



Messe München

 **ISR** '16
International
Symposium
on Robotics

In cooperation with:



47th International Symposium on Robotics
June 21–22, 2016
Messe München, Entrance East, Munich,
Germany

ROBOTICS IN THE ERA OF DIGITALISATION
www.isr2016.org

PROGRAM IN CONJUNCTION WITH

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Welcoming the Chairs of ISR 2016

Robotics in the era of Digitalization! After two years the 47th International Symposium on Robotics, ISR 2016, will again be held in Munich, Germany, from June 21–22, 2016. This international conference is jointly organized by the Mechanical Engineering Industry Association (VDMA) and the Information Technology Society (ITG) within VDE, and is supported by Fraunhofer IPA and the German Society for Robotics (DGR). The International Trade Fair for Automation and Mechatronics **AUTOMATICA** has again been chosen as conference platform.

AUTOMATICA expects around 800 exhibitors and more than 35,000 visitors from June 21–24, 2016. As the fair will last longer than **ISR 2016**, there is the possibility and time for all conference participants to visit this interesting exhibition during and after the conference. In about 150 presentations, **ISR 2016** will give many insights into the latest state-of-the-art robot technology to participants from both industry and science.

Sessions will be held on Modeling, Planning and Control, as well as Components & Technologies, while Robotics in Production / Industrial Robots will also be addressed, besides Service Robotics. Additionally, there will be sessions on Robotics in New Markets & Applications and on the Workplace of the Future. Presentations of the final nominees of the Joseph F. Engelberger Award and the IERA Award highlight the conference's gala banquet. Of course, there will be a conference poster session and video presentations of the latest robot developments, which can be attended between and parallel to the conference sessions.

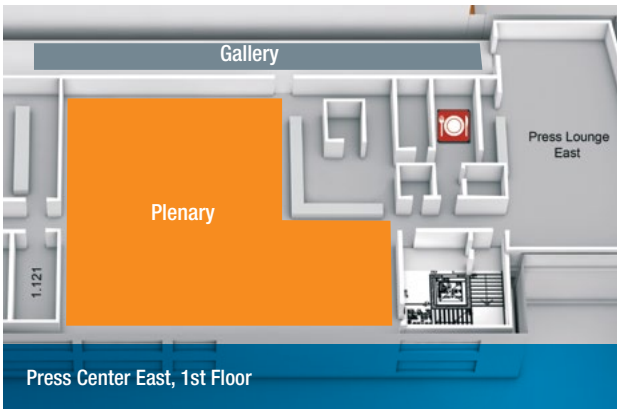


Univ.-Prof. Dr.-Ing. Dr. h.c. mult.
Alexander Verl, Chair of ISR 2016 on
behalf of the International Federation
of Robotics (IFR)



Prof. Dr.-Ing. Tamim Asfour,
Co-Chair of ISR 2016 on behalf
of the German Robotics Society
(DGR)

Location Press Center East



Keynotes

Tuesday, June 21, 2016:

Andra Keay: “Why Silicon Valley is winning the robotics race”

Alexander Waibel: “Bridging the Language Divide”



Andra Keay,
Silicon Valley Robotics, USA
11:40–12:25



Alexander Waibel,
Carnegie Mellon University, USA, Karlsruhe
Institute of Technology, Germany
13:45–14:30

Wednesday, June 22, 2016:

Peer Fischer: “Micro- and Nanorobots: Fabrication, actuation and control”

Dario Floreano: “Science, Technology, and Future of Small Autonomous Drones”



Peer Fischer,
Max Planck Research Group,
University of Stuttgart, Germany
11:40–12:25



Dario Floreano,
Swiss Federal Institute of
Technology, Switzerland
13:45–14:30

Tuesday, June 21, 2016

	Plenary	Room 1	Room 2
09:00	Registration		
09:45	Welcome		
10:00	IERA Session		
11:40	Keynote: Andra Keay		
12:25	Poster Session and Lunch		
13:45	Keynote: Alexander Waibel		
14:30	Modeling	Components	Industrial Robots: Facts
16:10	Poster Session and Coffee Break		
16:30	Planning	Technologies	Industrial Robots: Facts
18:10	End of Day 1		
18:30	Depart for Conference Dinner, bus transfer		

19:45–22:30

Conference Dinner at Augustiner Keller München
IERA and Engelberger Award Ceremony

Wednesday, June 22, 2016

	Plenary	Room 1	Room 2
09:00	Control	Service Robot Technologies	Human–Robot Cooperation
10:20	Poster Session and Coffee Break		
10:40	Assistive Robots	Service Robot Technologies	Control
11:40	Keynote: Peer Fischer		
12:25	Poster Session and Lunch		
13:45	Keynote: Dario Floreano		
14:30	Industrial Robots: Planning	New Robotics Applications	Industrial Robots: Vision, Environment
15:30	Poster Session and Coffee Break		
15:50	Industrial Robots: Coating, Painting, Welding	Industrial Robots: Assembly, Manufacturing	Industrial Robots: Handling, Forming, Processing
17:10	End of Conference		

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-  Jin Bae Park, ICROS, Korea
-  Jürgen Roßmann, RWTH Aachen, Germany
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Organized by

