 submissions from more than 40 countries all over the world including Regular and Special Session papers. All submissions were thoroughly reviewed by program committee members and external reviewers in the respective tracks. Special Session papers were reviewed within the corresponding tracks to ensure a harmonized review process and we would like to thank Alberto Ortiz and Carsten Röcker for organizing the entire process as Special Session Co-Chairs. To ensure a high standard of the conference, each paper was assigned to three reviewers at least. On the basis of Track Chairs recommendations, 125 contributions were finally accepted as full papers in regular tracks and 13 papers in three Special Sessions. Furthermore, 25 papers submitted originally as long papers have been invited to WiP/IP sessions. Compiling the track committees and organizing the review process in time was as usual a hard work. Therefore we are very grateful to all the track chairs who accomplished this important and critical task in their tracks, respectively: Valeriy Vyatkin, Alois Zoitl, Stig Petersen, Claudio Zunino, Ahlem Mifdaoui, Achim Retterberg, Cristian Mahulea, Michael Weyrich, Ramon Vilanova, Antonio Vissoli, Volker Lohweg, David Foit, Raul Suarez, Sebastian Zug, Michael Short, Weilian Su, Peter Palensky, Thomas Strasser. In addition to the regular papers, ETFA traditionally offers a platform to present recent research results from ongoing projects and novel ideas, which are so far not mature enough to be included in the program as full papers. Therefore, also ETFA’2016 conference includes in its program Work-in-Progress and Industry Practice (WiP/IP) papers at the forefront of technology in all nine regular tracks. This year we received a total 129 submissions of WiP/IP papers, in addition to the 25 that were invited among the rejected Regular and Special Session papers. At the end, 119 papers were selected to be included in the WiP/IP program of ETFA’2016. These WiP/IP papers are presented in a special dual way, comprising sessions with short oral presentations of 5 minutes for each paper followed by a poster show during coffee breaks. ETFA’2016 also comprises five excellent keynote speeches to provide state-of-the-art overviews and give a perspective on future research in important areas of the conference. It is our pleasure to welcome Reimund Neugebauer, President of the Fraunhofer-Society, Germany, Rolf Ernst, Technical University of Braunschweig, Germany, John S. Baras, University of Maryland, USA, Wolfgang E. Nagel, Technical University of Dresden, Germany and Alf Isaksson, ABB Corporate Research, Sweden.

The organization of such a large scientific conference is a complex task. Besides the chairs of the individual tracks, the special sessions and the WiP/IP tracks, we would also like to thank the numerous members of the international program committee and the reviewers for their timely and thorough contribution. Their willingness to dedicate precious time to the conference is very much appreciated. We also appreciate excellent cooperation with ETFA’2016 General Co-Chairs, Jürgen Jasperneite and Richard Zurawski. Finally, we would like to thank all the authors who submitted their work to ETFA2016 and contributed in this way most of all to the technical success of the conference.
**PROGRAM OVERVIEW**

**TUESDAY, SEPT. 6TH**
- 08:00 - 08:30: REGISTRATION
- 08:30 - 10:00: PARALLEL SESSIONS
  - T1.1: Model-based approaches
  - T2.1: Automation and industrial Internet of Things
  - T7.1: Mobile robots
  - T9.1: Information and Communication Technology in Energy Systems: Smart Buildings and Cities
  - S501: Methods and Technologies to enhance Software Reuse in Robotics & Automation
  - WiP 1a: Information Technology in Automation
- 10:00 - 10:30: COFFEE BREAK
- 10:30 - 11:00: OPENING SESSION
- 11:00 - 12:00: KEYNOTE 1
- 12:00 - 13:30: LUNCH BREAK
- 13:30 - 14:30: KEYNOTE 2
- 14:30 - 15:00: COFFEE BREAK
- 15:00 - 17:00: PARALLEL SESSIONS
  - T1.2: Multi-Disciplinary Engineering Models
  - T2.2: Wireless communication
  - T3.1: Timing Verification
  - T4.1: Advanced computerized manufacturing systems
  - T5.1: Advanced Control Application
  - T9.1: Information and Communication Technology in Automation
- 18:00 - 19:00: BOAT TOUR
- 19:00 - 21:00: WELCOME RECEPTION

**WEDNESDAY, SEPT. 7TH**
- 08:00 - 08:30: REGISTRATION
- 08:30 - 10:00: PARALLEL SESSIONS
  - T1.3: Semantic and Formal Methods
  - T4.2: Scheduling and control of manufacturing systems
  - T5.2: Advanced Industrial Control techniques
  - T7.2: Planning
  - WIP 2/5: Industrial Communication Technologies and Systems / Industrial Control
- 10:30 - 11:00: COFFEE BREAK
- 11:00 - 12:00: KEYNOTE 3
- 12:00 - 13:30: LUNCH BREAK
- 13:30 - 14:30: KEYNOTE 4
- 14:30 - 15:30: PARALLEL SESSIONS
  - T1.4: Decision support systems
  - T2.3: Real-time and industrial networks
  - T3.2: Design and Methods
  - T4.3: Modeling and analysis based on Petri net models
  - T5.3: Predictive Control Design, Tuning & Applications
  - T6.1: Optimization and Modern Heuristics
  - T8.1: Computer Vision, Computational Intelligence, and Modern Heuristics in Automation
- 16:00 - 18:00: PARALLEL SESSIONS
  - T1.5: Service-oriented Architectures
  - T1.6: Modular and Reusable Software Components
  - T5.3: Predictive Control Design, Tuning & Applications
  - T6.1: Optimization and Modern Heuristics
  - T8.1: Computer Vision, Computational Intelligence, and Modern Heuristics in Automation
- 19:00 - 24:00: CONFERENCE BANQUET

