

# **2020 25th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA 2020)**

**Vienna, Austria  
8-11 September 2020**

**Pages 1-610**



**IEEE Catalog Number: CFP20ETF-POD  
ISBN: 978-1-7281-8957-4**

**Copyright © 2020 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP20ETF-POD
ISBN (Print-On-Demand):	978-1-7281-8957-4
ISBN (Online):	978-1-7281-8956-7
ISSN:	1946-0740

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# TABLE OF CONTENTS

## **TT01 INFORMATION TECHNOLOGY IN AUTOMATION**

A MODEL FOR SIGNATORIES IN CYBER-PHYSICAL SYSTEMS .....	15
<i>Sreelakshmi Vattaparambil Sudarsan, Olov Schelén, Ulf Bodin</i>	
A SERVICE BUS CONCEPT FOR MODULAR AND ADAPTABLE PLC-SOFTWARE.....	22
<i>Virendra Ashiwal, Alois Zoitl, Matthias Konnerth</i>	
AN ANALYSIS OF THE APPLICABILITY OF VOICEXML AS BASIS FOR A DIALOG CONTROL FLOW IN INDUSTRIAL INTERACTION MANAGEMENT.....	30
<i>Felix Böhm, Ingo Siegert, Alexander Belyaev, Christian Diedrich</i>	
AUTOMATIC DETECTION AND IDENTIFICATION OF FASTENERS WITH SIMPLE VISUAL CALIBRATION USING SYNTHETIC DATA .....	38
<i>Sangjun Noh, Seunghyeok Back, Raeyoung Kang, Sungho Shin, Kyoobin Lee</i>	
CAPABILITY-BASED PROCESS MODELING AND CONTROL .....	45
<i>Michael Mayrhofer, Christoph Mayr-Dorn, Oujidane Guiza, Georg Weichhart, Alexander Egyed</i>	
CLOUD-MANAGED SERVICE DEPLOYMENT FOR MANUAL ASSEMBLY WORKSTATIONS.....	53
<i>Matthias Schneider, David Albert Breunig, Benjamin Götz, Abdul Kader Khalil</i>	
ENABLING FOG-BASED INDUSTRIAL ROBOTICS SYSTEMS .....	61
<i>Mohammed Salman Shaik, Václav Struhár, Zeinab Bakhshi, Van-Lan Dao, Nitin Desai, Alessandro V. Papadopoulos, Thomas Nolte, Vasileios Karagiannis, Stefan Schulte, Alexandre Venito, Gerhard Fohler</i>	
ASSESSING LONG DISTANCE COMMUNICATION ALTERNATIVES FOR THE REMOTE CONTROL OF AGVS .....	69
<i>Ronal Bejarano, Roope Pääkkönen, Jan Olaf Blech, Ian Peake, Peter Herrmann, Valeriy Vyatkin</i>	
FOGIFICATION OF ELECTRIC DRIVES: AN INDUSTRIAL USE CASE .....	77
<i>Mohammadreza Barzegaran, Nitin Desai, Jia Qian, Koen Tange, Bahram Zarrin, Paul Pop, Juha Kuusela</i>	
GENERATING AN INDUSTRIAL PROCESS GRAPH FROM 3D PIPE ROUTING INFORMATION .....	85
<i>Seppo Sierla, Mohammad Azangoo, Valeriy Vyatkin</i>	
KNOWLEDGE GRAPHS FOR EFFICIENT INTEGRATION AND ACCESS OF MANUFACTURING DATA .....	93
<i>Irlán Grangel-González, Felix Lösch, Anees Ul Mehdi</i>	
OCCUPANT FEEDBACK AND CONTEXT AWARENESS: ON THE APPLICATION OF BUILDING INFORMATION MODELING AND SEMANTIC TECHNOLOGIES FOR IMPROVED COMPLAINT MANAGEMENT IN COMMERCIAL BUILDINGS.....	101
<i>Francesco Massa Gray, Henrik Dibowski, Jan Gall, Sven Braun</i>	

REAL-TIME TEST PLATFORM FOR ENABLING GRID SERVICE VIRTUALISATION IN CYBER PHYSICAL ENERGY SYSTEM .....	109
<i>Carsten Krüger, Anand Narayan, Felipe Castro, Batoul Hage Hassan, Shadi Attarha, Davood Babazadeh, Sebastian Lehnhoff</i>	
REDUCING THE CONFIGURATION BURDEN IN AUTOMATION SYSTEMS - CASE STUDY IN A MODERN BREWERY .....	117
<i>Robert Ellen, Michael Lees</i>	
REPRESENTATION OF PLANT STRUCTURE USING XML AND ITS APPLICATION TO CULTIVATION MANAGEMENT .....	125
<i>Saki Saito, Kanami Yuyama, Masahisa Ishii, Victor Huang, Hiroaki Nishi</i>	
SERVICE GRANULARITY IN INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS.....	132
<i>Aydin Homay, Mario De Sousa, Alois Zoitl, Martin Wollschlaeger</i>	
SYMBIOTIC CYBER-PHYSICAL KANBAN 4.0: AN APPROACH FOR SMES .....	140
<i>Dorota Stadnicka, Andrea Bonci, Emanuele Lorenzoni, Grzegorz Dec, Massimiliano Pirani</i>	
SYSTEM ARCHITECTURES FOR CYBER-PHYSICAL PRODUCTION SYSTEMS ENABLING SELF-X AND AUTONOMY .....	148
<i>Daniel Stock, Thomas Bauernhansl, Michael Weyrich, Matthias Feurer, Rolf Wutzke</i>	
TIMING CONTRACTS AND MONITORS FOR SAFETY RELEVANT CONTROLLER DESIGN IN IEC 61499 .....	156
<i>Duc Do Tran, Kim Grüttner, Frank Oppenheimer, Wolfgang Nebel</i>	
TOWARD A KNOWLEDGE-BASED DATA BACKBONE FOR SEAMLESS DIGITAL ENGINEERING IN SMART FACTORIES .....	164
<i>Alexander Perzylo, Ingmar Kessler, Stefan Profanter, Markus Rickert</i>	
TOWARDS CONSOLIDATING INDUSTRIAL USE CASES ON A COMMON FOG COMPUTING PLATFORM .....	172
<i>Patrick Denzler, Jan Ruh, Marine Kadar, Cosmin Avasalcai, Wolfgang Kastner</i>	
<b><u>TT02 INDUSTRIAL COMMUNICATION TECHNOLOGIES AND SYSTEMS</u></b>	
A SIMPLER TSN? TRAFFIC SCHEDULING VS. PREEMPTION .....	183
<i>Alexander Gogolev, Philipp Bauer</i>	
ANALYSIS OF THE TSN STANDARDS FOR UTILIZATION IN LONG-LIFE INDUSTRIAL DISTRIBUTED CONTROL SYSTEMS .....	190
<i>Daniel Hallmans, Mohammad Ashjaei, Thomas Nolte</i>	
ANALYSIS OF TIME SYNCHRONIZATION FOR CONVERGED WIRED AND WIRELESS NETWORKS.....	198
<i>Maximilian Schüngel, Steven Dietrich, David Ginhör, Shun-Ping Chen, Michael Kuhn</i>	
ASSESSMENT OF DIFFERENT ALGORITHMS TO SOLVE THE SET-COVERING PROBLEM IN A RELAY SELECTION TECHNIQUE.....	206
<i>Suelen Laurindo, Ricardo Moraes, Carlos Montez, Francisco Vasques</i>	
CLOCK SYNCHRONIZATION IN INTEGRATED TSN-ETHERCAT NETWORKS.....	214
<i>Daniel Bujosa Mateu, Daniel Hallmans, Mohammad Ashjaei, Alessandro V. Papadopoulos, Julian Proenza, Thomas Nolte</i>	

END-TO-END OPTIMIZED JOINT SCHEDULING OF CONVERGED WIRELESS AND WIRED TIME-SENSITIVE NETWORKS.....	222
<i>David Ginhör, René Guillaume, Johannes Von Hoyningen-Huene, Maximilian Schüngel, Hans D. Schotten</i>	
HOSTING FUNCTIONAL SAFETY APPLICATIONS IN FACTORY NETWORKS THROUGH TIME-SENSITIVE NETWORKING.....	230
<i>Sascha Gent, Pablo Gutiérrez Peón, Thomas Frühwirth, Dieter Etz</i>	
HYBRID OPC UA: ENABLING POST-QUANTUM SECURITY FOR THE INDUSTRIAL INTERNET OF THINGS.....	238
<i>Sebastian Paul, Esther Guerin</i>	
IEC 61850 OVER TSN: TRAFFIC MAPPING AND DELAY ANALYSIS OF GOOSE TRAFFIC.....	246
<i>Théo Docquier, Ye-Qiong Song, Vincent Chevrier, Ludovic Pontnau, Abdelaziz Ahmed-Nacer</i>	
ONLINE STREAM-AWARE ROUTING FOR TSN-BASED INDUSTRIAL CONTROL SYSTEMS.....	254
<i>Ching-Chih Chuang, Tzu-Hsien Yu, Chung-Wei Lin, Ai-Chun Pang, Tien-Jan Hsieh</i>	
OPEN-SOURCE OPC UA SECURITY AND SCALABILITY.....	262
<i>Nikolas Mühlbauer, Erkin Kirdan, Marc-Oliver Pahl, Georg Carle</i>	
PORTABLE TRUST ANCHOR FOR OPC UA USING AUTO-CONFIGURATION.....	270
<i>David Meier, Florian Patzer, Matthias Drexler, Jürgen Beyerer</i>	
REAL-TIME CAPABLE OPC-UA PROGRAMS OVER TSN FOR DISTRIBUTED INDUSTRIAL CONTROL.....	278
<i>Christian Eymüller, Julian Hanke, Alwin Hoffmann, Markus Kugelmann, Wolfgang Reif</i>	
SINGLE MESSAGE DISTRIBUTION OF TIMING INFORMATION FOR TIME SYNCHRONIZATION IN CONVERGED WIRED AND WIRELESS NETWORKS.....	286
<i>Maximilian Schüngel, Steven Dietrich, David Ginhör, Shun-Ping Chen, Michael Kuhn</i>	
TSN-BASED CONVERGED INDUSTRIAL NETWORKS: EVOLUTIONARY STEPS AND MIGRATION PATHS.....	294
<i>Christian Von Arnim, Mihai Dragan, Florian Frick, Armin Lechler, Oliver Riedel, Alexander Verl</i>	
WIRELESS CONNECTIVITY IN INDUSTRIAL SENSOR AND CONTROL NETWORKS: CHALLENGES AND ISSUES IN A REAL IMPLEMENTATION FOR A SMART PRODUCTION USE-CASE.....	302
<i>Adeel Ahmed, Daniel Valtiner, Christos Thomos, Franz Dielacher</i>	