- ITG (VDE) Information Technology Society of VDE
- VDMA Robotik + Automation
- IFR International Federation of Robotics
- DGR German Association on Robotics

Conference ISR 2016 Program

Plenary

Gallery

Room 1

Room 2

Tuesday, June 21, 2016

■ 09:45–10:00

Welcome

Room: Plenary

Chair: Alexander Verl (Stuttgart University, Germany)

■ 10:00–11:40

IERA Session

Room: Plenary

■ 11:40–12:25

Keynote 1: Andra Keay "Why Silicon Valley is winning the robotics race"

Room: Plenary

■ 12:25–13:45

Poster Session and Lunch

Rooms: Gallery/Restaurant

POSTERS:

P1 MODELING, PLANNING AND CONTROL

P1.1 Analytic Forward and Inverse Kinematics of a Multi-Elastic-Link Robot Arm

*Myrel Alsayegh and Freia Irina Mues (Technical University of Dortmund, Germany);
Jörn Malzahn (Istituto Italiano Di Tecnologia (IIT), Italy); Torsten Bertram
(Technische Universität Dortmund, Germany)*

P1.2 Simultaneous Calibration of Odometry and external Sensors of Omnidirectional Automated Guided Vehicles (AGVs)

Daniel Heß (University of Applied Sciences and Arts, Dortmund, Germany);

*Frank Künemund (University of Applied Sciences and Arts Dortmund, Germany);
Christof Röhrig (University of Applied Sciences and Arts in Dortmund, Germany)*

P1.3 The Virtual Space Robotics Testbed

Thomas Steil, Marc Priggemeyer and Markus Emde (RWTH Aachen University, Germany); Juergen Rossmann (Technical University of Aachen, Germany)

P1.4 Dynamic modeling of new modular manipulators

Zoltán Forgó (Sapientia University, Romania)

P1.5 Human Push–Recovery: Strategy Selection Based on Push Intensity Estimation

Lukas Kaul (Karlsruhe Institute of Technology & Institute for Anthropomatics and Robotics, Germany); Tamim Asfour (Karlsruhe Institute of Technology (KIT), Germany)

P2 COMPONENTS & TECHNOLOGIES

P2.1 3D Scanning of Workpieces with Cooperative Industrial Robot Arms

Maximilian Wagner (Nuremberg Campus of Technology, Germany); Peter Heß (Technische Hochschule Nürnberg Georg Simon Ohm, Germany); Sebastian Reitelshöfer (Friedrich–Alexander–Universität Erlangen–Nürnberg, Germany); Jörg Franke (FAU Erlangen–Nuremberg, Germany)

P2.2 Fast and efficient traversable region extraction using quantized elevation map and 2D laser rangefinder

Lae–Kyoung Lee (Pohang University of Science and Technology (POSTECH), Korea)

P2.3 Visual/Tactile–based sensing strategy for grasping of planar non–rigid objects

Pablo Gil, Carlos Mateo, Angel Delgado and Fernando Torres (University of Alicante, Spain)

P2.4 KaCanOpen: An Open Plug&Play CANopen Stack for ROS in Modern C++

Thomas Keh (Karlsruhe Institute of Technology (KIT), Germany); Andreas Bihlmaier (Karlsruhe Institute of Technology, Germany); Julien Mintenbeck and Heinz Wörn (Karlsruhe Institute of Technology (KIT), Germany)

P3 ROBOTICS IN PRODUCTION / INDUSTRIAL ROBOTS

Maximilian Wagner (Nuremberg Campus of Technology, Germany); Peter Heß (Technische Hochschule Nürnberg Georg Simon Ohm, Germany); Sebastian Reitelshöfer (Friedrich–Alexander–Universität Erlangen–Nürnberg, Germany); Jörg Franke (FAU Erlangen–Nuremberg, Germany)

P3.2 Energy Efficient Kinodynamic Motion Planning for Holonomic AGVs in Industrial Applications using State Lattices

Frank Kühnemund (University of Applied Sciences and Arts Dortmund, Germany); Daniel Heß (University of Applied Sciences and Arts, Dortmund, Germany); Christof Röhrig (University of Applied Sciences and Arts in Dortmund, Germany)

P3.3 A New Multi–Modal Approach Towards Reliable Bin–Picking Application

Veit Müller (Fraunhofer Institute for Factory Operation and Automation IFF, Germany); Roland Behrens (Fraunhofer Institute for Factory Operation and Automation (IFF), Germany); Norbert Elkmann (Fraunhofer IFF, Germany)

P3.4 Influence of Grasping Position to Robot Assembling

Task Akira Suyama and Yasumichi Aiyama (University of Tsukuba, Japan)

P3.5 On Cognitive Robot Wood Working in SMERobotics

Mathias Haage (Lund University, Sweden)

P3.6 Assisted Online Programming of Cooperative Workflows based on Task Prediction Visualization

Frank Dittrich, Christian Kunz and Heinz Woern (Karlsruhe Institute of Technology (KIT), Germany)

P3.7 Semantic Translation Tool for Robotics Applications

Pablo Quilez (Fraunhofer IPA, Germany)