**THURSDAY, SEPT. 8TH**
- 08:30 - 10:30: PARALLEL SESSIONS
  - T1.7: Virtual Commissioning and Testing
  - T5.2: Advanced Industrial Control techniques
- 10:30 - 11:00: COFFEE BREAK
- 11:00 - 12:00: KEYNOTE 5
- 12:00 - 13:30: LUNCH BREAK
- 13:30 - 14:30: KEYNOTE 6
- 14:30 - 15:30: PARALLEL SESSIONS
  - T1.8: Service-oriented Architectures
  - T1.9: Modular and Reusable Software Components
  - T5.3: Predictive Control Design, Tuning & Applications
  - T6.1: Optimization and Modern Heuristics
  - T8.1: Computer Vision, Computational Intelligence, and Modern Heuristics in Automation
- 16:00 - 18:00: PARALLEL SESSIONS
  - T1.9: Service-oriented Architectures
  - T1.10: Modular and Reusable Software Components
  - T5.3: Predictive Control Design, Tuning & Applications
  - T6.1: Optimization and Modern Heuristics
  - T8.1: Computer Vision, Computational Intelligence, and Modern Heuristics in Automation
- 19:00 - 24:00: CONFERENCE BANQUET

**FRIDAY, SEPT. 9TH**
- 09:00 - 10:30: PARALLEL SESSIONS
  - T1.8: Service-oriented Architectures
  - T5.2: Advanced Industrial Control techniques
- 10:30 - 11:00: COFFEE BREAK
- 11:00 - 12:00: KEYNOTE 6
- 12:00 - 13:30: LUNCH BREAK
- 13:30 - 14:30: PARALLEL SESSIONS
  - T1.9: Service-oriented Architectures
  - T1.10: Modular and Reusable Software Components
  - T5.3: Predictive Control Design, Tuning & Applications
  - T6.1: Optimization and Modern Heuristics
  - T8.1: Computer Vision, Computational Intelligence, and Modern Heuristics in Automation
- 14:30 - 15:00: CLOSING SESSION
- 16:00 - 18:00: VISIT PÉRAGAMON MUSEUM (OPTIONAL)
We cordially invite you to the ETFA’2016 Industry Day. This year, Industry Day is dedicated to the subject of “Industrie 4.0 in Practice”. It features presentations by industry experts from various sectors of manufacturing industry. The Industry Day offers an opportunity to exchange views with researchers and practitioners from academia and industry.

The Industry Day also showcases practical solutions to challenges posed by Industrie 4.0 offered by the Technology-Network “Intelligent Technical Systems OstWestfalenLippe – it’s OWL”. Network partners from renowned companies are going to share their experiences related to Industrie 4.0, as well as the best practices.

**Detailed Program**

- **08:30 - 09:00** Registration
- **09:00 - 09:15** Welcome and Introduction
  - Prof. Dr. Jürgen Jasperneite (Fraunhofer IOSB-INA)
- **09:15 - 10:15** Session 1
  - 09:15 - 09:45: Making machines intelligent: Solutions from the Technology-Network it’s OWL
    - Günter Korder (it’s OWL)
  - 09:45 - 10:15: The perspective of the industrial automation industry on Industrie 4.0
    - Frank Krallia (Phoenix Contact)
- **10:15 - 10:45** Coffee Break
- **10:45 - 12:15** Session 2
  - 10:45 - 11:15: International approach to Digital Manufacturing
    - Harald Egerer (The Manufacturing Technology Centre, Coventry/GB)
  - 11:15 - 11:45: Industrie 4.0 – Reconfigurable drives in industrial applications
    - An example of intralogistics systems
    - Marc Vathauer (MSF Vathauer)
  - 11:45 - 12:15: Industrie 4.0 as a key to condition monitoring and predictive maintenance
    - Dr. Jan Stefan Michels (Weidmüller Group)
- **12:15 - 13:15** Lunch Break
- **13:15 - 14:45** Best Practice Session
  - Innovation Project – Intelligent adaptation and networking of agricultural machines
    - Thilo Steckel (Claas E-Systems) and Wilhelm Nüsser (HGWG)
  - Transfer Project – UniPack, technology transfer at work
    - Jan Ottenmeyer (Agoform)
  - Business start-ups – topcare, a project for successful networking
    - Simon Jegelka (topcare)
- **14:45 - 15:15** Coffee Break
- **15:15 - 16:00** Panel Discussion: Industrie 4.0 – what’s next, what’s missing?
  - moderated by Günter Korder (it’s OWL)
  - Dr. Roman Dumitrescu (it’s OWL)
  - Dr. Jan Stefan Michels (Weidmüller Gruppe)
  - Prof. Dr. Stefan Witte (iRT – Institute Industrial IT)
  - Tanja Krüger (Resolto)
  - Thorsten Hülsmann (EffizienzCluster LogistikRuhr)
  - Harald Egerer (MTC, Coventry/GB)
  - Marc Vathauer (MSF Vathauer)
- **16:00 - 16:15** Closing Session
  - Prof. Dr. Jürgen Jasperneite (Fraunhofer IOSB-INA)
- **16:15 - 17:00** Get-Together
7TH 4DIAC USERS’ WORKSHOP

CONTACTS: Alois Zoitl (fortiss GmbH, Germany), Gerhard Ebenhofer (PROFACTOR GmbH, Austria), Thomas Strasser (AIT Austrian Institute of Technology)

FOCUS: The open source initiative 4DIAC – Framework for Distributed Industrial Automation and Control – has been founded with the idea to support research activities and industrial adoption of distributed automation systems. With this workshop we would like to bring the developers and users of 4DIAC together as the users are the main drivers of ongoing development activities. This event should provide a discussion platform to present novel research and achieved results based on the 4DIAC open source project. Moreover, new ideas and approaches as well as near future plans for 4DIAC can be discussed which turn this initiative into the position to become a larger framework for many application domains.