### **TT03 REAL TIME AND NETWORKED EMBEDDED SYSTEMS**

GENERATING ROS-BASED SOFTWARE FOR INDUSTRIAL CYBER-PHYSICAL SYSTEMS FROM UML/MARTE.....	313
<i>Marco Aurelio Wehrmeister</i>	
IMPACT OF FRAME SIZE AND DEADLINES ON WRR SCHEDULING IN A SWITCHED ETHERNET NETWORK WITH CRITICAL AND NON-CRITICAL FLOWS.....	321
<i>Aakash Soni, Jérôme Ermont, Jean-Luc. Scharbarg</i>	

MAPPING AND SCHEDULING AUTOMOTIVE APPLICATIONS ON ADAS PLATFORMS USING METAHEURISTICS.....	329
<i>Shane D. McLean, Silviu S. Craciunas, Emil Alexander Juul Hansen, Paul Pop</i>	
MODEL-BASED DEVELOPMENT CONSIDERING SELF-DRIVING SYSTEMS FOR MANY- CORE PROCESSORS .....	337
<i>Ryo Yoshinaka, Takuya Azumi</i>	
PROBABILISTIC SCHEDULABILITY ANALYSIS FOR PRECEDENCE CONSTRAINED TASKS ON PARTITIONED MULTI-CORE.....	345
<i>Slim Ben-Amor, Liliana Cucu-Grosjean, Mehdi Mezouak, Yves Sorel</i>	
REAL-TIME VIRTUALIZATION FOR INDUSTRIAL AUTOMATION.....	353
<i>Claudio Scordino, Ida Maria Savino, Luca Cuomo, Luca Miccio, Andrea Tagliavini, Marko Bertogna, Marco Solieri</i>	
SDN-BASED MANAGEMENT SOLUTION FOR TIME SYNCHRONIZATION IN TSN NETWORKS.....	361
<i>Minh-Thuyen Thi, Siwar Ben Hadj Said, Michael Boc</i>	
WHEN SECURITY AFFECTS SCHEDULABILITY OF TSP SYSTEMS: TRADE-OFFS OBSERVED BY DESIGN SPACE EXPLORATION.....	369
<i>Ill-Ham Atchadam, Laurent Lemarchand, Hai Nam Tran, Frank Singhoff, Karim Bigou</i>	

#### **TT04 AUTOMATED MANUFACTURING SYSTEMS**

ADAPTIVE QUALITY CONTROL FOR DISCRETE LARGE-SCALE MANUFACTURING SYSTEMS SUBJECTED TO DISTURBANCES.....	379
<i>Benjamin Lindemann, Nasser Jazdi, Michael Weyrich</i>	
ASSISTED PLANNING AND SETUP OF COLLABORATIVE ROBOT APPLICATIONS IN MODULAR PRODUCTION SYSTEMS .....	387
<i>Michael Wojtynek, Julian Leichert, Sebastian Wrede</i>	
DEVELOPMENT OF A MOBILE ROBOTIZED SYSTEM FOR PALLETIZING APPLICATIONS.....	395
<i>Alberto Baldassarri, Gino Innero, Roberto Di Leva, Gianluca Palli, Marco Carricato</i>	
DISTRIBUTED IMPLEMENTATION OF GRAFCETS THROUGH IEC 61499 .....	402
<i>Oscar Miguel-Escrig, Julio-Ariel Romero-Pérez, Bianca Wiesmayr, Alois Zoitl</i>	
INSTABILITY PROBLEMS IN CO-SIMULATION OF MODULAR SYSTEMS.....	410
<i>Ludvig Ekström, Kristofer Bengtsson, Bengt Lennartson</i>	
TOWARDS COMPOSITIONAL AUTOMATED PLANNING .....	416
<i>Endre Eros, Martin Dahl, Petter Falkman, Kristofer Bengtsson</i>	
TOWARDS SAFE HUMAN ROBOT COLLABORATION - RISK ASSESSMENT OF INTELLIGENT AUTOMATION .....	424
<i>Atieh Hanna, Kristofer Bengtsson, Per-Lage Götvall, Mikael Ekström</i>	

## **TT05 INDUSTRIAL CONTROL**

A KINEMATIC SWARM MODEL FOR VORTEX-LIKE BEHAVIOR AROUND AN UNCERTAIN TARGET .....	435
<i>Luigi D'Alfonso, Antonio Bono, Anselmo Filice</i>	
A SIMPLE TECHNIQUE TO IMPROVE THE SET-POINT FOLLOWING PERFORMANCE OF PREDICTIVE FUNCTIONAL CONTROL.....	441
<i>Manuel Beschi, Antonio Visioli</i>	
CURRENT DISTRIBUTION MONITORING IN CAPACITOR DISCHARGE WELDING .....	447
<i>Moritz Meiners, Tobias Reichenstein, Jörg Franke, Rainer Hauenstein</i>	
DISTRIBUTED FINITE-TIME SECONDARY CONTROL OF ISLANDED MICROGRIDS BY COUPLED SLIDING-MODE TECHNIQUE.....	454
<i>Milad Gholami, Alessandro Pisano, Seyed Mohsen Hosseini, Elio Usai</i>	
FEED-FORWARD CONTROL FOR A DRINKING WATER TREATMENT PLANT CHLORINATION PROCESS.....	462
<i>J. Gamiz, H. Mart'nez, A. Grau, Y. Bolea, R. Vilanova</i>	
REAL-TIME IMPLEMENTATION OF SWITCHED MULTI-OBJECTIVE PRIORITIZING MPC FOR A BRANDY DISTILLATION PROCESS.....	468
<i>Marwa Ben Ticha, Vincent Sircoulomb, Nicolas Langlois</i>	
SURVEY INTO PREDICTIVE KEY PERFORMANCE INDICATOR ANALYSIS FROM DATA MINING PERSPECTIVE .....	476
<i>Akshay Thakur, Robert Beck, Sanaz Mostaghim, Daniel Großmann</i>	
TACTILE-SENSING APPARATUS FOR SENSIBLE CATCHING OF GUIDED HEAVY MASSES .....	484
<i>Maximilian Schmidt, Veit Müller, Holger Althaus, Norbert Elkmann</i>	
THE TARGET CAPTURING PROBLEM FOR MULTI-AGENT DOUBLE-INTEGRATOR SYSTEMS: A DISTRIBUTED MODEL PREDICTIVE CONTROL SCHEME.....	492
<i>Giuseppe Fedele, Giuseppe Franzè</i>	
THE USE OF SYMMETRICAL ANGLE SWITCHED SINGLE- & 3-PHASE RECTIFIERS IN MICRO HYDRO POWER PLANTS.....	498
<i>Henry Bory-Prevez, Herminio Martínez-García, Luís Vázquez-Seisdedos, Encarna García-Vilchez, Antoni Grau-Saldes</i>	

## **TT06 COMPUTER VISION AND HUMAN-MACHINE INTERACTION IN INDUSTRIAL AND FACTORY AUTOMATION**

ACCURATE STITCH POSITION IDENTIFICATION OF SEWN THREADS IN TEXTILES .....	505
<i>Dieter Geller, Tarek Stiebel, Oliver Rippel, Jonas Osburg, Volker Lutz, Thomas Gries, Dorit Merhof</i>	
ASSEMBLY PROCESS PREDICTION WITH DIGITAL ASSISTANCE SYSTEMS TO ENSURE SYNCHRONY BETWEEN DIGITAL AND PHYSICAL PRODUCT STATE USING RECURRENT NEURAL NETWORKS .....	513
<i>Rainer Mueller, Leenhard Hoerauf, Attique Bashir</i>	