P3.8 Novel Intelligent Technologies for Industrial Robot in Manufacturing–Architectures and Applications

Haruhisa Okuda (Mitsubishi Electric Corporation, Japan)

P3.9 Implementation of a safe hybrid workplace for robot–assisted riveting

Ramez Awad and Manuel Fechter (Fraunhofer IPA, Germany)

P3.10 Advanced safety solutions for human–robot–cooperation

Timo Salmi (VTT, Technical Research Center of Finland, Finland)

P4 ROBOTICS IN SERVICE / MOBILE ROBOTICS**mobile robots**

Rainer Halmheu (Technische Universität Dortmund & Audi AG Ingolstadt, Germany); Boris Otto (Technische Universität Dortmund, Germany); Thomas Pauleser (Audi AG Ingolstadt, Germany)

P4.2 Development of an intelligent care cart and new supply concepts for care homes and hospitals

Birgit Graf (Fraunhofer IPA, Germany); Ralf Simon King (Universität Stuttgart, ISW, Germany); Christian Schiller and Andrea Rößner (Universität Stuttgart, IAT, Germany)

P4.3 AnyWalker: all-terrain robotic chassis

Semyon Sechenev and Igor Ryadchikov (Kuban State University, Russia); Evgeny Nikulchev (Moscow Technological Institute, Russia); Sergey Sinita (Kuban State University, Russia)

P4.4 Test concept for a mobile robot with optimized traction

Ludwig Barthuber and Peter Firsching (Deggendorf Institute of Technology, Germany)

P4.5 A proposal of extracting of motion primitives by analyzing tracked data of hand motion from human demonstration

Ngoc Hung Pham and Takashi Yoshimi (Shibaura Institute of Technology, Japan)

P4.6 Folding mechanism for a remotely deployable robotic vehicle

Mathew Holloway (Imperial College London, United Kingdom); Miguel Julia (Q-Bot Limited, United Kingdom); Peter Childs (Imperial College London, United Kingdom)

P4.7 Context-aware Planning by Refinement for Personal Robots in Smart Homes

Nathan Ramoly and Bouzeghoub Amel (Télécom SudParis, France); Beatrice Finance (University of Versailles, France)

- P4.10 Asymptotic optimal trajectory planning under consideration of kinematic and direction constraints for mobile car-like robots**
Tobias Lindeholz (Zentrum für Telematik, Germany); Robin Hess (Universität Würzburg, Germany); Daniel Eck and Klaus Schilling (University of Würzburg, Germany)
- P4.11 Two Autonomous Robots for the DLR SpaceBot Cup—Lessons Learned from 60 Minutes on the Moon**
Sven Lange and Daniel Wunschel (Chemnitz University of Technology, Germany); Stefan Schubert, Tim Pfeifer, Peter Weissig, Andreas Uhlig and Martina Truschzinski (TU Chemnitz, Germany); Peter Protzel (Technische Universität Chemnitz, Germany)
- P4.12 Mechatronics Practice in Education Step by Step, Workshop on Mobile Robotics**
Anton Yudin (National University of Science and Technology MISiS & Bauman Moscow State Technical University, Russia); Maria Salmina (Lomonosov Moscow State University, Russia); Vladimir Sukhotskiy (State Budget Vocational and Educational Institution Vorobyovi Gori, Russia)
- P4.13 Relative Motion Estimation Based on Sensor Eigenfusion Using a Stereoscopic Vision System and Adaptive Statistical Filtering**
Gennaro Notomista and Mario Selvaggio (Istituto Italiano di Tecnologia, Italy)

P5 NEW ROBOTICS APPLICATIONS

- P5.1 Learning and executing rhythmic movements through chaotic neural networks: a new method for walking humanoid robots**
Giuseppina C Gini, Matteo Bana and Alessio Franchi (Politecnico di Milano, Italy); Michele Folgheraiter (Nazarbayev University, Kazakhstan)
- P5.2 7 DoF Hand and Arm Tracking for Teleoperation of Anthropomorphic Robots**
Jan Graßhoff, Lasse Hansen, Ivo Kuhlemann and Kristian Ehlers (Universität zu Lübeck, Germany)
- P5.3 Ultra-Flexible Production Systems for Automated Factories**
Remus Boca (ABB Corporate Research Center, USA); Harald Staab (ABB Inc., USA);

George Zhang (ABB & Corporate Research Center, USA); Sang Choi (ABB, Inc. & US Corporate Research Center, USA); Carlos Martinez (ABB, USA); Thomas Fuhlbrigge (ABB Corporate Research Center, USA); Will Eakins and Gregory Rossano (ABB Inc., Corporate Research, USA); Srinivas Nidamarthi (ABB Inc, USA)

■ 13:45-14:30

Keynote 2: Alexander Waibel "Bridging the Language Divide"

Room: Plenary

■ 13:45-16:10

S1.1: Modeling

Room: Plenary

Session Chair: Christian Scheurer (Konzernforschung KUKA Roboter GmbH)

13:45 **Sampling-based Path Planning to Cartesian Goal Positions for a Mobile Manipulator Exploiting Kinematic Redundancy**