09:00 - 13:00 MORNINGS SESSION Room Bernina
Welcome and Recent Activities of the 4DIAC Open Source Initiative A. Zoitl (fortiss GmbH)
Agent-based local energy market control using 4DIAC C. Moyo, T. Strasser (AIT)
Smart Grid Automation with IEC 61499 Sergio Tatus (INDA Power)
Human-Robot Collaborative Assembly: 4DIAC as base Technology in the SYMBIO-TIC project Gerhard Ebenhofer (Profactor GmbH)
Integrating FORTE with ROS Waldemar Eisenmenger (fortiss GmbH)
Architecture for services composition in OPC UA Servers using FORTE Federico Perez (Escuela Superior de Ingenieros)
Integrating OPC UA with 4DIAC Petr Kadera (Czech Institute of Informatics, Robotics, and Cybernetics Czech Technical University in Prague)
Cert-4FUN, Towards a Certified Compiler backend for IEC 61499 Petri Kadera (Czech Institute of Informatics, Robotics, and Cybernetics Czech Technical University in Prague)
Towards using Formal Behavioral Specifications in IEC 61499 for Remote Software Health Monitoring Jan Olaf Blech (RMIT)
Modelling Apps for Open CPS with 4DIAC Martin Jobst (fortiss GmbH)
4DIAC in Teaching – Lessons from Lab Exercises and Student Projects Martin Melik Merkumians (Vienna University of Technology)

14:00 - 18:00 AFTERNOON/HANDS-ON SESSION
The afternoon is reserved for hands on and discussions where the 4DIAC team will be available for detailed discussions and explanation on using 4DIAC as well as on implementation details. The following topics can be covered but suggestions from the audience are welcome:
- Short Introduction to IEC 61499 and 4DIAC
- Guided small control application example
- Implementing a control application for a simulated press application
- Extending 4DIAC IDE
- Overview on FORTE
- Real-time execution and communication architecture

2ND M2H’2016 WORKSHOP

CONTACTS: Gregory Faraut (Univ. Paris-Sud, France), Cristian Mahulea (University of Zaragoza)

FOCUS: The 2nd International Workshop on Models and Methods for healthcare systems management and planning (M2H’2016) intends to bring together universities and hospitals to discuss actual problems of healthcare systems related to the hospital management and see how they can receive a mathematical approach. Since the application domain is very complex, new models of healthcare organization based on advanced ICT systems and services should be proposed with the participation of both parts: academic and hospitals. The main emphasis of the workshop will be given to the applications related to the care of older patients and the involvement of the citizen in the decision-makings.

09:00 - 13:00 MORNING SESSION Room Gotthard
Session 1 Scheduling problems
09:00 - 09:40 Appointment Scheduling of Diagnostic Facilities Subject to Non-stationary Emergency Demand and Waiting Time Targets Jing Wen, Na Geng and Xialan Xie
09:40 - 10:20 Operation Planning of Elective Patients in an Orthopedic Surgery Department Daniel Clavel, Cristian Mahulea, Jorge Albareda and Manuel Silva
Session 2 Demonstrators – ICT tools in healthcare
11:00 - 11:40 Improving the dynamic capabilities of an emergency departments using an event-based information architecture Kristofer Bengtsson, Elin Blomgren, Oskar Henriksson, Linnea Johansson, Einar Lindalof, Martin Petterson and Åsa Söderlund

11:40 - 12:20 From clinical guideline to formal models by using HEAT Luis Parrilla, José Garcia, Jorge Albareda and Cristian Mahulea
Session 3 Case study
12:20 - 13:00 Motion Detector Placement Optimization in Smart Homes for Inhabitant Location Tracking Maria Pia Panti, Gregory Faraut, Jean-Jacques Lesage and Michele Roccotelli
FOCUS: Aim of this 2nd International Workshop on Robotics Technology Transfer: Innovation from Academia to Industry (RTT2016) is to monitor the current state of the art of robotics technology transfer through successful examples of conversion of scientific findings from research laboratories into useful products, processes and services. Relevance is given to the innovative content of the developed applications and to their technology and commercial impact, as well as to their contribution to the spread of robot systems and to successful solutions for a stable industry academia collaboration. This collaboration can also be spread to research institutes, universities, industry organizations and stakeholders, technology transfer offices and governments as well.