DATA-DRIVEN INDUSTRIAL HUMAN-MACHINE INTERFACE TEMPORAL ADAPTATION FOR PROCESS OPTIMIZATION .....	518
<i>Daniel Reguera-Bakhache, Iñaki Garitano, Roberto Uribeetxeberria, Carlos Cernuda, Urko Zurutuza</i>	
FULLY-AUTOMATED PACKAGING STRUCTURE RECOGNITION IN LOGISTICS ENVIRONMENTS .....	526
<i>Laura Dörr, Felix Brandt, Martin Pouls, Alexander Naumann</i>	
GAN-BASED DEFECT SYNTHESIS FOR ANOMALY DETECTION IN FABRICS.....	534
<i>Oliver Rippel, Maximilian Müller, Dorit Merhof</i>	
GUIDING THE OPERATOR'S ATTENTION AMONG A PLURALITY OF OPERATOR WORKSTATION SCREENS .....	541
<i>Veronika Domova</i>	
HUMAN-ROBOT ASSEMBLY: METHODOICAL DESIGN AND ASSESSMENT OF AN IMMERSIVE VIRTUAL ENVIRONMENT FOR REAL-WORLD SIGNIFICANCE.....	549
<i>Johannes Höcherl, Andreas Adam, Thomas Schlegl, Britta Wrede</i>	
IMPROVING SAFEGUARDS AND FUNCTIONALITY IN INDUSTRIAL COLLABORATIVE ROBOT HMIS THROUGH GUI AUTOMATION .....	557
<i>Tudor B. Ionescu, Joachim Fröhlich, Markus Lachenmayr</i>	
MACHINE VISION BASED AUTOMATION TO IMPROVE PROCESS AND QUALITY CONTROL IN ROLLING MILLS§.....	565
<i>Vidyadhar Rao, Shishira S., Sithu D. Sudarsan</i>	
PARADIGM CHANGE TOWARDS VISUAL ANALYTICS FOR DATA-DRIVEN QUALITY IMPROVEMENT IN HIGHLY FLEXIBLE PRODUCTION SYSTEMS .....	573
<i>Frederik Schmihing, Matthias Schindler, Roland Jochem</i>	
POINTCLOUD-BASED IDENTIFICATION OF OPTIMAL GRASPING POSES FOR CLOTH-LIKE DEFORMABLE OBJECTS .....	581
<i>Alessio Caporali, Gianluca Palli</i>	
POSENETWORK: PIPELINE FOR THE AUTOMATED GENERATION OF SYNTHETIC TRAINING DATA AND CNN FOR OBJECT DETECTION, SEGMENTATION, AND ORIENTATION ESTIMATION.....	587
<i>Alejandro Magaña, Hang Wu, Philipp Bauer, Gunther Reinhart</i>	
REALIZING BODY-MACHINE INTERFACE FOR QUADROTOR CONTROL THROUGH KALMAN FILTERS AND RECURRENT NEURAL NETWORK.....	595
<i>Alexander Menshchikov, Daniil Lopatkin, Evgeny Tsykunov, Dzmity Tsetserukou, Andrey Somov</i>	
XR-COCKPIT: A COMPARISON OF VR AND AR SOLUTIONS ON AN INTERACTIVE TRAINING STATION.....	603
<i>Ariel Caputo, Sergiu Jacota, Serhiy Krayevskyy, Marco Pesavento, Fabio Pellacini, Andrea Giachetti</i>	
<b><u>TT07 INTELLIGENT ROBOTS AND SYSTEMS</u></b>	
2D LOCALIZATION IN LARGE AREAS USING INEXPENSIVE RGBD CAMERA AUGMENTED WITH VISUAL TAGS .....	613
<i>Nayabrasul Shaik, Matthias Lutz, Christian Schlegel</i>	



AN ADAPTIVE ROBOTIC GRASPING WITH A 2-FINGER GRIPPER BASED ON DEEP LEARNING NETWORK.....	620
<i>Wafae Sebbata, Mourad A. Kenk, Jean-François Brethé</i>	
ANALYZING REGIONS OF SAFETY FOR HANDLING SHARED DATA IN COOPERATIVE SYSTEMS.....	628
<i>Georg Jäger, Johannes Schleiss, Sasiporn Usanavasin, Sebastian Stober, Sebastian Zug</i>	
COLLISION FREE MOTION PLANNING FOR ROBOTS BY CAPTURING THE ENVIRONMENT.....	636
<i>Philipp Blanke, Marvin Boltes, Simon Storms, Lars Lienenlücke, Christian Brecher</i>	
CUT-IN CRITICAL LEVEL PREDICTION VIA SIMULATION BASED TIME-TO-COLLISION ALGORITHM.....	643
<i>Yunhao Hu, Mian Dai, Kui Wang, Lars Drugge</i>	
EFFECTIVE HUMAN-ROBOT COLLABORATION THROUGH WEARABLE SENSORS.....	651
<i>Ali Al-Yacoub, Achim Buerkle, Myles Flanagan, Pedro Ferreira, Ella-Mae Hubbard, Niels Lohse</i>	
IMPLEMENTING RESOURCE ADEQUATE SERVICE ROBOT BEHAVIOR BY SYSTEMATIC MANAGEMENT OF NON-FUNCTIONAL PROPERTIES: AN INTRALOGISTICS USE CASE.....	659
<i>Timo Blender, Christian Schlegel</i>	
INTEGRATION OF A MULTI-CAMERA VISION SYSTEM AND ADMITTANCE CONTROL FOR ROBOTIC INDUSTRIAL DEPALLETIZING.....	667
<i>Davide Chiaravalli, Gianluca Palli, Riccardo Monica, Jacopo Aleotti, Dario Lodi Rizzini</i>	
KINEMATIC STRUCTURES ESTIMATION ON THE RGB-D IMAGES.....	675
<i>Rafal Staszak, Milena Molska, Kamil Mlodzikowski, Justyna Ataman, Dominik Belter</i>	
LADYBUG. AN INTENSITY BASED LOCALIZATION BUG ALGORITHM.....	682
<i>Athanasios Lentzas, Dimitris Vrakas</i>	
PRELIMINARY STUDY ON ROLE OF FINITE-SIZED FOOT IN PUSH RECOVERY OF BIPED ROBOT IN SAGITTAL PLANE VIA STABILIZATION OF DIVERGENT COMPONENT OF MOTION.....	690
<i>Gyunghoon Park, Yonghwan Oh</i>	
INDUSTRIAL ROBOT PROGRAMMING METHODS: A SCOPING REVIEW.....	696
<i>Oliver Heimann, Jan Guhl</i>	
ROBOTIC WORKCELL FOR SOLE GRASPING IN FOOTWEAR MANUFACTURING.....	704
<i>Guillermo Oliver, Pablo Gil, Fernando Torres</i>	
SEMANTIC LOCAL PLANNING FOR MOBILE ROBOTS THROUGH PATH OPTIMIZATION SERVICES ON THE EDGE: A SCENARIO-BASED EVALUATION.....	711
<i>Tim Klaas, Jens Lambrecht, Eugen Funk</i>	
SEN3BOT NET: A META-SENSORS NETWORK TO ENABLE SMART FACTORIES IMPLEMENTATION.....	719
<i>Marina Indri, Fiorella Sibona, Pangcheng David Cen Cheng</i>	
THE DOUBLE PROPELLER DUCTED-FAN, AN UAV FOR SAFE INFRASTRUCTURE INSPECTION AND HUMAN-INTERACTION.....	727
<i>Andrea Bonci, Alice Cervellieri, Sauro Longhi, Giacomo Nabissi, Giuseppe Antonio Scala</i>	

VISUAL SERVOING AND IMPEDANCE CONTROL IN ROBOTIC MANIPULATORS FOR ON-ORBIT SERVICING.....	734
<i>Javier García, Andrés Rodríguez, Joaquín Estremera, Bruno Santamaria, Diego Gonzalez, Mikel Armendia</i>	

## **TT08 INTELLIGENT SENSORS, SENSOR NETWORKS, AND INFORMATION PROCESSING**

DESIGN CLASSIFICATION OF AGGREGATING SYSTEMS IN INTELLIGENT INFORMATION SYSTEM ARCHITECTURES.....	745
<i>Chris Paul Iatrou, Lukas Ketzel, Markus Graube, Martin Häfner, Leon Urbas</i>	
EFFICIENT CLASSIFICATION VIA PARTIAL CO-TRAINING FOR VIRTUAL METROLOGY.....	753
<i>Cuong Nguyen, Xin Li, Shawn Blanton, Xiang Li</i>	
PREDICTIVE MAINTENANCE WITH NOA: APPLICATION AND INSIGHTS FOR ROTATING EQUIPMENT.....	761
<i>Luise Rahm, Julius Lorenz, Valentin Khaydarov, Thomas Maywald, Thilo Glas, Leon Urbas</i>	
PROSUMER AND DEMAND-SIDE MANAGEMENT IMPACT ON RURAL COMMUNITIES' ENERGY BALANCE.....	768
<i>Simon Howind, Valentin Bauer, Alexander Wendt, Gerald Franzl, Thilo Sauter, Stefan Wilker</i>	
RSS-BASED LOCALIZATION FOR DIRECTIONAL ANTENNAS.....	774
<i>Anetta Nagy, Thomas Bigler, Albert Treytl, Roland Stenzl, Stefan Wilker, Thilo Sauter, Tu Wien</i>	

## **TT09 COMPLEX AUTOMATION SYSTEMS AND SYSTEMS ENGINEERING**

A NOVEL STRATEGY FOR BALANCING THE WORKLOAD OF INDUSTRIAL LINES BASED ON A GENETIC ALGORITHM.....	785
<i>Isiah Zaplana, Emanuela Cepolina, Fabrizio Faieta, Oronzo Lucia, Roberto Gagliardi, Khelifa Baizid, Mariapaola D'Imperio, Ferdinando Cannella</i>	
A PREDICTIVE-BASED MAINTENANCE APPROACH FOR ROLLING STOCKS VEHICLES.....	793
<i>Roberto Nappi, Gianluca Cutrera, Antonio Vigliotti, Giuseppe Franzè</i>	
A REGION-BASED APPROACH FOR STATE ESTIMATION OF TIMED AUTOMATA UNDER NO EVENT OBSERVATION.....	799
<i>Chao Gao, Dimitri Lefebvre, Carla Seatzu, Zhiwu Li, Alessandro Giua</i>	
A SIMULATION-BASED PROCESS MODEL FOR ANALYZING IMPACT OF MAINTENANCE ON PROFITABILITY.....	805
<i>Kai Schenkelberg, Ulrich Seidenberg, Fazel Ansari</i>	
ALLOCATION OF PPRS FOR THE PLANT PLANNING IN THE FINAL AUTOMOTIVE ASSEMBLY.....	813
<i>Jan Herzog, Hannes Röpke, Arndt Lüder</i>	
CLUSTER-BASED ENERGY LOAD PROFILING ON RESIDENTIAL SMART BUILDINGS.....	821
<i>Alkiviadis Savvopoulos, George Kalogeras, Christos Anagnostopoulos, Christos Alexakos, Spyros Sioutas, Athanasios P. Kalogeras</i>	