Ruben Seyboldt, Christian Frese and Angelika Zube (Fraunhofer IOSB, Germany)

14:05 **Real Time Texture Generation in Optimized Large-Scale Polygon Meshes with KinectFusion**

Alexander Mock and Thomas Wiemann (Osnabrück University, Germany); Dorit Borrmann (Julius-Maximilians Universität Würzburg, Germany); Tristan Igelbrink (Osnabrück University, Germany); Joachim Hertzberg (Osnabrück University & DFKI Robotics Innovation Center, Osnabrück Branch, Germany)

14:25 **Experimental Robot Inverse Dynamics Identification Using Classical and Machine Learning Techniques**

Vinzenz Bargsten (University of Bremen & DFKI Bremen, Germany); José de Gea Fernández and Yohannes Kassahun (DFKI Bremen, Germany)

14:45 **The Advantages of Using Behavior Trees in Multi-Robot Systems**

Michele Colledanchise, Alejandro Marzinotto, Dimos Dimarogonas and Petter Ogren (KTH-The Royal Institute of Technology, Sweden)

15:05 **Automatic Testing Framework for Benchmarking Applications**

Florian Weisshardt (Fraunhofer IPA, Germany); Florian Köhler (Leibniz Universität Hannover, Germany)

■ 13:45-16:10

S2.1: Components

Room 1

Session Chair: Ulrike Thomas (Chemnitz University of Technology, Germany)

13:45 Active Ankle—an Almost—Spherical Parallel Mechanism

Marc Simnofske (DFKI Deutsches Forschungszentrum für Künstliche Intelligenz, Germany); Bertold Bongardt (Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI), Afghanistan); Shivesh Kumar (Robotics Innovation Center, Deutsche Forschungszentrum für Künstliche Intelligenz GmbH, Germany); Frank Kirchner (German Research Center for Artificial Intelligence (DFKI) GmbH, Bremen, Germany)

14:05 Optical Workspace Monitoring System for Safeguarding Tools on the Mobile Manipulator VALERI

José Saenz (Fraunhofer IFF, Germany); Christian Vogel (Fraunhofer Institute for Factory Operation and Automation IFF, Germany)

14:25 Tactile Sensors for Safety and Interaction with the Mobile Manipulator VALERI

José Saenz and Markus Fritzsche (Fraunhofer IFF, Germany)

14:45 Development of a Self-Adaptive Gripper and Implementation of a Gripping Reflex to Increase the Dynamic Payload Capacity

Marc Manz (German Research Center for Artificial Intelligence (DFKI), Germany); Sebastian Bartsch (DFKI Bremen GmbH—Robotics Innovation Center, Germany); Marc Simnofske (DFKI Deutsches Forschungszentrum für Künstliche Intelligenz, Germany); Frank Kirchner (German Research Center for Artificial Intelligence (DFKI) GmbH, Bremen, Germany)

15:05 An Optical Tactile Sensor for Measuring Force Values and Directions for Several Soft and Rigid Contacts

Alexey Kolker (Novosibirsk State Technical University & Siberian Research Meteorological Institute, Russia); Michael Jokesch and Ulrike Thomas (Chemnitz University of Technology, Germany)

■ 13:45-16:10

S3.1: Industrial Robots – Facts

Room 2

Session Chair: Jörg Franke (FAU Erlangen-Nuremburg, Germany)

- 13:45 **Do Robots Create Jobs? The Data Says Yes!**
Bob Doyle (Association for Advancing Automation, USA)
- 14:05 **Towards the Impact of Robot Trajectory Profiles on User Experience**
Barbara Kühnlenz (Coburg University of Applied Sciences and Arts, Germany); Kolja Kühnlenz (Coburg University of Applied Sciences and Arts & TU Munich, Germany)
- 14:25 **Attribute Enabled Programming of Industrial Robots**
Remus Boca (ABB Corporate Research Center, USA); Jianjun Wang (ABB Corporate Research, USA); Harald Staab (ABB Inc., USA); Gregory Rossano (ABB Inc., Corporate Research, USA); Thomas Fuhlbrigge (ABB Corporate Research Center, USA)
- 14:45 **Example Application of ISO/TS 15066 to a Collaborative Assembly Scenario**
Bjoern Matthias (ABB AG Corporate Research, Germany); Thomas Reisinger (ABB Automation GmbH, Germany)
- 15:05 **A Flexible Architecture for Automatically Generating Robot Applications based on Expert Knowledge**
Miroslav Macho, Ludwig Nägele, Alwin Hoffmann, Andreas Angerer and Wolfgang Reif (University of Augsburg, Germany)

■ 16:10–16:30
Poster Session and Coffee Break
Rooms: Galary/Restaurant

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for all poster presentations

■ 16:30–18:10
S1.2: Planning
Room: Plenary
Session Chair: Uwe Zimmermann (Konzernforschung KUKA Roboter GmbH)

- 16:30 **Establishing Performance Guarantees for Behavior-Based Robot Missions Using an SMT Solver**
Feng Tang and Damian Lyons (Fordham University, USA); Ronald Arkin (Georgia Institute of Technology, USA)