CONTACTS: Marina Indri (Politecnico di Torino), Antoni Grau (Technical University of Catalonia)

SESSION 1

14:00 - 16:00

Opening by Marina Indri and Antoni Grau, RTT2016 Workshop organizers

14:10 - 14:40

Invited talk. invited person from euRobotics

14:40 - 15:00

From Academia to Industry by an Innovative Project: ECHORD++ Antonio Grau, Yolanda Bobe, Ana Puig-Pey, Alberto Sanfeliu and Josep Casanovas (UPC, Spain)

15:00 - 15:20

Use of machine vision in collaborative robotics: An industrial case. Alberto Tellaeche, Iñaki Maurtua, Aitor Ibarguren (IK4-Tekniker, Spain)

15:20 - 15:40

Interactive pose calibration of a set of robots.忙toni Maurtua, Aitor Ibarguren (IK4-Tekniker, Spain)

14:00 - 18:00

SESSION 2

16:00 - 16:30

COFFEE BREAK

16:30 - 18:00

SESSION 2

16:30 - 16:50

An Off-Line Robot Motion Planning Approach for the Reduction of the Energy Consumption. Alba Fenucci, Marina Indri (Politecnico di Torino, Italy) and Fabrizio Romaneli (COMAU, Italy)

16:50 - 17:10

3D simulation-based user interfaces for a highly-reconfigurable industrial assembly cell. Christian Schlietke, Eric Guillo Kaigom, Daniel Losch, Georg Grinshpun, Markus Emde, Ralf Wapo, Nils Wantia and Juergen Rozsman (Aachen University, Germany)

17:10 - 17:30

Underpinning UK High-Value Manufacturing: Development of a Robotic Re-manufacturing System. Richard French and Hector Marin-Reyes (Aachen University, Germany)

17:30 - 18:00

Round Table: How to foster technology transfer in Robotics? / Panelists: Marina Indri, Antoni Grau, invited panelists to be define / Open discussion among attendees

18:00

Workshop Closing

SESSION 1

11:00 - 12:00

Opening / Hands-on CoAP, University of Rostock

12:00 - 13:00

LUNCH BREAK

13:00 - 14:00

HANS-ON SESSION 3

14:00 - 18:00

CoAP – A Lightweight IoT protocol for future industrial systems

Hands-on CoAP University of Rostock

Introduction to CoAP and MQTT (30 min)

CoAP-Stack and CoAP Proxy (60 min)

Semantic-driven framework with generation of CoAP services, Phillipp von Rotenhan, Siemens (30 min)

11:30 - 12:00

From Mechatronic Components to Industrial Automation Things – An IoT model for cyber-physical manufacturing systems Kleanthis Triantafyllooulos, Theodoros Forabis

12:00 - 12:30

QoS-as-a-Service in the Local Cloud Luis Ferrera, Michelle Albano and Jerker Delsing

12:30 - 13:00

Microservices Approach for the Internet of Things Bjorn Butzin, Frank Golatowski and Dirk Timmermann

10:00 - 10:30

QoS-as-a-Service in the Local Cloud

10:30 - 11:00

COFFEE BREAK

11:00 - 13:00

SESSION 2

11:00 - 11:30

TRM-SIoT: A Scalable Hybrid Trust & Reputation Model for the Social Internet of Things Eleftherios Kokiou-Kogias, Orfevs Voutyras and Theodore Varvarigou

11:30 - 12:00

From Mechatronic Components to Industrial Automation Things – An IoT model for cyber-physical manufacturing systems Kleanthis Triantafyllooulos, Theodoros Forabis

10:00 - 10:30

QoS-as-a-Service in the Local Cloud

10:30 - 11:00

COFFEE BREAK

11:00 - 13:00

SESSION 2

11:00 - 11:30

TRM-SIoT: A Scalable Hybrid Trust & Reputation Model for the Social Internet of Things Eleftherios Kokiou-Kogias, Orfevs Voutyras and Theodore Varvarigou
## DETAILED PROGRAM

### Wednesday, September 7th, 2016

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<td>08:00 - 08:30</td>
<td>Registration</td>
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<td>Parallel Sessions</td>
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<td><strong>T1.1</strong></td>
<td>Model-based approaches</td>
<td>Enzian</td>
<td>Alois Zoitl, Martin Meika-Merkumians</td>
<td>Automatic Generation of Diagnostic Handling Code for Decentralized PLC-based Control Architectures [38] Michael Steinegger, Martin Meika-Merkumians, Johannes Zap and Georg Schitter</td>
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<td>08:40 - 09:00</td>
<td>T1.1 Model-based approaches</td>
<td>Enzian</td>
<td>Alois Zoitl, Martin Meika-Merkumians</td>
<td>A Model-Based Approach to Qualified Process Automation for Anomaly Detection and Treatment [7] Deju Chen, Dimitri Valeri Pantlenko, Mahmood R. Khubazi and Daniel Sonntag</td>
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<td>09:00 - 09:30</td>
<td>T2.1 Automation and industrial Internet of Things</td>
<td>Siemensaal</td>
<td>Stefano Scanzio, Stig Petersen</td>
<td>Evaluation and simulation of building automation systems based on their AutomationML description [34] Damian Eduardo Diaz Fuentes, Uwe Becker, Patrick Diekhake, Michelle Günter, Andre Scholz, Philipp Puntel Schmidt and Alexander Fay</td>
</tr>
<tr>
<td>09:30 - 10:00</td>
<td>T7.1 Mobile robots</td>
<td>Reuss</td>
<td>Sebastian Zug, Raul Suarez</td>
<td>Towards a Virtual Machine Approach to Resilient and Safe Mobile Robots [181] Sorin Adam, Marco Kuhlmann and Dirk Schulz</td>
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<tr>
<td>09:40 - 10:00</td>
<td>T9.1 Information and Communication Technology in Energy Systems: Smart Buildings and Cities</td>
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<td>Discovery in SOA-Governed Industrial Middleware with mDNS and DNS-SD [164] Ahmed Ismail and Wolfgang Kastner</td>
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09:20 - 09:40 District heating temperature control algorithm based on short term weather forecast and consumption predictions [92]
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09:40 - 10:00 Distributed Real-Time Control Service Framework for Human-Robot Interaction Applications [144]
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08:40 - 09:00 A Model Based Engineering Tool for ROS Component Compositioning, Configuration and Generation of Deployment Information [197]
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Henrik Dibowski, Jiri Rojicek, Jiri Vass, Ondrej Holub and Jiri Bojicik