CRITICAL ANALYSIS OF THE SUITABILITY OF SURROGATE MODELS FOR FINITE ELEMENT METHOD APPLICATION IN CATALOG-BASED SUSPENSION BUSHING DESIGN .....	829
<i>Carlos Cernuda, Iñigo Llavori, Alexandru-Ciprian Zavoianu, Aitor Aguirre, Alaitz Zabala, Jon Plaza</i>	
DESIGN AND SIMULATION OF A BATTERY SWAPPING SYSTEM FOR ELECTRIC VEHICLES.....	837
<i>Emiliano Traini, Faveto Alberto, Giulia Bruno, Franco Lombardi</i>	
DIGITAL TECHNIQUES FOR ENERGY OPTIMIZATION IN A UNIVERSITY BUILDING: A CASE STUDY .....	844
<i>Luca Ferrarini, Riccardo Babini</i>	
DIGITAL TWIN FOR VERIFICATION AND VALIDATION OF INDUSTRIAL AUTOMATION SYSTEMS – A SURVEY .....	851
<i>Andreas Löcklin, Manuel Müller, Tobias Jung, Nasser Jazdi, Dustin White, Michael Weyrich</i>	
EFFICIENT TEST CASE GENERATION FROM PRODUCT AND PROCESS MODEL PROPERTIES AND PRECONDITIONS .....	859
<i>Kristof Meixner, L. Kathrein, D. Winkler, Arndt Lüder, Stefan Biffel</i>	
GENERATING INDUSTRY 4.0 ASSET ADMINISTRATION SHELLS WITH DATA FROM ENGINEERING DATA LOGISTICS.....	867
<i>Arndt Lüder, Anna-Kristin Behnert, Felix Rinker, Stefan Biffel</i>	
HOW TO PLAY TAG: A FORMALIZATION OF SEMANTIC INTEROPERABILITY TO CATCH SEMANTICS IN BUILDING AUTOMATION.....	875
<i>Bastian Wollschlaeger, Elke Eichenberg, Klaus Kabitzsch</i>	
LESSONS LEARNED FROM DEVELOPING INDUSTRIAL APPLICATIONS ACCORDING TO RAMI 4.0 BY APPLYING MODEL BASED SYSTEMS ENGINEERING .....	883
<i>Christoph Binder, Boris Brankovic, Christian Neureiter, Arndt Lüder</i>	
OPTIMIZATION OF PROCESS-AWARE ATTACK DETECTION FOR INDUSTRIAL CONTROL SYSTEMS SECURITY .....	889
<i>Franck Sicard, Estelle Hotellier, Javier Soto Pérez-Olivares, Eric Zamaï</i>	
TOWARDS A CONTRIBUTION TO THE EARLY V&V AND EVALUATION OF ARCHITECTURAL SOLUTIONS FOR NUCLEAR INFRASTRUCTURES PROJECT DELIVERY .....	897
<i>Jérémy Bourdon, Pierre Couturier, Vincent Chapurlat, Robert Plana, Victor Richet, Benjamin Baudouin</i>	
TRAVEL TIME MINIMIZATION AT ROUNDABOUTS FOR CONNECTED AND AUTOMATED VEHICLES.....	905
<i>Ovidiu Pauca, Constantin F. Caruntu</i>	
USING MULTI-AGENT SYSTEMS FOR DEMAND RESPONSE AGGREGATORS: A TECHNICAL IMPLEMENTATION.....	911
<i>Stefan Woltmann, Andre Coordes, Michael Stomberg, Julia Kittel</i>	

## **TT10 ARTIFICIAL INTELLIGENCE FOR CYBER PHYSICAL SYSTEMS IN AUTOMATION**

A CLASSIFICATION FRAMEWORK USING IMPERFECTLY LABELED DATA FOR MANUFACTURING APPLICATIONS.....	921
<i>Shuo Zhao, Xin Li, Ying-Chi Chen</i>	
A DEEP LEARNING APPROACH FOR WORK RELATED STRESS DETECTION FROM AUDIO STREAMS IN CYBER PHYSICAL ENVIRONMENTS.....	929
<i>Ishara Madhavi, Sadil Chamishka, Rashmika Nawaratne, Vishaka Nanayakkara, Damminda Alahakoon, Daswin De Silva</i>	
A SYSTEMATIC ASSESSMENT OF EMBEDDED NEURAL NETWORKS FOR OBJECT DETECTION.....	937
<i>Micaela Verucchi, Gianluca Brilli, Davide Sapienza, Mattia Verasani, Marco Arena, Francesco Gatti, Alessandro Capotondi, Roberto Cavicchioli, Marko Bertogna, Marco Solieri</i>	
ADAPT: AN AUTOMATIC DIAGNOSIS OF ACTIVITY AND PROCESSES IN AUTOMATION ENVIRONMENTS.....	945
<i>Igor Azkarate Fernández, Aitor Aguirre Ortuzar, Josu Uranga Andrés, Luka Eciolaza Echeverría</i>	
ANOMALY DETECTION BASED ON HISTOGRAM METHODOLOGY AND FACTOR ANALYSIS USING LIGHTGBM FOR COOLING SYSTEMS.....	952
<i>Tomu Yanabe, Hiroaki Nishi, Masahiro Hashimoto</i>	
CONTINUAL LEARNING OF FAULT PREDICTION FOR TURBOFAN ENGINES USING DEEP LEARNING WITH ELASTIC WEIGHT CONSOLIDATION.....	959
<i>Benjamin Maschler, Hannes Vietz, Nasser Jazdi, Michael Weyrich</i>	
FROM STIRRING TO MIXING: ARTIFICIAL INTELLIGENCE IN THE PROCESS INDUSTRY.....	967
<i>Valentin Khaydarov, Sebastian Heinze, Markus Graube, Andreas Knüpfer, Maximilian Knespel, Silke Merkelbach, Leon Urbas</i>	
ONTOLOGY-BASED SKILL DESCRIPTION LEARNING FOR FLEXIBLE PRODUCTION SYSTEMS.....	975
<i>Anna Himmelhuber, Stephan Grimm, Thomas Runkler, Sonja Zillner</i>	
TOWARDS OPTIMAL ASSEMBLY LINE ORDER SEQUENCING WITH REINFORCEMENT LEARNING: A CASE STUDY.....	982
<i>Saad Shafiq, Christoph Mayr-Dorn, Atif Mashkoor, Alexander Eged</i>	

## **WIP WIP01 INFORMATION TECHNOLOGY IN AUTOMATION**

A PROCESS TO DEVELOP LEAN BIG-DATA PLATFORM ARCHITECTURES FOR INDUSTRIAL MANUFACTURING CONTEXTS.....	993
<i>Marvin Illian, Simon Althoff, Holger Karl</i>	
A SOFTWARE MEASURE FOR IEC 61499 BASIC FUNCTION BLOCKS.....	997
<i>Lisa Sonnleithner, Alois Zoitl</i>	
ACCESS CONTROL MODEL FOR TIME SERIES DATABASES USING NGAC.....	1001
<i>Alex Chiquito, Ulf Bodin, Olov Schelén</i>	

AN APPROACH FOR DATA PIPELINE WITH DISTRIBUTED QUERY ENGINE FOR INDUSTRIAL APPLICATIONS .....	1005
<i>Arnab Ghosh Chowdhury, Marvin Illian, Lukasz Wisniewski, Jürgen Jasperneite</i>	
AUTOMATED DASHBOARD GENERATION FOR MACHINE TOOLS WITH OPC UA COMPATIBLE SENSORS .....	1009
<i>Garabet A. Topalian-Rivas, Jonas Wassermann, Mustafa Severengiz, Jörg Krüger</i>	
AUTOMATING THE DEVELOPMENT OF MACHINE SKILLS AND THEIR SEMANTIC DESCRIPTION .....	1013
<i>Aljosha Köcher, Constantin Hildebrandt, Birte Caesar, Jupiter Bakakeu, Jörn Peschke, André Scholz, Alexander Fay</i>	
AVOIDING YEAR 2038 PROBLEM ON 32-BIT LINUX BY REWINDING TIME ON CLOCK SYNCHRONIZATION .....	1019
<i>Ryo Okabe, Jun Yabuki, Masakatsu Toyama</i>	
CONTINUOUS INTEGRATION FOR VEHICLE SIMULATIONS .....	1023
<i>Stefan H. Reiterer, Sinan Balci, Desheng Fu, Martin Benedikt, Andreas Soppa, Helena Szczerbicka</i>	
DATA ACQUISITION APPROACHES FOR AI-SUPPORTED METAL PROCESSING .....	1027
<i>Bernhard Girsule, Gernot Rottermann, Christian Jandl, Mylene Kreiger, Thomas Moser, Patricia Fuchs</i>	
DETERMINISTIC TIME-SERIES JOINS FOR ASYNCHRONOUS HIGH-THROUGHPUT DATA STREAMS .....	1031
<i>Christoph Schranz, Peter Michael Jeremias</i>	
DIGITAL TWINS FOR MANUFACTURING USING UML AND BEHAVIORAL SPECIFICATIONS .....	1035
<i>Mohammad Azangoo, Amir Taherkordi, Jan Olaf Blech</i>	
FAULT HANDLING IN DISCRETE EVENT SYSTEMS APPLIED TO IEC 61499 .....	1039
<i>Herbert A. S. Leitão, Roberto S. U. Rosso, André B. Leal, Alois Zoitl</i>	
FEATURE-ORIENTED CONTROL PROGRAMMING .....	1043
<i>Niklas Fors, Alfred Theorin, Sven Gestegård Robertz, Görel Hedin</i>	
INTRODUCTION OF AN ARCHITECTURE FOR FLEXIBLE FUTURE PROCESS CONTROL SYSTEMS AS ENABLER FOR INDUSTRY 4.0 .....	1047
<i>Michael Gundall, Calvin Glas, Hans D. Schotten</i>	
KNOWLEDGE REPRESENTATION IN MODELING AND SIMULATION: A SURVEY FOR THE PRODUCTION AND LOGISTIC DOMAIN .....	1051
<i>Franz Georg Listl, Jan Fischer, Dagmar Beyer, Michael Weyrich</i>	
MODELLING PRODUCTION SYSTEM FAMILIES WITH AUTOMATIONML .....	1057
<i>Antonio Garmendia, Manuel Wimmer, Alexandra Mazak-Huemer, Esther Guerra, Juan De Lara</i>	
PERFORMANCE EVALUATION OF CONTAINERIZATION PLATFORMS FOR CONTROL AND MONITORING DEVICES .....	1061
<i>Harri Manninen, Vesa Jääskeläinen, Jan Olaf Blech</i>	

