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

ROBOTICS IN THE ERA OF DIGITALISATION
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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.

Welcoming the Chairs of ISR 2016

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

Press Center East, Ground Floor

Press Center East, 1st Floor

Press Center East, 2nd Floor
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
## Program

**Tuesday, June 21, 2016**

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<td>09:45</td>
<td>Room 1: Welcome</td>
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<td>14:30</td>
<td>Room 2: Modeling, Components, Industrial Robots: Facts</td>
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<td>Room 2: Poster Session and Coffee Break</td>
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<td>16:30</td>
<td>Room 2: Planning, Technologies, Industrial Robots: Facts</td>
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<td>18:10</td>
<td>Room 2: End of Day 1</td>
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<td>18:30</td>
<td>Room 2: Depart for Conference Dinner</td>
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**Wednesday, June 22, 2016**

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<td>09:00</td>
<td>Control</td>
<td>Service Robot Technologies</td>
<td>Human–Robot Cooperation</td>
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<td>10:20</td>
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<td>Poster Session and Coffee Break</td>
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<td>10:40</td>
<td>Assistive Robots</td>
<td>Service Robot Technologies</td>
<td>Control</td>
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<td>15:30</td>
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<td>Poster Session and Coffee Break</td>
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<td>15:50</td>
<td>Industrial Robots: Coating, Painting, Welding</td>
<td>Industrial Robots: Assembly, Manufacturing</td>
<td>Industrial Robots: Handling, Forming, Processing</td>
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<td>17:10</td>
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<td>End of Conference</td>
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- **18:30–22:30**
  - Conference Dinner at Augustiner Keller München
  - IERA and Engelberger Award Ceremony
Program Committee ISR 2016

Chair
- Alexander Verl, University of Stuttgart (representing Fraunhofer IPA), Germany

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- Shinsuke Sakakibara, IFR, Japan
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- Manfred Dresselhaus, KUKA Industries, Germany
- Olav Egeland, NTNU, Norway
- Norbert Elkmann, Fraunhofer IFF, Germany
- Jörg Franke, University Erlangen, Germany
- Christian Frey, Fraunhofer IOSB, Germany
- Martin Hägele, Fraunhofer IPA, Germany
- Joachim Hertzberg, University Osnabrück, Germany
- Bernd Kuhlenkötter, Ruhr–Universität, Germany
- Christophe Leroux, CEA LIST DIASI, France
- Ren C. Luo, National Taiwan University, Taiwan
- Tim Lüth, Technical University München, Germany
- Björn Matthias, ABB Forschungszentrum, Germany
- Alexander Meißner, Dürr Systems, Germany
Kurt Nielsen, Danish Technological Institute, Denmark
Mircea Nitulescu, Robotics Society of Romania, Romania
Jong-Oh Park, Chonnam National University, Korea
Jin Bae Park, ICROS, Korea
Jürgen Roßmann, RWTH Aachen, Germany
Klaus-Dieter Schilling, Zentrum für Telematik, Germany
Thorsten Schüppstuhl, Technical University Hamburg-Harburg, Germany
Ulrike Thomas, Technical University Chemnitz, Germany
Roland Tschakarow, Robert Bosch Start-up GmbH, Germany
Kai-Uwe Vayhinger, Schunk GmbH & Co. KG, Germany
Bernardo Wagner, University Hannover, Germany
Georg von Wichert, Siemens AG, Germany
Dirk Wollherr, Technical University Munich, Germany
Heinz Wörn, Karlsruhe Institute for Technology, Germany
Haibin Yu, Shenyang Institute of Automation (SIA), China

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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
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); Jürgen 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
Laee-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)

P2.5 TagMap: semantic mapping with Deep Learning
Miguel Cazorla (University of Alicante, Spain)
P3.1 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)

P3.2 Energy Efficient Kinodynamic Motion Planning for Holonomic AGVs in Industrial Applications using State Lattices
Frank Künemund (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)
P4.1 Laser scanner detection and localization of successively arranged 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 Sinitsa (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)