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09:20 - 09:40 ROS Engineering Workbench based on semantically enriched App Models for improved Reusability [226]
Kanez Awad, Arne Hoeppner, Arne Roennau and Mirko Bordignon

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Industrie 4.0 – From the Perspective of Applied Research

Prof. Dr. Rüdiger Gräf, President of the Fraunhofer-Society, Germany

12:00 - 13:30 LUNCH BREAK

13:30 - 14:30 KEYNOTE 2

Room Enzian

Automatic Ethernet – Opportunities and Pitfalls

Prof. Dr. Rolf Ernst, Technical University of Braunschweig, Germany

14:30 - 15:00 COFFEE BREAK

15:00 - 17:00 PARALLEL SESSIONS

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Dietmar Winkler, Fajar Ekaputra and Stefan Biff

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16:20 - 16:40 Losloss Exchange of Automation Project Configuration Data [88] Arndt Lüder, Nicole Schmidt and Michael John

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A Novel Approach Towards Model-Driven Reliability Analysis of Simulink Models [327]
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18:00 - 19:00 BOAT TOUR
19:00 - 21:00 WELCOME RECEPTION

During the boat tour through Berlins’ famous waterways you are able to see legendary sights like the Museum Island.
INDUSTRIE 4.0 – FROM THE PERSPECTIVE OF APPLIED RESEARCH

SUMMARY: “Industrie 4.0” is about real-time data-exchange between cyber-physical systems with the overall goal to increase productivity, quality and flexibility while lowering costs for personalized products and processes. Enablers for “Industrie 4.0” are advances in computer, network and sensing technologies. The transformation will further progress over the next decades in face of new technologies, innovations and infrastructural settings and enable new kinds of products and business models. The ultimate vision for the factory of the future is based on the smart and digital connection of machines, robots and 3D-printers, products, sensor systems, resource infrastructures, logistics systems and ordering platforms together with humans, cloud systems, intelligent assistants and the internet. Hence, the total sourcing, production, retail, delivery and recycling processes will be regarded as a unified organism. The new and high degree of digitization requires sophisticated technologies in many areas. These include research and development for e.g. novel forms of cyber security, networks and fast connectivity (5G and beyond), computing and processing solutions and Machine Learning. Innovative project examples from these research areas will be shown in the presentation.

AUTOMOTIVE ETHERNET – OPPORTUNITIES AND PITFALLS

SUMMARY: The automotive industry is undergoing major changes. Automatic driving, electro mobility, and wireless connectivity are changing automotive technology at the same time, more than any other innovation over decades of automotive history. Automotive embedded systems are at the core of this development facing new challenges to performance, safety and security. Embedded systems technology is answering with a transition from traditional single core microcontrollers to multi- and manycore systems, and with new network architectures.

Today, Switched Ethernet is generally accepted as the future automotive backbone technology. Switched Ethernet provides a great opportunity to improve performance and control cost, but is not without risk when it comes to functional safety. Such risks are not limited to protocol and communication stacks but include switch and gateway implementations as well as individual car network configurations.

The presentation will start with an overview on the use of Switched Ethernet in time and safety critical applications before it summarizes potential shortcomings when applied to safety critical systems.

BIOGRAPHY: Prof. Rolf Neugebauer was born in Thuringia, Germany, on June 27, 1953. He graduated from the Technische Universität Dresden (TUD) in 1979 with a degree in me-chanical engineering. From 1979 to 1984, he was a scientific associate and a senior scientific assistant at TUD, where he received his doctorate in 1984 and gained the post of professor in 1989. In 1991, he became director of the Fraunhofer Institute for Machine Tools and Forming Technology IWU with locations in Chemnitz, Dresden, Augsburg and Zittau. In 1993 he was appointed chair of the Machine Tools department at the Technische Universität Chemnitz (TU Chemnitz) and in 2000 he became managing director of TU Chemnitz’s Institute of Machine Tools and Production Processes. On October 1, 2012, he took up the post of president of the Fraunhofer-Gesellschaft. Prof. Neugebauer is a Fellow of the International Academy for Production Engineering (CIRP) and a member of the National Academy of Science and Engineering (acatech). From 2010 to 2011 he was the president of the German Academic Society for Production Engineering and since 2014 he has been a member of the German National Academy of Sciences. This year, Prof. Neugebauer was appointed co-chair of the German federal government’s High-Tech Forum, an advisory board for the development of Germany’s research and development policy.