PREDICTION-BASED ASSEMBLY ASSISTANCE SYSTEM.....	1065
<i>Arpad Gellert, Stefan-Alexandru Precup, Bogdan-Constantin Pirvu, Constantin-Bala Zamfirescu</i>	
REQUIREMENTS FOR A DYNAMIC INTERFACE MODEL OF IEC 61499 FUNCTION BLOCKS.....	1069
<i>Bianca Wiesmayr, Alois Zoitl</i>	
TOWARDS A COMPREHENSIVE ARCHITECTURE FOR AUTONOMOUS ADAPTIVE MACHINES.....	1073
<i>Rainer Herzog, Stephanie Von Riegen, Lothar Hotz</i>	
TOWARDS A REFERENCE ARCHITECTURE FOR LEVERAGING MODEL REPOSITORIES FOR DIGITAL TWINS .....	1077
<i>Daniel Lehner, Sabine Wolny, Alexandra Mazak-Huemer, Manuel Wimmer</i>	
TOWARDS AUTOMATED GENERATION OF FUNCTION MODELS FROM P&IDS .....	1081
<i>Mengchu Song, Morten Lind</i>	
TOWARDS MODEL-BASED PERFORMABILITY EVALUATION OF PRODUCTION SYSTEMS.....	1085
<i>Alessio Bucaioni, Francesco Flammini, Mats Ahlskog</i>	

## **WIP WIP02 INDUSTRIAL COMMUNICATION TECHNOLOGIES AND SYSTEMS**

A COMPLIANCE TESTING STRUCTURE FOR IMPLEMENTATION OF INDUSTRY STANDARDS THROUGH OPC UA.....	1091
<i>Selvine G. Mathias, Sebastian Schmied, Daniel Großmann, Ralph Klaus Müller, Björn Mroß</i>	
A CONCEPT FOR WIRELESS NETWORK INTEGRATION IN PRODUCTION SYSTEM PLANNING.....	1095
<i>Petar Vukovic, Tobias Lechler, Jörg Franke</i>	
A PROFINET SIMULATOR FOR THE DIGITAL TWIN OF NETWORKED ELECTRICAL DRIVE SYSTEMS.....	1099
<i>Alberto Morato, Stefano Vitturi, Tommaso Fedullo, Giovanni Peserico, Federico Tramarin</i>	
A SIMULATION MODEL FOR INTEGRATING 5G INTO TIME SENSITIVE NETWORKING AS A TRANSPARENT BRIDGE.....	1103
<i>Lukas Martenvormfelde, Arne Neumann, Lukasz Wisniewski, Jürgen Jasperneite</i>	
AN APPROACH FOR AGGREGATION AND HISTORICIZATION OF PRODUCTION ENTITIES IN THE GRAPH .....	1107
<i>Sebastian Schmied, Daniel Großmann, Selvine G. Mathias, Ralph Klaus Mueller</i>	
ANALYSIS OF 5G-TSN INTEGRATION TO SUPPORT INDUSTRY 4.0.....	1111
<i>Ana Larrañaga, M. Carmen Lucas-Estañ, Imanol Martinez, Iñaki Val, Javier Gozalvez</i>	
EXTENDING MQTT-SN WITH REAL-TIME COMMUNICATION SERVICES.....	1115
<i>Fernando Fontes, Bruno Rocha, Alexandre Mota, Paulo Pedreiras, Valter Silva</i>	
FEASABILITY OF BLUETOOTH 5.0 CONNECTIONLESS COMMUNICATIONS FOR I2V APPLICATIONS.....	1119
<i>Juan Carlos García Ortiz, Javier Silvestre-Blanes, Víctor Sempere-Paya, Rubén Ponce Tortajada</i>	

FLEXIBLE SAFETY SYSTEMS FOR SMART MANUFACTURING .....	1123
<i>Dieter Etz, Thomas Frühwirth, Wolfgang Kastner</i>	
IMPLEMENTATION ASPECTS OF MULTI-LEVEL FRAME PREEMPTION IN TSN.....	1127
<i>Mladen Knezic, Milos Kovacevic, Zeljko Ivanovic</i>	
INITIATING AN IES BASED TECHNICAL FRAMEWORK ON LOCAL ENERGY COMMUNITIES.....	1131
<i>Gerald Franzl, Andrija Goranovic, Stefan Wilker, Thilo Sauter, Albert Treytl</i>	
PEG-LDPC CODING FOR CRITICAL COMMUNICATIONS IN FACTORY AUTOMATION .....	1135
<i>L. Fanari, E. Iradier, J. Montalban, P. Angueira, Óscar Seijo, Iñaki Val</i>	
RATE ADAPTATION BY REINFORCEMENT LEARNING FOR WI-FI INDUSTRIAL NETWORKS.....	1139
<i>Giovanni Peserico, Tommaso Fedullo, Alberto Morato, Stefano Vitturi, Federico Tramarin</i>	
REAL-TIME INDUSTRIAL COMMUNICATION BY USING OPC UA FIELD LEVEL COMMUNICATION .....	1143
<i>Santosh Kumar Panda, Mainak Majumder, Lukasz Wisniewski, Jurgen Jasperneite</i>	
STANDARDIZATION OF EDGE CONFIGURATION .....	1147
<i>Markus Rentschler, Dominik Rohrmus, Ulrich Löwen, Andreas Graf Gatterburg, Bernd Vojanec, Alexander Willner</i>	
TOWARDS DATA SOVEREIGNTY OF ASSET ADMINISTRATION SHELLS ACROSS VALUE ADDED CHAINS.....	1151
<i>Magnus Redeker, Sören Volgmann, Florian Pethig, Johannes Kalhoff</i>	
TOWARDS TIME-SENSITIVE NETWORKING IN HETEROGENEOUS PLATFORMS WITH VIRTUALIZATION .....	1155
<i>Luca Leonardi, Lucia Lo Bello, Gaetano Patti</i>	
VALIDATION OF DYNAMIC INTEROPERABILITY AND VIRTUAL COMMISSIONING OF PRODUCTION EQUIPMENT IN EARLY DEVELOPMENT STAGES.....	1159
<i>Ralph Klaus Müller, Daniel Großmann, Sebastian Schmied, Selvine G. Mathias</i>	
<b><u>WIP WIP03 REAL TIME AND NETWORKED EMBEDDED SYSTEMS</u></b>	
CONSIDERING SAFETY REQUIREMENTS IN DESIGN PHASE OF FUTURE E/E ARCHITECTURES .....	1165
<i>Hadi Askaripoor, Morteza Hashemi Farzaneh, Alois Knoll</i>	
ECONOMIC DESIGN FOR A RELIABLE PROSTHETIC ARM .....	1169
<i>Mayar M. Medhat, Gehad I. Alkady, Ramez M. Daoud, Hany M. Elsayed, Mustafa Arafa, Hassanein H. Amer</i>	
IDENTIFICATION OF EXECUTION MODES FOR REAL-TIME SYSTEMS USING CLUSTER ANALYSIS .....	1173
<i>Kevin Zagalo, Liliana Cucu-Grosjean, Avner Bar-Hen</i>	
VERIFICATION OF SYMBOLIC DISTRIBUTED PROTOCOLS FOR NETWORKED EMBEDDED DEVICES .....	1177
<i>Andrea Augello, Rosolino D'Antoni, Salvatore Gaglio, Giuseppe Lo Re, Gloria Martorella, Daniele Peri</i>	

## **WIP WIP04 AUTOMATED MANUFACTURING SYSTEMS**

A NEIGHBORHOOD SELECTION STRATEGY FOR PRODUCTION SCHEDULING USING CP AND LNS.....	1183
<i>Max Åstrand, Mikael Johansson</i>	
CALIBRATING INDUSTRIAL ROBOTS WITH ABSOLUTE POSITION TRACKING SYSTEM.....	1187
<i>Petr Novák, Šimon Stoszek, Jirí Vyskocil</i>	
IEC 61131-3 FRONT-END FOR THE LLVM COMPILER FAMILY.....	1191
<i>Tiago Catalão, Mário De Sousa</i>	
IMPLEMENTATION OF PLC CONTROLLER CONNECTED GAZEBO-ROS TO SUPPORT IEC 61131-3.....	1195
<i>Yungjun Kim, Seung-Yong Lee, Sun Lim</i>	

## **WIP WIP05 INDUSTRIAL CONTROL**

AUTOMATIZED METHOD OF MOMENTS TO ESTIMATE PROCESS MODEL OF DIESEL ENGINE DYNAMICS.....	1201
<i>Tuomo Lindh, Niko Nevaranta</i>	
APPLICATION OF A MBSE APPROACH TO IMPROVE THE DYNAMIC PERFORMANCE OF A SCARA ROBOT.....	1205
<i>Diego Gonzalez, Javier Arenas, Olivier Schmidt, Mikel Armendia</i>	
INDUSTRY 4.0: REAL-TIME MONITORING OF AN INJECTION MOLDING TOOL FOR SMART PREDICTIVE MAINTENANCE.....	1209
<i>Eurico Esteves Moreira, Filipe Serra Alves, Marco Martins, Gabriel Ribeiro, António Pina, Diogo E. Aguiam, Edoardo Sotgiu, Elisabete P. Fernandes, João Gaspar</i>	
MULTI-AGENT CONTEXT-AWARE DYNAMIC-SCHEDULING FOR LARGE-SCALE PROCESSING NETWORKS.....	1213
<i>Shuhui Qu, Yirong Chen, Jurgen Jasperneite, Michael D. Lepech, Jie Wang</i>	
ONLINE IDENTIFICATION OF DYNAMIC RESISTANCE AND INDUCTANCE IN ACTIVE MAGNETIC BEARING APPLICATION USING CURRENT OVERSAMPLING.....	1217
<i>Niko Nevaranta, Teemu Sillanpää</i>	