- 16:50 **Industrial implementation of a multi-task redundancy resolution at velocity level for highly redundant mobile manipulators**
Christian Scheurer and Mario Fiore (KUKA Roboter GmbH, Germany); Shashank Sharma (Bonn Rhine Sieg University of Applied Sciences, Germany)
- 17:10 **Data-Driven Human Grasp Movement Analysis**
Hamal Marino and Marco Gabiccini (University of Pisa, Italy); Ales Leonardis (The University of Birmingham, United Kingdom); Antonio Bicchi (University of Pisa, Italy)
- 17:30 **Distance Metrics for Path Planning with Dynamic Roadmaps**
Andreas Völz and Knut Graichen (Ulm University, Germany)

■ 16:30-18:10
S2.2: Technologies
Room 1
Session Chair: Bernd Kuhlenkötter (Ruhr-Universität Bochum, Germany)

- 16:30 **Fast Edge-Based Detection and Localization of Transport Boxes and Pallets in RGB-D Images for Mobile Robot Bin Picking**
Dirk Holz (University of Bonn, Germany)
- 16:50 **May I be your Personal Coach? Bringing Together Person Tracking and Visual Re-identification on a Mobile Robot**
Tim Wengefeld, Markus Eisenbach, Thanh Trinh and Horst-Michael Gross (Ilmenau University of Technology, Germany)
- 17:10 **Texture Characterization with Semantic Attributes: Database and Algorithm**
Richard Bormann, Dominik Esslinger, Daniel Hundsdoerfer and Martin Hägele (Fraunhofer IPA, Germany)
- 17:30 **ENACT: An Efficient and Extensible Entity-Actor Framework for Modular Robotics Software Components**
Tobias Werner, Michael Gradmann, Eric Orendt, Maximilian Sand and Michael Spangenberg (Universität Bayreuth, Germany); Dominik Henrich (University of Bayreuth, Germany)

17:50 Affordance Estimation For Vision–Based Object Replacement on a Humanoid Robot

Wail Mustafa (University of Southern Denmark, Denmark); Mirko Wächter (Institute for Anthropomatics, Karlsruhe Institute of Technology, Germany); Sandor Szedmak (University of Innsbruck, Austria); Alejandro Agostini (University of Göttingen, Germany); Dirk Kraft (University of Southern Denmark, Denmark); Tamim Asfour (Karlsruhe Institute of Technology (KIT), Germany); Justus H. Piater (University of Innsbruck, Austria); Florentin Wörgötter (University of Goettingen, Germany); Norbert Krueger (University of Southern Denmark, Denmark)

■ **16:30-18:10**

S3.2: Industrial Robots – Technologies

Room 2

Session Chair: Heinz Wörn (Karlsruhe Institute of Technology (KIT), Germany)

16:30 A Framework for Robot Control Software Development and Debugging Using a Real–Time Capable Physics Simulation

Fabian Aichele, Björn Schenke, Bernd Eckstein and Albert Groz (TruPhysics GmbH, Germany)

16:50 Modularization of skill ontologies for industrial robots

Ludwig Jacobsson and Jacek Malec (Lund University, Sweden)

17:10 User–Defined Transition between Path Segments in Terms of Tolerances in Speed and Position Deviation

Wolfgang Weber (University of Applied Sciences Darmstadt, Germany); Alexander König (University of Applied Sciences Darmstadt, Germany); Dany Nodem (University of Applied Sciences Darmstadt, Germany)

17:30 Robot Assembly Skills based on Compliant Motion Control

Fan Dai (ABB AG & Corporate Research, Germany); Arne Wahrburg, Bjoern Matthias and Hao Ding (ABB AG Corporate Research, Germany)

17:50 Editing and synchronizing multi–robot playback programs

Michael Riedl, Johannes Baumgartl and Dominik Henrich (University of Bayreuth, Germany)

■ **19:45 –22:30**

Conference Dinner at Augustiner Keller München
IERA and Engelberger Award Ceremony

Wednesday, June 22, 2016

■ 09:00–10:20
S1.3: Control
Room: Plenary
Session Chair: tba

- 09:00 **From Virtual Testbeds to real lightweight robots: Development and deployment of control algorithms for soft robots, with particular reference to industrial peg-in-hole insertion tasks**
Georgij Grinshpun, Torben Cichon and Dipika Dipika (RWTH – Aachen University, Germany); Juergen Rossmann (Technical University of Aachen, Germany)
- 09:20 **Experimental verification of the advantages of a modular open chain metamorphic manipulator**
Charalampos Valsamos (University of Patras & Mechanical Eng. and Aeronautics Dpt., Greece); Vassilis Moulitanitis (University of the Aegean, Greece); Nikos Aspragathos (University of Patras, Greece)
- 09:40 **Online Calibration of Industrial Robots using Inertial Sensors**
Hendrik Vieler (ISW – University of Stuttgart, Germany); Armin Lechler (University of Stuttgart, Germany); Jochen Grimm (ISW – University of Stuttgart, Germany)
- 10:00 **Practical trajectory design for semi-automation of forestry cranes**
Szabolcs Fodor (Umeå University, Sweden)