BIOGRAPHY: Rolf Ernst is a professor at the Technische Universität Braunschweig, Germany. He chairs the Institute of Computer and Network Engineering (IDA) with more than 50 employees covering embedded systems research from computer architecture and real-time systems theory to challenging automotive, aerospace, or smart building applications. His research is or was funded by national and European programs as well as by companies, such as BMW, Bosch, Daimler, Ford, GM, Toyota, Volkswagen, Intel, Siemens, or Thales. He chaired major scientific events, such as ICCAD, DATE, or ESWEEK. He was a member of the European ARTEMIS Strategic Research Agenda team and served as an expert for the successor program ECSEL as well as for H2020. He is an IEEE fellow, a DATE fellow, served as an ACM SIGDA Distinguished Lecturer, and is a member of the German Academy of Science and Engineering, acatech. He is a member of the advisory board (Beirat) of the German Ministry of Economics and Technology for entrepreneurship programs (www.exist.de). In 2014, he received the Lifetime Achievement Award of the European Design Automation Association, EDAA.

Reimund Neugebauer
President of the Fraunhofer-Society, Germany

Rolf Ernst
Technical University of Braunschweig, Germany
### Detailed Program

#### 08:30 - 10:30

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17:20 - 17:40  T1.5  Service-oriented Architectures
   Room Aare
   Chair Markus Graube, Jan Hladik and Leon Urbas
   17:20 - 17:40  Requirements engineering and modelling for building automation systems [35]
   Michelle Gunther, Patrick Diekhake, André Scholz, Damian Díaz, Philipp Puntel Schmidt, Uwe Becker and Alexander Fay

17:40 - 18:00  T1.5  Service-oriented Architectures
   Room Room Siemensaal
   Chair Dave Foit, Helene Dörksen
   17:40 - 18:00  Designing Optimal Harmonic Filters in Dynamic Optimization Approaches for Resource Allocation Planning in Inland Navigation Networks [41]
   Eric Durella, Houda Nousseau, Arnaud Doniec and Kanie Chugpat

18:00 - 18:20  T1.5  Service-oriented Architectures
   Room Room Siemensaal
   Chair Dave Foit, Helene Dörksen
   Miguel Leon Ortiz, Yrjen Zwiender and Ning Xiong

18:40 - 19:00  T1.5  Service-oriented Architectures
   Conference Banquet
   Chair Shunsuke Hori and Takuya Azumi
   18:40 - 19:00  Evaluation and Improvement of Global Pose Estimation with Multiple AprilTags for Industrial Manipulators [43]
   Christian Nielson, Stefan Buttnner, Zoltan Csaba Marton, Laura Beckmann and Ulrike Thomas

19:00 - 21:00  T1.5  Service-oriented Architectures
   Conference Banquet
   Chair Shunsuke Hori and Takuya Azumi
   19:00 - 21:00  Intelligent Operating Strategy for an Internal Rubber Mixer’s Multi-Motor Drive System Based on Artificial Neural Network [6]
   Malte Strupp and Detmar Zimmer
THE NEXT WONDER – MBSE/MBE: FROM IDEAS TO “MAKING PRODUCTS AND SERVICES”

SUMMARY: Advances in Information Technology have enabled the design of complex engineered systems, with large number of heterogeneous components and capable of multiple complex functions, leading to the ubiquitous cyber-physical systems (CPS). These advances have at the same time increased the capabilities of such systems and have increased their complexity to such an extent that systematic design towards predictable performance is extremely challenging, if not infeasible with current methodologies and tools. We first describe a rigorous framework we are developing for model-based systems engineering (MBSE), a system level design methodology that addresses these challenges, which also incorporates manufacturing, operation and life cycle considerations. We describe applications of the framework to several important current technological problems (several major domains of CPS): power grids, automotive, aerospace, energy efficient buildings, sensor and communication networks, smart manufacturing, robotics and UAVs, health care, cyber-security. And we close with a description of what is still lacking, research challenges and future promising research directions.

BIG DATA AND BEYOND – WHAT CAN WE EXPECT IN THE FUTURE!

SUMMARY: The sheer volume of data generated and accumulated in industry as well as in many scientific disciplines is a critical issue that needs even more attention, especially on the management and political level. The data is generated already today by production environments with hundreds of millions of parts, cameras, sensors, robots, but also technical devices like microscopes, usage and business data, as well as logistic information, to name just a few sources. This will be driven to even higher levels by the developments in the Internet of Things. Autonomous driving and Cyber-Physical Systems as further enabling technologies for new business opportunities, but also challenging operation procedures for data processing. In future, the successful management of these challenges may decide on business success – or failure. There is an urgent need for intelligent mechanisms to acquire, process, and analyze data, which have to run and scale efficiently on current and future computing architectures. To be prepared for the future, we need quite some changes in our data processing procedures, but essential will be the availability of experts working as data architects, data scientists, but also data change agents and information brokers.

BIOGRAPHY:
John S. Baras received B.S. in Electrical and Mechanical Engineering from the National Technical University of Athens, Greece, 1970; M.S. and Ph.D. in Applied Mathematics from Harvard University 1971, 1973. Since 1973 with the Electrical and Computer Engineering Department, and the Applied Mathematics Faculty, at the University of Maryland College Park. Since 2000 faculty member in the Fischell Department of Bioengineering. Since 2014 faculty member in the Mechanical Engineering Department. Founding Director of the Institute for Systems Research (ISR) from 1985 to 1991. Since 1991, Founding Director of the Maryland Center for Hybrid Networks (HYNET). Since 2013, Guest Professor at the Royal Institute of Technology (KTH), Sweden. Life Fellow of the IEEE, Fellow of the SIAM, Fellow of the AAAS and a Foreign Member of the Royal Swedish Academy of Engineering Sciences. Received the 1980 George Axelby Award from the IEEE Control Systems Society, the 2006 Leonard Abraham Prize from the IEEE Communications Society, the 2014 Tage Erlander Guest Professorship from the Swedish Research Council, and a three year (2014-2017) Hans Fischer Senior Fellowship from the Institute for Advanced Study of the Technical University of Munich, Germany. Professor Baras' research interests include automatic control, communication and computing systems and networks, and model-based systems engineering.