## **WIP WIP06 COMPUTER VISION AND HUMAN-MACHINE INTERACTION IN INDUSTRIAL AND FACTORY AUTOMATION**

3D MAPPING OF X-RAY IMAGES IN INSPECTIONS OF AEROSPACE PARTS.....	1223
<i>Daniele Evangelista, Matteo Terreran, Alberto Pretto, Michele Moro, Carlo Ferrari, Emanuele Menegatti</i>	
A TEMPLATE-FREE OBJECT MOTION ESTIMATION METHOD FOR INDUSTRIAL VISION SYSTEM IN ALIGNING MACHINE.....	1227
<i>Qiaochu Zhao, Itetsu Taniguchi, Takao Onoye</i>	
AN EXPERT REVIEW ON THE APPLICABILITY OF BLOCKLY FOR INDUSTRIAL ROBOT PROGRAMMING.....	1231
<i>Mario Winterer, Christian Salomon, Jessica Köberle, Rudolf Ramler, Markus Schittengruber</i>	



AUTOMATED OPTICAL INSPECTION USING ANOMALY DETECTION AND UNSUPERVISED DEFECT CLUSTERING .....	1235
<i>Jan Lehr, Alik Sargsyan, Martin Pape, Jan Philipps, Jörg Krüger</i>	
CENTROID LOSS FOR WEAKLY-SUPERVISED SEMANTIC SEGMENTATION IN A QUALITY-CONTROL APPLICATION .....	1239
<i>Kai Yao, Alberto Ortiz, Francisco Bonnin-Pascual</i>	
DISTRIBUTED ARCHITECTURE FOR A SMART LEDS DISPLAY SYSTEM BASED ON MQTT.....	1243
<i>Tullio Facchinetti, Andrea Bonandin, Guido Benetti, Daniele De Martini</i>	
EFFICIENT INTEGRATED CIRCUITS CHARACTERIZATION THROUGH COMPUTER VISION ASSISTANCE .....	1247
<i>Raphael Abele, Jean-Luc Damoiseaux, Daniele Fronte, Pierre-Yvan Liardet, Jean-Marc Boi, Djamal Merad</i>	
IMPROVING USABILITY OF SEARCH AND RESCUE DECISION SUPPORT SYSTEMS: WARA-PS CASE STUDY.....	1251
<i>Veronika Domova, Erik Gärtner, Fredrik Prántare, Martin Pallin, Johan Källström, Nikita Korzhitskii</i>	
OBJECT CLASSIFICATION ON A HIGH-RESOLUTION TACTILE FLOOR FOR HUMAN-ROBOT COLLABORATION.....	1255
<i>Tobias Peter, Simone Bexten, Veit Müller, Viola Hauffe, Norbert Elkmann</i>	
PROJECTIVE- AR ASSISTANCE SYSTEM FOR SHARED HUMAN-ROBOT WORKPLACES IN INDUSTRIAL APPLICATIONS.....	1259
<i>Christian Vogel, Erik Schulenburg, Norbert Elkmann</i>	
TOWARDS A 3D SCANNING/VR-BASED PRODUCT INSPECTION STATION .....	1263
<i>Mohammad Azangoo, Jan Olaf Blech, Udayanto Dwi Atmojo, Valeriy Vyatkin, Kamal Dhakal, Mikael Eriksson, Miika Lehtimäki, Jonathan Leinola, Pyry Pietarila</i>	
TOWARDS A MODULAR ARCHITECTURE FOR INDUSTRIAL HMIS.....	1267
<i>Muddasir Shakil, Alois Zoitl</i>	
 <b><u>WIP WIP07 INTELLIGENT ROBOTS AND SYSTEMS</u></b>	
A FLEXIBLE SOFTWARE ARCHITECTURE FOR ROBOTIC INDUSTRIAL APPLICATIONS .....	1273
<i>Angelo Rendiniello, Alberto Remus, Ines Sorrentino, Prajval Kumar Murali, Daniele Pucci, Marco Maggiali, Lorenzo Natale, Silvio Traversaro, Enrico Villagrossi, Andrea Polo, Alessandro Ardesi</i>	
A LIGHTWEIGHT PERCEPTION MODULE FOR PLANNING PURPOSES.....	1277
<i>Muhayy Ud Din, Jan Rosell, Sohail Bukhari, Mansoor Ahmad, Wajahat M Qazi</i>	
AUTONOMOUS REAL-TIME GAUGE READING IN AN INDUSTRIAL ENVIRONMENT.....	1281
<i>Stefan Dumberger, Raimund Edlinger, Roman Froschauer</i>	
FLEXIBLY CONFIGURING TASK AND MOTION PLANNING PROBLEMS FOR MOBILE MANIPULATORS*.....	1285
<i>Siddhant Saoji, Jan Rosell</i>	

HARD REAL TIME EMBEDDED SOLUTION FOR EXECUTION TIME ANALYSIS OF NON-LINEAR CONTROL LAWS .....	1289
<i>Andrea Bonci, Giacomo Nabissi, Giuseppe Antonio Scala</i>	
INTEGRATION OF AUTONOMOUS TASK PLANNING INTO RECONFIGURABLE SKILL-BASED INDUSTRIAL ROBOTS .....	1293
<i>Lisa Heuss, Gunther Reinhart</i>	
IOT AND FOG ANALYTICS FOR INDUSTRIAL ROBOT APPLICATIONS .....	1297
<i>Anders Lager, Alessandro Papadopoulos, Thomas Nolte</i>	
LOW-COST EMBEDDED VISION FOR INDUSTRIAL ROBOTS: A MODULAR END-OF-ARM CONCEPT .....	1301
<i>Ole Kroeger, Felix Wollschläger, Jörg Krüger</i>	
PROCESS SIMULATION USING PHYSICAL JOINING MODELS FOR LEARNING ROBOT-BASED ASSEMBLY TASKS .....	1305
<i>Arik Lämmle, Balázs András Bálint</i>	
SEMANTIC SEGMENTATION OF STREET SCENES USING A HYBRIDISATION BETWEEN 3D FEATURES AND CNNs .....	1309
<i>Lavinia Ferariu, Teodor-Andrei Sauciuc</i>	
TOWARDS ROBUST LOOP CLOSURE DETECTION IN WEAKLY TEXTURED ENVIRONMENTS USING POINTS AND LINES .....	1313
<i>Joan P. Company-Corcoles, Emilio Garcia-Fidalgo, Alberto Ortiz</i>	
TRAJECTORY PREDICTION OF HUMANS IN FACTORIES AND WAREHOUSES WITH REAL-TIME LOCATING SYSTEMS .....	1317
<i>Andreas Löcklin, Tamás Ruppert, László Jakab, Robert Libert, Nasser Jazdi, Michael Weyrich</i>	
TRUST AND REPUTATION IN HETEROGENEOUS MULTI-AGENT SYSTEM FOR PRODUCTION PROCESSES BASED ON THE MARKET ECONOMY .....	1321
<i>Jana Jost, Benedikt Mättig</i>	
 <b><u>WIP WIP08 INTELLIGENT SENSORS, SENSOR NETWORKS, AND INFORMATION PROCESSING</u></b>	
A WIRELESS NETWORK ARCHITECTURE FOR MONITORING OF HOSPITALIZED PATIENTS .....	1327
<i>Luca Leonardi, Lucia Lo Bello, Gaetano Patti</i>	
AN IIOT SYSTEM TO MONITOR 3D-PRINTED ARTIFACTS VIA LORAWAN EMBEDDED SENSORS .....	1331
<i>Luca Trevisan, Stefano Vitturi, Federico Tramarin, Alberto Morato</i>	
DATA-DRIVEN SOFT SENSOR FOR CONTINUOUS PRODUCTION MONITORING: AN APPLICATION TO PAPER STRENGTH .....	1335
<i>Davide Raffaele, Tomas Ondruch</i>	
ENABLING IOT CONNECTIVITY FOR MODBUSTCP SENSORS .....	1339
<i>Tony John, Mathias Vorbröcker</i>	

IMPLEMENTATION OF AN ENERGY HARVESTING POWERED ORIENTATION ESTIMATION SENSOR .....	1343
<i>Adrian Osterwind, Hilko Meyer, Johannes Meyer, Marcel Maas, Gerd Von Colln</i>	
MEASURING TEMPERATURE DISTRIBUTIONS ALONG HEAT EXCHANGER PIPES IN PETROCHEMICAL PROCESSES.....	1347
<i>Samir Cerimovic, Thilo Sauter, Albert Treytl, Rudolf Stachl, Joachim Binder, Petar Basic, Franz Mehofer, Ernst Schober, Sherry Rinsche</i>	
MONTE CARLO SIMULATIONS FOR PROBABILISTIC VALIDATION OF CONSEQUENCE REASONING FROM MULTILEVEL FLOW MODELLING.....	1351
<i>Emil K. Nielsen, Denis Kirchhübel, Thomas M. Jørgensen</i>	
NFC FOR POWERING SENSORS IN CONCRETE.....	1355
<i>Thomas Bigler, Gábor Kovács, Albert Treytl, Roman Windl</i>	
ON-BOARD ENERGY CONSUMPTION ASSESSMENT FOR SYMBOLIC EXECUTION MODELS ON EMBEDDED DEVICES .....	1359
<i>Antonio Bordonaro, Salvatore Gaglio, Giuseppe Lo Re, Gloria Martorella, Daniele Peri</i>	
SENSOR FAILURE RECOVERY USING MULTI LOOK-BACK LSTM ALGORITHM IN INDUSTRIAL INTERNET OF THINGS.....	1363
<i>Ade Pitra Hermawan, Dong-Seong Kim, Jae-Min Lee</i>	
SIDE-CHANNEL WATERMARKING FOR LORAWAN USING ROBUST INTER-PACKET TIMING .....	1367
<i>Thomas Bigler, Albert Treytl, Thilo Sauter</i>	