■ 09:00–10:00
S4.1: Service Robot Technologies
Room 1
Session Chair: Tamim Asfour (Karlsruhe Institute of Technology (KIT), Germany)

- 09:00 **Energy-Aware Mobile Robot Exploration**
Micha Rappaport (University of Klagenfurt, Austria)
- 09:20 **Autonomous Surveying of Underfloor Voids**
Miguel Julia (Q-Bot Limited, United Kingdom); Mathew Holloway (Imperial College London, United Kingdom); Oscar Reinoso (Miguel Hernández University, Spain); Peter Childs (Imperial College London, United Kingdom)

09:40 An new kinematic of a spherical joint for service robots*Tim Fröhlich (Fraunhofer IPA, Germany)* **09:00–10:20****S3.3: Human-Robot Cooperation**

Room 2

Session Chair: Martin Hägele (Fraunhofer IPA, Germany)

09:00 New development for flexible robot supported quality investigations in the field of Human Robot Collaboration in automotive industries*Sebastian Keller (BTU Cottbus – Senftenberg, Germany); Steffen Bindel and Alexander König (BMW Group, Germany)***09:20 Sensor Glove for an Intuitive Human–Machine Interface for Exoskeletons as Manual Load Handling Assistance***Patrick Stelzer, Werner Kraus and Andreas Pott (Fraunhofer IPA, Germany)***09:40 Smart Workbench: Towards Optimal User Assistance in Industrial Human–Robot Applications***Johannes Höcherl (Ostbayerische Technische Hochschule Regensburg, Germany); Thomas Schlegl (OTH Regensburg, Germany)***10:00 Model Predictive Contact Control for Human–Robot Interaction***Angelika Zube, Jonas Hofmann and Christian Frese (Fraunhofer IOSB, Germany)* **10:20–10:40****Poster Session and Coffee Break**

Rooms: Gallery/Restaurant

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 **10:40–11:40****S4.2: Assistive Robots**

Room: Plenary

Session Chair: Sven Behnke (University of Bonn, Germany)—requested

- 10:40 **Control and Analysis of a Therapeutic Massage Robot: A Milestone of Human–Robot in Physical Contact**
Ren C. Luo, Chien–Wei Hsu and Shen–Yu Chen
(National Taiwan University, Taiwan)
- 11:00 **A Sampling–Based Tree Planner for Navigation Among Movable Obstacles**
Elisa Tosello and Nicola Castaman (University of Padua, Italy); Enrico Pagello
(University Padova, Italy)
- 11:20 **What Older Adults would Like a robot to Do in Their Homes – First results from a User Study in the Homes of Users**
Markus Vincze (Vienna University of Technology, Austria)

■ 10:40-11:40

S4.3: Service Robot Applications

Room 1

Session Chair: Tamim Asfour (Karlsruhe Institute of Technology (KIT), Germany)

- 10:40 **Enabling Autonomous Locomotion into Sand – A Mobile and Modular Drilling Robot**
Felix Becker and Simon Börner (Technische Universität Ilmenau, Germany); Roy Lichtenheldt (German Aerospace Center (DLR) – Institute of System Dynamics and Control, Germany); Klaus Zimmermann (TU Ilmenau, Germany)
- 11:00 **A robot for spray applied insulation in underfloor voids**
Mathew Holloway (Imperial College London, United Kingdom); Miguel Julia (Q–Bot Limited, United Kingdom); Peter Childs (Imperial College London, United Kingdom)
- 11:20 **Automatic Tire Changing of Large Mining Vehicles with Industrial Robots**
Harald Staab (ABB Inc., USA); Remus Boca (ABB Corporate Research Center, USA); Carlos Martinez (ABB, USA); Gregory Rossano, Will Eakins and Dan Lasko (ABB Inc., Corporate Research, USA); Thomas Fuhlbrigge (ABB Corporate Research Center, USA)

■ 10:40-11:40

S3.4: Control

Room 2

Session Chair: Martin Hägele (Fraunhofer IPA, Germany)—requested

- 10:40 **Sensorless Null–Space Admittance Control for Redundant Manipulators**
*Arne Wahrburg and Bjoern Matthias (ABB AG Corporate Research, Germany);
 Fan Dai (ABB AG & Corporate Research, Germany); Hao Ding (ABB AG Corporate
 Research, Germany)*
- 11:00 **A wireless haptic data suit for controlling humanoid robots**
*Alessandro Graziano, Paolo Tripicchio, Emanuele Ruffaldi and Carlo Avizzano
 (Scuola Superiore Sant’Anna, Italy)*
- 11:20 **Fault propagation and graph–based path generation for skill–based robot programming**
Christian Lehmann and Duc Tho Le (Brandenburg University of Technology, Germany)

■ 11:40–12:25
K3: Keynote: Peer Fischer
 Room: Plenary

■ 12:25–13:45
Poster Session and Lunch
 Rooms: Gallery

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 for all poster presentations

■ 13:45–14:30
K4: Keynote: Dario Floreano
 Room: Plenary

■ 14:30–15:30
S3.5: Industrial Robots – Planning
 Room: Plenary
 Session Chair: Arturo Baroncelli (IFR, Italy)