Wolfgang E. Nagel has studied computer science at Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen and received his PhD in 1993. After 12 years at Jülich Supercomputing Center and Center for Advanced Computing Research (CACl), Caltech he got a Full Professorship at Technische Universität Dresden in 1997. Since 2001, he holds the Chair for Computer Architecture in the Department of Computer Science and is Director of the Institute of Computer Engineering. Wolfgang Nagel is chairman of the Gauß-Allianz, chairman of the Advisory Board of the HLRS Stuttgart, and head of the Scientific Advisory Council of FZ Jülich. He has published more than 150 papers covering modern programming concepts and software tools to support the development of scalable and data intensive applications, analysis of innovative computer architectures, and the development of efficient parallel algorithms and methods. He has been the Founding Director of the Center for Information Services and High Performance Computing (ZIH) at TUD. Since October 2014, he is the Scientific Coordinator of ScaDS Dresden/Leipzig, one of the two German Big Data competence centers funded by the BMBF.

John S. Baras
University of Maryland, USA

Wolfgang E. Nagel
Technical University of Dresden, Germany
09:00 - 10:30 PARALLEL SESSIONS

T1.7 Virtual Commissioning and Testing
Room Enzian
Chairs Alois Zoitl, Holger Voos
09:10 - 09:30 A Measurement Study on Virtualization Overhead for Applications of Industrial Automation Systems [13]
Yu Kaneko, Toshio Ito and Takahiro Hara
09:30 - 09:50 Test methodology for virtual commissioning based on behaviour simulation of production systems [28]
Sebastian Süß, Stephan Magnus, Mario Thron, Holger Zipper, Ulrich Odelfey, Anton Strahilov, Adam Kłodowski and Thomas Bár
Integrating dynamic process simulation into detailed automation engineering [89]
Niklas Paganus, Kari Honkola and Tommi Karhela
10:00 - 10:30 Context Modeling with Situation Rules
Integrating dynamic process simulation into detailed automation engineering [89]
Niklas Paganus, Kari Honkola and Tommi Karhela

10:10 - 10:30 Setting governor properties on ARM architectures in image processing applications [201]
Javier Silverbrians
A Generic Approach for Detection of Wear-Out Situations in Machine Subsystems [385]
Fabian Rachake, Christian Bayer and Ola Enge-Rosenblatt
A Concept for Self-Configuration of Adaptive Sensor and Information Fusion Systems [295]
Alexander Fritz, Uwe Monks and Volker Lohweg
Detection of Commercial Offset Printing through Natural Multimodal Communication [327]
Javier Silverbrians

10:50 - 11:10 An embedded architecture for robotic manipulation in the construction field [177]
Andreas Tönnis, Juan Manuel Jacinto-Villegas, Massimo Saller, Carlo Alberto Avizzano and Marta Niccolini
11:10 - 11:30 Robotics Cell Work-Flow Management through an IEC 61499-ROS architecture [162]
Andrea Orlandini, Matteo Giussani and Federico Vicentin

11:50 - 12:10 A Generic Framework for Defect Detection on Vessel Structures based on Image Saliency [335]
Francisco Bonnin-Pascual and Alberto Ortiz
Exploiting Tactile Surface Sensors as a Gesture Input Device for Intuitive Robot Programming [317]
Arne Mußfeldt, Jan Niklas Haus, Jingyuan Cheng and Arne Muxfeldt
Exploiting Tactile Surface Sensors as a Gesture Input Device for Intuitive Robot Programming [317]
Arne Mußfeldt, Jan Niklas Haus, Jingyuan Cheng and Arne Muxfeldt

12:30 - 13:50 PARALLEL SESSIONS

T7.3 Software architectures and sensor applications
Room Limmat
Chairs Raul Suarez, Sebastian Zieg
09:10 - 09:30 Material Comparison and Design of a Flexible Tactile Sensor Matrix for Industrial Manipulators [190]
Jan Niklas Haus and Arne Mußfeldt
09:30 - 09:50 Towards a Planning-based Framework for Symbiotic Human-Robot Collaboration [131]
Amedeo Cesta, Giuliom Bernardi, Andrea Orlindini and Alessandro Umbrico
09:50 - 10:10 Automated Enhancement and Detection of Commercial Offset Printing through Natural Multimodal Communication [327]
Javier Silverbrians
Exploiting Tactile Surface Sensors as a Gesture Input Device for Intuitive Robot Programming [317]
Arne Mußfeldt, Jan Niklas Haus, Jingyuan Cheng and Arne Muxfeldt
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09:30 - 09:50 Vision-based Sorting of Medium Density Fibreboard and Grade A Wood Waste [183]
Maarten Verheyen, Wim Beckers, Eric Claesen, Geert Moonen and Eric Demester
10:10 - 10:30 An Architecture for Adaptive Tactile Perception on Tactile Surface Sensors [162]
Andreas Tönnis, Juan Manuel Jacinto-Villegas, Massimo Saller, Carlo Alberto Avizzano and Marta Niccolini

09:50 - 10:10 Setting governor properties on ARM architectures in image processing applications [201]
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Alexander Fritz, Uwe Monks and Volker Lohweg
Detection of Commercial Offset Printing through Natural Multimodal Communication [327]
Javier Silverbrians