## **WIP WIP09 COMPLEX AUTOMATION SYSTEMS AND SYSTEMS ENGINEERING**

ANALYSIS OF DISTRIBUTED CONTROL SYSTEMS USING TIMED AUTOMATA WITH GUARDS AND DIOID ALGEBRA .....	1373
<i>Fatima Ait Oumeziane, Alain Ourghanlian, Said Amari</i>	
ARROWHEAD DATAMANAGER INTEGRATION WITH ECLIPSE 4DIAC ENVIRONMENT .....	1377
<i>Marco Romanato, Dmitrii Drozdov, Sandeep Patil, Jerker Delsing, Valeriy Vyatkin</i>	
DISTRIBUTED FUNCTIONAL SAFETY FOR MODULAR PROCESS PLANTS.....	1381
<i>Anselm Klose, Florian Pelzer, Mike Barth, Rainer Drath, Rainer Oehlert, Silvia Vélez León, Alexander Horch, Christoph Kotsch, Jochen Knab, Bernhard Gut, Hartmut Manske, Leon Urbas</i>	
EXTENDING MULTILEVEL FLOW MODELING WITH ROLES FOR CONDITION MONITORING AND PREVENTIVE MAINTENANCE .....	1385
<i>Jing Wu, Morten Lind, Ilmar Santos</i>	
KALIX: A JAVA 11 LIBRARY FOR DEVELOPING ECLIPSE ARROWHEAD SYSTEM-OF-SYSTEMS.....	1389
<i>Emanuel Palm, Ulf Bodin, Olov Schelén</i>	
MANAGEMENT OF A COMPANY-WIDE MODULE POOL FOR MODULAR PLANTS *.....	1393
<i>Michael Vach, Katharina Stark, Marcel Dix, Mario Hoernicke</i>	
MODELCONDUCTOR: AN ON-LINE DATA MANAGEMENT ARCHITECTURE FOR DIGITAL TWINS .....	1397
<i>Panu Aho, Eero Immonen</i>	

PAVING PATHWAYS FOR DIGITALIZATION IN ENGINEERING: COMMON CONCEPTS IN ENGINEERING CHAINS .....	1401
<i>Arndt Lüder, Laura Baumann, Anna-Kristin Behnert, Felix Rinker, Stefan Biffel</i>	
TOWARDS A DOMAIN-SPECIFIC LANGUAGE FOR PRODUCT-PROCESS-RESOURCE CONSTRAINTS .....	1405
<i>Kristof Meixner, J. Decker, H. Marcher, Arndt Lüder, Stefan Biffel</i>	
TOWARDS IMPLEMENTATION OF INTEROPERABLE SMART SENSOR SERVICES IN IEC 61499 FOR PROCESS AUTOMATION .....	1409
<i>Pranay Jhunjhunwala, Udayanto Dwi Atmojo, Valeriy Vyatkin</i>	
TOWARDS MODEL CONSISTENCY REPRESENTATIONS IN A MULTI-DISCIPLINARY ENGINEERING NETWORK .....	1413
<i>Dietmar Winkler, Arndt Lüder, K. Meixner, F. Rinker, Stefan Biffel</i>	
<b><u>WIP WIP10 ARTIFICIAL INTELLIGENCE FOR CYBER PHYSICAL SYSTEMS IN AUTOMATION</u></b>	
ANALYSIS OF MACHINE LEARNING BASED CONDITION MONITORING SCHEMES APPLIED TO COMPLEX ELECTROMECHANICAL SYSTEMS .....	1419
<i>Francisco Arellano-Espitia, Artvin Darien Gonzalez-Abreu, Miguel Delgado Prieto, Juan José Saucedo-Dorantes, Roque Alfredo Osornio-Rios</i>	
AUTOMATED DETECTION OF PRODUCTION CYCLES IN PRODUCTION PLANTS USING MACHINE LEARNING .....	1423
<i>Andreas Bunte, Henrik Ressler, Natalia Moriz</i>	
DEEP LEARNING BASED CONDITION MONITORING APPROACH APPLIED TO POWER QUALITY .....	1427
<i>Artvin-Darien Gonzalez-Abreu, Juan-Jose Saucedo-Dorantes, Roque-Alfredo Osornio-Rios, Francisco Arellano-Espitia, Miguel Delgado-Prieto</i>	
DEEPWIND: AN ACCURATE WIND TURBINE CONDITION MONITORING FRAMEWORK VIA DEEP LEARNING ON EMBEDDED PLATFORMS .....	1431
<i>Hassan Ghasemzadeh Mohammadi, Rahil Arshad, Sneha Rautmare, Suraj Manjunatha, Maurice Kuschel, Felix Paul Jentsch, Marco Platzner, Alexander Boschmann, Dirk Schollbach</i>	
DYNAMIC CONTEXT MODELING FOR CYBER-PHYSICAL SYSTEMS APPLIED TO A PILL DISPENSER .....	1435
<i>Nada Sahlab, Nasser Jazdi, Michael Weyrich</i>	
KNOWLEDGE-BASED GENERATION OF A PLANT-SPECIFIC REINFORCEMENT LEARNING FRAMEWORK FOR ENERGY REDUCTION OF PRODUCTION PLANTS .....	1439
<i>Elisabeth Schmidl, Eva Fischer, Matthias Wenk, Jörg Franke</i>	
AGENT-BASED DECENTRALISED ARCHITECTURE FOR MULTI-STAGE AND INTEGRATED SCHEDULING .....	1443
<i>Felix Gehlhoff, Alexander Fay</i>	
REMAINING USEFUL LIFETIME ESTIMATION WITH SOBOLEV TRAINING .....	1447
<i>Gavneet Singh Chadha, S M Nazmus Sakeib, Andreas Schwung</i>	

TOWARDS DATA-DRIVEN MALFUNCTIONING DETECTION IN PUBLIC AND INDUSTRIAL POWER GRIDS .....	1451
<i>David Fellner, Helfried Brunner, Thomas I. Strasser, Wolfgang Kastner</i>	

TOWARDS REAL-TIME PROCESS MONITORING AND MACHINE LEARNING FOR MANUFACTURING COMPOSITE STRUCTURES .....	1455
<i>Simon Stieber, Alwin Hoffmann, Alexander Schiendorfer, Wolfgang Reif, Matthias Beyrle, Jan Faber, Michaela Richter, Markus Sause</i>	

## **WS01 4TH INTERNATIONAL WORKSHOP ON ROBOTICS TECHNOLOGY TRANSFER - RTT2020**

AUGMENTED REALITY FOR ROBOT CONTROL IN LOW-COST AUTOMATION CONTEXT AND IOT .....	1461
<i>Gustavo Caiza, Pablo Bonilla-Vasconez, Carlos A. Garcia, Marcelo V. Garcia</i>	

AUTOMATIZED INSERTION OF MULTIPOLAR ELECTRIC PLUGS BY MEANS OF FORCE CONTROLLED INDUSTRIAL ROBOTS .....	1465
<i>Michael Ortner, Stefan Gadringer, Hubert Gattringer, Andreas Mueller, Ronald Naderer</i>	

ONLINE SUPERVISED GLOBAL PATH PLANNING FOR AMRS WITH HUMAN-OBSTACLE AVOIDANCE .....	1473
<i>Marina Indri, Fiorella Sibona, Pangcheng David Cen Cheng, Corrado Possieri</i>	

TOWARDS DIGITAL TWINS FOR INDUSTRIAL ASSEMBLY - IMPROVING ROBOT SOLUTIONS BY INTUITIVE USER GUIDANCE AND ROBOT PROGRAMMING .....	1480
<i>Lars Carøe Sørensen, Simon Mathiesen, Ralf Waspe, Christian Schlette</i>	

## **WS02 ROBOT-BASED INSPECTION SYSTEMS AND POST-PROCESSING TOOLS**

ACCURATE IDENTIFICATION OF 3D POSE THROUGH REPROJECTION ONTO A SINGLE IMAGE FROM MASK-RCNN CONTOUR.....	1487
<i>Gabriele Baris, Carlo Alberto Avizzano</i>	

ASSESSMENT OF SHIP ROBOTIC INSPECTIONS .....	1495
<i>Laura Poggi, Cesare Mario Rizzo, Tomaso Gaggero, Marco Gaiotti, Enrico Ravina</i>	

EVALUATION OF A SKILL-BASED CONTROL ARCHITECTURE FOR A VISUAL INSPECTION-ORIENTED AERIAL PLATFORM.....	1503
<i>Emilio Garcia-Fidalgo, Francisco Bonnin-Pascual, Joan P. Company-Corcoles, Alberto Ortiz</i>	

KNOWLEDGE-BASED SERVICE-ORIENTED SYSTEM FOR THE AUTOMATED PROGRAMMING OF ROBOT-BASED INSPECTION SYSTEMS .....	1511
<i>Alejandro Magaña, Silvia Gebel, Philipp Bauer, Gunther Reinhart</i>	

MAV TELE-OPERATION CONSTRAINED ON VIRTUAL SURFACES FOR INSPECTION OF INFRASTRUCTURES.....	1519
<i>Florian Dietrich, Julien Marzat, Martial Sanfourche, Sylvain Bertrand, Anthelme Bernard-Brunel, Alexandre Eudes</i>	