- 14:30 **Planning and Execution of Collision-free Multi-robot Trajectories in Industrial Applications**
Andreas Angerer, Alwin Hoffmann and Michael Vistein (University of Augsburg, Germany); Jonghwa Kim (University of Augsburg & Institut für Informatik, Germany); Wolfgang Reif (University of Augsburg, Germany); Lars Larsen and Michael Kupke (German Aerospace Center, Germany)
- 14:50 **Anytime Assembly Sequence Planning**
Robert Andre (Technische Universität Chemnitz, Germany); Ulrike Thomas (Chemnitz University of Technology, Germany)
- 15:10 **A Complete Automated Chain For Flexible Assembly using Recognition, Planning and Sensor-Based Execution**
Korbinian Nottensteiner (German Aerospace Center (DLR), Institute for Robotics and Mechatronics, Germany); Tim Bodenmüller, Michael Kassecker, Maximo Roa and Andreas Stemmer (DLR, Germany); Daniel Seidel (TU Munich, Germany); Ulrike Thomas (Chemnitz University of Technology, Germany)

■ 14:30-15:30

S5: New Robotics Applications

Room 1

Session Chair: Kurt Nielsen (Forskerparken 10F, Denmark)—requested

- 14:30 **Improved Ergonomics via an Intelligent Movement and Gesture Detection Jacket**
Jan Kuschan, Henning Schmidt and Jörg Krüger (Fraunhofer IPK, Germany)
- 14:50 **Development and Control of the Multi-Legged Robot MANTIS**
Sebastian Bartsch (DFKI Bremen GmbH – Robotics Innovation Center, Germany); Marc Manz (German Research Center for Artificial Intelligence (DFKI), Germany); Peter Kampmann (DFKI GmbH – Robotics Innovation Center, Germany); Hendrik Hanff (DFKI GmbH, Germany); Alexander Dettmann (DFKI GmbH – Robotics Innovation Center Bremen, Germany); Malte Langosz (DFKI GmbH, Germany); Kai von Szadkowski (University of Bremen, Germany); Jens Hilljegerdes (DFKI GmbH – Robotics Innovation Center, Germany); Marc Simnofske (DFKI Deutsches Forschungszentrum für Künstliche Intelligenz, Germany); Philipp Kloss (DFKI GmbH, Germany); Manuel Meder (University of Bremen, Germany); Frank Kirchner (German Research Center for Artificial Intelligence (DFKI) GmbH, Bremen, Germany)
- 15:10 **The Neurobotic Platform: A simulation environment for brain-inspired robotics**
Florian Rührbein (Technical University of Munich, Germany); Marc-Oliver Gewaltig (EPFL, Switzerland); Cecilia Laschi (SSSA, Italy); Gudrun J. Klinker (Technische

Universitaet Muenchen, Germany); Paul Levi (FZI, Germany); Alois Knoll (Technical University Munich Garching, Germany)

■ 14:30-15:30

S3.6: Industrial Robots: Vision, Environment

Room 2

Session Chair: tba

14:30 **Camera-based Obstacle Classification for Automated Reach Trucks using Deep Learning**

Marian Himstedt (University of Lübeck, Germany); Erik Maehle (University of Lubeck, Germany)

14:50 **Real-time bearing fault probability estimation using onsite learning for industrial robots**

Joung Ji Hoon and Lim Hyunkyuu (Hyundai Heavy Industries Co., Ltd., Korea)

15:10 **Using a Flexible Skill-Based Approach to Recognize Objects in Industrial Scenarios**

Rasmus Andersen, Casper Schou, Jens Damgaard and Ole Madsen (Aalborg University, Denmark)

■ 15:30-15:50

Poster Session and Lunch

Rooms: Gallery/Restaurant

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for all poster presentations

■ 15:50-17:10

S3.7: Industrial Robots – Coating, Painting, Welding

Room: Plenary

Session Chair: Arturo Baroncelli (IFR, Italy)

15:50 **Automated spray coating of complex 2.5D workpieces in small batch sizes with complex geometries in throughput by an innovative machine combination**

Denise Klose and Thorsten Schüppstuhl (Technische Universität Hamburg-Harburg, Germany); Dominik Osthues (Venjakob Maschinenbau GmbH & Co. KG, Germany)

- 16:10 **Automatic Gyro Effect Simulation for Robotic Painting Application**
Xiongzhi Li (ABB Robotics, USA)
- 16:30 **Detection of Assembly Variations for Automatic Program Adaptation in Robotic Welding Systems**
Alexander Kuss and Ulrich Schneider (Fraunhofer IPA, Germany); Thomas Dietz (Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Germany); Alexander Verl (University of Stuttgart, Germany)
- 16:50 **New Applications of Cutting and Welding Robots with Automatic Offline-Programming**
Jobst Bickendorf (Autocam Informationstechnik GmbH, Germany)

■ 15:50-17:10

S3.8: Industrial Robots: Assembly, Manufacturing

Room 1

Session Chair: Bjoern Matthias (ABB AG Corporate Research, Germany)