10:30 - 10:50 An in-vehicle wireless sensor network for heavy vehicles [191]
Dharshitha Parthasarathy, Russ Whiton, Jonas Hagenkans and Tomas Gustafsson
Efficient Automotive Wireless SW Updates [217]
Marco Siegle, Michael Karner, Joachim Hillebrand, Werner Rom, Kay Roemer and Carlo Boano
10:50 - 11:10 An Architecture for Adaptive Tactile Perception on Tactile Surface Sensors [162]
Andreas Tönnis, Juan Manuel Jacinto-Villegas, Massimo Saller, Carlo Alberto Avizzano and Marta Niccolini
11:10 - 11:30 Robotics Cell Work-Flow Management through an IEC 61499-ROS architecture [162]
Andrea Orlandini, Matteo Giussani and Federico Vicentin

11:30 - 11:50 Vision-based, statistical learning system for fault recognition in industrial assembly environment [69]
Zsolt Janos Viharos, Dimitrij Prof. Csetverikov, András Dr. Háry, Ramóna Saghegyi, András Báta, László Zalányi, István Pomozi, Sallieusen Solids, Zsolt Kővér and Balázs Verjő
Hand-guiding robots along predefined geometric paths under hard joint constraints [250]
Magnus Hanses, Roland Behrens and Nettobert Eckmann
Exploiting Tactile Surface Sensors as a Gesture Input Device for Intuitive Robot Programming [317]
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AUTOMATIC CONTROL – FUTURE CHALLENGES, SOLUTIONS, AND SYSTEMS

SUMMARY: Since the turn of the century the on-going Digitalization has more or less completely transformed the consumer markets. The similar change in industry has only started and the next decade we will see a lot of changes also in process and manufacturing industry as well as power systems. This talk will focus on the impact this has on Automatic Control in a broad sense. The notion of Internet of Things, as well as related topics like Cyber-Physical Systems, means that the entire architecture for control systems will be subject to change. As a major supplier of automation systems, ABB has long been at the forefront of technology that connects devices to each other, helping lead the revolution that began with the Internet of Things. There are multiple possible directions in which the future systems may develop. The access to cheap microprocessors may lead to a much more decentralized control than today’s control systems. On the other hand improved means of communication, such as 5G, and the scalable potential of cloud computing could lead in the complete opposite direction. Similarly, what used to be independent systems, e.g. process automation and power systems, are getting more and more integrated with each other.

BIography: Alf Isaksson received his MSc and PhD from Linköping University, Sweden in 1983 and 1988 respectively. After graduating he stayed at Linköping University until 1991 as an Assistant Professor. From 1991 to 1992 he spent one year as a Research Associate at The University of Newcastle, Australia. Returning to Sweden in 1992 he moved to the Royal Institute of Technology (KTH) in Stockholm, where eventually in 1999 he was promoted to Full Professor. In 2001 he made the shift from academic to industrial research and joined ABB Corporate Research in Västerås, Sweden. After a specialist career culminating in an appointment to Corporate Research Fellow 2009, he is now since January 2014 Global Research Area Manager with the responsibility of internally funding all research in Control at all ABB’s research centers world-wide. At the same time he still kept a connection to the academic world as Adjunct Professor at Linköping University for 10 years 2006-2015.

Alf Isaksson
ABB Corporate Research, Sweden
Welcome Reception and a Cruise, Sept. 07, 2016
Fraunhofer Forum, Berlin, 6 pm – 9 pm
On September 7th, 2016, at 5:50 pm, a bus transfer will take attendees from the conference site to the Berlin’s Treptow harbor for a boat tour, on “Mark Brandenburg”, of Berlin’s famous waterways. The tour will take attendees around Berlin’s legendary sights such as “Nikolai Viertel”, Berlin Cathedral, and the Museum Island. At 7 pm, the boat will dock close to Fraunhofer Forum for the Welcome Reception. From Fraunhofer Forum, Berlin's attractions are at the walking distance. For more information on the welcome reception, the public transportation in Berlin, etc. please visit: www.etfa2016.org/program/transportation

Conference Banquet, Sept. 08, 2016
Tipi am Kanzleramt
The conference banquet will be held at the Tipi am Kanzleramt, which is the largest fixed pavilion stage in Europe. The marquee theatre with its impressive four supporting masts, is regarded as one of Berlin's most exceptional event locations. It is close to the Office of the Federal Chancellor in the center of Berlin. You reach the TIPI am Kanzleramt with Berlins S-Bahn from S Anhalter Bahnhof – directly next to the conference Hotel – to Brandenburger Tor and a short walk along the Kanzleramt. Or by Bus number 100 from Potsdamer Platz to Platz der Republik. For more information please visit: www.etfa.org/program/transportation or our help-desk at the conference hotel.

Additional Tour, Sept. 09, 2016
Guided Tour Pergamon Museum
After the closing session, interested participants are welcome to join a special tour of the Pergamon Museum – one of the most famous museums in Germany and the World. The Pergamon museum houses three of the “Staatliche Museen zu Berlin’s” most impressive collections: the antic collection, the Middle East collection, and the collection of Islamic art. The antic collection is one of the world's most important collections of Greek and Roman art. The Middel East collection primarily collects artefacts from a 6000-year timespan of cultural history from the regions Mesopotamia, Syria, and Anatolia. The approximately 270,000 objects in its overwhelming collection were mainly found during the major German excavations in Babylon, Assur, Uruk, and Habuba Kabira.
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