P4.8 Three Dimensional Probabilistic Path Planning with Aerial Vehicles for Unstructured Environments
Andre Dias, Tiago Santos and Eduardo Silva (INESC TEC/ISEP–LSA, Portugal); José Almeida (Instituto Superior de Engenharia do Porto, Portugal)

P4.9 Industrial Robotics Teaching in Industrial Electronics and Automatic Control Degree at UPC
Yolanda Bolea, Antoni Grau and Alberto Sanfeliu (Technical Univ of Catalonia, Spain)
P.4.10  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)

P.4.11  A semi–automated Personal Trolley Robot
Christoph Uhrhan (Furtwangen University, Germany); Lukas Haas (Reutlingen University, Germany)

P.4.12  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 Truschinski (TU Chemnitz, Germany); Peter Protzel (Technische Universität Chemnitz, Germany)

P.4.13  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)

P.4.14  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);
13:45-14:30
Keynote 2: Alexander Waibel “Bridging the Language Divide”
Room: Plenary

13:45-14:05
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)

14:05-14:30
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)

14:30-14:45
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)

14:45-15:05
The Advantages of Using Behavior Trees in Mult–Robot Systems
Michele Colledanchise, Alejandro Marzinotto, Dimos Dimarogonas and Petter Ogren (KTH–The Royal Institute of Technology, Sweden)

15:05-15:25
Automatic Testing Framework for Benchmarking Applications
Florian Weisshardt (Fraunhofer IPA, Germany); Florian Köhler (Leibniz Universität Hannover, 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-Nuremberg, 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 Kühlñenz (Coburg University of Applied Sciences and Arts, Germany); Kolja Kühlñenz (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

Please check page 10 for all poster presentations

16:30–18:10  S1.2: Planning
Room: Plenary
Session Chair: Rüdiger Dillmann (Karlsruhe Institute of Technology (KIT), Germany)—requested

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 Path Planning for Cooperative Autonomous Soaring gliders
Muhammad Aneeq uz Zaman (University of Illinois, Urbana–Champaign, USA); Fatma Faruq (National University Of Sciences and Technology, Pakistan)

17:50 Distance Metrics for Path Planning with Dynamic Roadmaps
Andreas Völz and Knut Graichen (Ulm University, 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 Hundsdöerfer 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 Kratt (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); Dary 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, Bjørn 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)

18:30–22:30
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 Moulianitis (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)
09:00 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

Please check page 10 for all poster presentations

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 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 **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)
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); 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 Neurorobotic Platform: A simulation environment for brain-inspired robotics
Florian Röhbein (Technical University of Munich, Germany); Marc-Oliver Gewaltig (EPFL, Switzerland); Cecilia Laschi (SSSA, Italy); Gudrun J. Klinker (Technische
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 Lübeck, Germany)

14:50 Real–time bearing fault probability estimation using onsite learning for industrial robots
Joung Ji Hoon and Lim Hyunkyu (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
Please check page 10 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**  
Xiongzi 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)

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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 Städtler (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 Kuhlenkötter (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 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

Contact

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Website

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

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Cancellation policy

In case of cancellation, provided that written notice is received at the VDE-Conference Services before May 1, 2016 (except authors registration), the registration fee will be fully refunded less a handling fee of EUR 60. After May 1, 2016 no refund will be made. Proceedings will then be sent to the registrant after the conference.

Payment

Payment for registration, including bank charges and processing fees, must be made in Euro. The conference fee has to be fully paid in advance.

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.
Registration Desk Hours
Tuesday, June 21, 2016, 08:00-18:00
Wednesday, June 22, 2016, 08:00-17:00
Availability by e-mail on-site
E-mail: vde-conferences@vde.com

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.
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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.

Official language
The official conference language is English. All sessions will be held in English only.

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.

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
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