- 15:50 **Teaching door assembly tasks in uncertain environment**
Stefano Michieletto and Francesca Stival (University of Padova, Italy); Enrico Pagello (University Padova, Italy)
- 16:10 **A variant-flexible assembly cell for hydraulic valve sections using a sensitive lightweight robot**
Christian Lehmann (Brandenburg University of Technology, Germany); Jost Philipp Städter (Brandenburg University of Technology Cottbus – Senftenberg, Germany); Kornelius Wächter (Brandenburg University of Technology, Germany)
- 16:30 **Analysis and Development of the Fused Layer Manufacturing Process using Industrial Robots**
Michael Rieger (Ruhr-Universität Bochum & Lehrstuhl für Produktionssysteme, Germany); Benjamin Johnen (Ruhr-Universität Bochum, Germany); Bernd Kühlenkötter (Ruhr-Universität Bochum, Lehrstuhl für Produktionssysteme (LPS), Germany)
- 16:50 **Repair of Composite Structures with a Novel Human-Machine System**
Rebecca Rodeck and Thorsten Schüppstuhl (Technische Universität Hamburg-Harburg, Germany)

■ 15:50-17:10

S3.9: Industrial Robots: Handling, Forming, Processing

Room 2

Session Chair: Christian Schlosser (TU-Hamburg-Harburg, Germany)

- 15:50 **Machine Learning In Incremental Sheet Metal Forming**
Denis D. Störkle, Patrick Seim and Lars Thyssen (Ruhr Universität Bochum, Germany); Bernd Kuhlenkötter (Ruhr-Universität Bochum, Germany)
- 16:10 **Robot based automation of artistic stone surface production**
Gregor Steinhagen (TU Dortmund, Institute of Production Systems, Germany); Johannes Braumann (Association for Robots in Architecture | University for Arts and Design Linz, Austria); Carsten Krewet (TU Dortmund University, Institute of Production Systems, Germany); Jan Brüninghaus and Sigrid Brell-Cokcan (RWTH Aachen University, Chair of Individualized Building Production, Germany); Bernd Kuhlenkötter (Ruhr-Universität Bochum, Lehrstuhl für Produktionssysteme (LPS), Germany)
- 16:30 **Mixed Case Palletizing with Industrial Robots**
Christian Wurll (Swisslog Automation GmbH, Germany)
- 16:50 **Automatic programming and control for robotic deburring**
Julian Ricardo Diaz Posada, Shivaram Kumar and Ulrich Schneider (Fraunhofer IPA, Germany); Thomas Dietz (Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Germany); Alexander Verl (Stuttgart University, Germany)



General Information

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Website

Visit the ISR 2016 homepage for getting the latest information related to the conference: www.isr2016.org

Registration Desk Hours

Tuesday, June 21, 2016, 08:00-18:00
Wednesday, June 22, 2016, 08:00-17:00
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Conference that is embedded in the **AUTOMATICA** fair and presents intelligent, digitally networked working environments. It combines the key topics of production, automation, information technology and IT security in a single event.

Proceedings

All papers/posters accepted for presentation at the conference will be published as USB-Stick and included in IEEE Xplore. The USB-Stick will be handed on-site to all participants attending the conference.

Munich and the Conference Venue

Munich, the capital of Bavaria, is one of Germany's most exciting travel destinations and offers variety for every visitor. The lively city consists of a mixture of visible history of almost one thousand years and modern spirit. Please visit the official website at www.munich.de for further information.

ISR 2016 will take place in the Press Center East, Entrance East. The Press Center East is connected to the Messe München exhibition center where the fair **AUTOMATICA** will take place.

Hotel Reservation

For room reservation please check our website www.isr2016.org for accommodation. Further accommodation can be booked at:

www.automatica-munich.com/accommodation

Please be aware that parallel to **ISR 2016** there are several events taking place. We therefore recommend to book your room early.



Social Program

The Conference Dinner and the Engelberg Award Ceremony will take place on June 21, 2016 in the Augustiner Keller (www.augustinerkeller.de) in Munich. Departure for the evening event will be from the conference venue, combined with a guided city bus tour.

The attendance is included in the conference fee (except Day Registration). Additional tickets may be ordered.

The highlight of the conference's gala dinner is the presentation of the final nominees of IERA Award and the Engelberger Award.

IERA Award



In 2005 the IEEE Robotics and Automation Society (IEEE/RAS) and the International Federation of Robotics (IFR) agreed to jointly sponsor the Invention and Entrepreneurship Award. The purpose of this award is to highlight and honor

the achievements of the inventors with value creating ideas and entrepreneurs who propel those ideas into world-class products. At the same time the joint disposition of the award underlines the determination of both organizations to promote stronger collaboration between robotics science and robotics industry. The annual presented award consists of a plaque and a USD 2,000 honorarium.

Joseph F. Engelberger Award



Named after Joseph F. Engelberger, known throughout the world as the founding force behind industrial robotics, the Engelberger Robotics Award is the world's most prestigious robotics honor. The awards are awarded to outstanding individuals to honor excellent achievements in technology development, application, education and leadership.

Insurance

The organizers may not be held responsible for any injury to participants or damage, theft and loss of personal belongings. Participants should therefore make their own insurance arrangements.

Venue

Messe München, Entrance East

Am Messeturm 4

81829 München, Germany

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