ROBOTICS TECHNOLOGY FOR INSPECTION OF SHIPS .....	1526
<i>Enrico Carrara, Alessandro Grasso</i>	

## **SS01 INDUSTRIAL CYBERSECURITY METHODS AND TECHNOLOGIES**

AN ANALYSIS OF BLACK ENERGY 3, CRASHOVERRIDE, AND TRISIS, THREE MALWARE APPROACHES TARGETING OPERATIONAL TECHNOLOGY SYSTEMS .....	1537
<i>Marcus Geiger, Jochen Bauer, Michael Masuch, Jörg Franke</i>	
APPLICABILITY OF SECURITY STANDARDS FOR OPERATIONAL TECHNOLOGY BY SMES AND LARGE ENTERPRISES.....	1544
<i>Patrick Wagner, Gerhard Hansch, Christoph Konrad, Karl-Heinz John, Jochen Bauer, Jörg Franke</i>	
ATTACK DETECTION IN CYBER-PHYSICAL PRODUCTION SYSTEMS USING THE DETERMINISTIC DENDRITIC CELL ALGORITHM .....	1552
<i>Rui Pinto, Gil Gonçalves, Eduardo Tovar, Jerker Delsing</i>	
BLOCKCHAIN TECHNOLOGIES FOR IOT APPLICATIONS: USE-CASES AND LIMITATIONS .....	1560
<i>Emanuel Vieira, Joaquim Ferreira, Paulo C. Bartolomeu</i>	

## **SS02 CHALLENGES OF MACHINE LEARNING IN INTELLIGENT TECHNICAL SYSTEMS**

A REDUNDANCY METRIC BASED ON THE FRAMEWORK OF POSSIBILITY THEORY FOR TECHNICAL SYSTEMS.....	1571
<i>Christoph-Alexander Holst, Volker Lohweg</i>	
ADAPTIVE DIMENSIONALITY REDUCTION FOR LOCAL PRINCIPAL COMPONENT ANALYSIS .....	1579
<i>Nico Migenda, Wolfram Schenck</i>	
DISCUSSION OF USING MACHINE LEARNING FOR SAFETY PURPOSES IN HUMAN DETECTION.....	1587
<i>Simone Bexten, José Saenz, Christoph Walter, Julian-Benedikt Scholle, Norbert Elkmann</i>	
INCORPORATION OF EXPERT KNOWLEDGE FOR LEARNING ROBOTIC ASSEMBLY TASKS .....	1594
<i>Marco Braun, Sebastian Wrede</i>	
INCREMENTAL LATIN HYPERCUBE ADDITIVE DESIGN FOR LOLIMOT.....	1602
<i>Tim Voigt, Martin Kohlhase, Oliver Nelles</i>	
MACHINE LEARNING-BASED UNBALANCE DETECTION OF A ROTATING SHAFT USING VIBRATION DATA.....	1610
<i>Oliver Mey, Willi Neudeck, André Schneider, Olaf Enge-Rosenblatt</i>	

## **SS03 INDUSTRIAL INTERNET FOR THE FACTORIES OF THE FUTURE**

A FRAMEWORK FOR VIRTUALIZING TIME-AWARE SHAPER USING HIGH PERFORMANCE NFV.....	1621
<i>Waseem Mandarawi, Hamza Chahed, Hermann De Meer</i>	

CONFIGURATION SOLUTION FOR TSN-BASED INDUSTRIAL NETWORKS UTILIZING SDN AND OPC UA.....	1629
<i>Thomas Kobzan, Immanuel Blöcher, Maximilian Hendel, Simon Althoff, Alissa Gerhard, Sebastian Schriegel, Jürgen Jasperneite</i>	

HYS-R: A HYBRID SUBSCRIPTION-RECOVERY METHOD FOR DOWNLINK CONNECTIVITY IN 6TISCH NETWORKS.....	1637
<i>Hossam Farag, Patrik Österberg, Mikael Gidlund</i>	

TOWARDS AUTOMATED SECURITY EVALUATION WITHIN THE INDUSTRIAL REFERENCE ARCHITECTURE.....	1644
<i>Marco Ehrlich, Martin Gergeleit, Henning Trsek, Georg Lukas</i>	

WORST-CASE DELAY SLICING FOR TIME-SENSITIVE APPLICATIONS IN SOFTWAREZED INDUSTRIAL NETWORKS.....	1652
<i>Frimpong Ansah, Jürgen Rottmeier, Andreas Zirkler, Hermann De Meer</i>	

### **SS04 SENSEI - SKILL BASED SYSTEMS ENGINEERING**

A FORMAL CAPABILITY AND SKILL MODEL FOR USE IN PLUG AND PRODUCE SCENARIOS.....	1663
<i>Aljosha Köcher, Constantin Hildebrandt, Luis Miguel Vieira Da Silva, Alexander Fay</i>	

A GENERIC APPROACH FOR THE INDUSTRIAL APPLICATION OF SKILL-BASED ENGINEERING USING OPC UA .....	1671
<i>Fabian Spitzer, René Lindorfer, Roman Froschauer, Michael Hofmann, Markus Ikeda</i>	

AN ONTOLOGY-BASED METAMODEL FOR CAPABILITY DESCRIPTIONS .....	1679
<i>Michael Weser, Jürgen Bock, Siwara Schmitt, Alexander Perzylo, Kathrin Evers</i>	

MODELING EXPERT KNOWLEDGE FOR OPTIMAL CPPS RESOURCE SELECTION FOR A PRODUCT PORTFOLIO .....	1687
<i>Kristof Meixner, Arndt Lüder, Jan Herzog, Hannes Röpke, Stefan Biffl</i>	

### **SS06 ADAPTIVE AND RECONFIGURABLE CYBER-PHYSICAL SYSTEMS**

NETWORK FAULT TOLERANCE BY MEANS OF DIVERSE PHYSICAL LAYERS.....	1697
<i>Pablo Gutiérrez Peón, Wilfried Steiner, Elisabeth Uhlemann</i>	

RECONFIGURABLE CYBER-PHYSICAL SYSTEM FOR LIFESTYLE VIDEO-MONITORING VIA DEEP LEARNING.....	1705
<i>Daniel Deniz, Francisco Barranco, Juan Isern, Eduardo Ros</i>	

RECONFIGURING TDMA COMMUNICATIONS FOR DYNAMIC FORMATION OF VEHICLE PLATOONS .....	1713
<i>Aqsa Aslam, Frederico Santos, Luis Almeida</i>	

TOWARDS A PROGRAMMING PARADIGM FOR RECONFIGURABLE COMPUTING: ASYNCHRONOUS GRAPH PROGRAMMING.....	1721
<i>Joshua Fryer, Paulo Garcia</i>	

**SS07 REFURBISHMENT AND RE-MANUFACTURING OF MACHINERY IN CYBER-PHYSICAL PRODUCTION SYSTEMS**

TOWARDS SMART REMANUFACTURING AND MAINTENANCE OF MACHINERY - REVIEW OF AUTOMATED INSPECTION, CONDITION MONITORING AND PRODUCTION OPTIMISATION..... 1731  
*Zezhong Wang, Yuchun Xu, Xianghong Ma, Gareth Thomson*

**SS09 ARTIFICIAL INTELLIGENCE ON THE ENERGY 4.0**

RENEWABLE ENERGY SOURCE AND STORAGE SYSTEMS SIZING OPTIMIZATION FOR INDUSTRIAL PROSUMERS ..... 1741  
*Eva M. Urbano, Victor Martinez-Viol, Konstantinos Kampouropoulos, Luis Romeral*

SUPPORT VECTOR MACHINE BASED NOVELTY DETECTION AND FDD FRAMEWORK APPLIED TO BUILDING AHU SYSTEMS..... 1749  
*Victor Martinez-Viol, Eva M. Urbano, Konstantinos Kampouropoulos, Miguel Delgado-Prieto, Luis Romeral*

**SS10 ROLES OF DIGITAL TWIN IN INDUSTRY 4.0**

DYNAMIC PROCESS PLANNING USING DIGITAL TWINS AND REINFORCEMENT LEARNING..... 1757  
*Zai Müller-Zhang, Pablo Oliveira Antonino, Thomas Kuhn*

INFORMATION MODEL OF A DIGITAL PROCESS TWIN FOR MACHINING PROCESSES..... 1765  
*Birte Caesar, Albrecht Hänel, Eric Wenkler, Christian Corinth, Steffen Ihlenfeldt, Alexander Fay*

INTRODUCTION OF A COMPREHENSIVE STRUCTURE MODEL FOR THE DIGITAL TWIN IN MANUFACTURING ..... 1773  
*Tobias Lechler, Jonathan Fuchs, Martin Sjarov, Matthias Brossog, Andreas Selmaier, Florian Faltus, Toni Donhauser, Jörg Franke*

THE DESIGN OF A DIGITAL-TWIN FOR PREDICTIVE MAINTENANCE..... 1781  
*Stefano Centomo, Nicola Dall’Ora, Franco Fummi*

THE DIGITAL TWIN CONCEPT IN INDUSTRY – A REVIEW AND SYSTEMATIZATION..... 1789  
*Martin Sjarov, Tobias Lechler, Jonathan Fuchs, Matthias Brossog, Andreas Selmaier, Florian Faltus, Toni Donhauser, Jörg Franke*

**SS11 AI, MACHINE LEARNING AND FORMAL METHODS FOR SAFE AND SECURE REAL-TIME CYBER-PHYSICAL SYSTEMS**

ANALYTIC METHOD FOR AUTOMATIC TEST CASE GENERATION FOR FUNCTION BLOCK DIAGRAM ..... 1799  
*Tomáš Ausberger, Karel Kubíček, Pavla Medvecová, Tomáš Myslivec, Milan Štetina*

MODEL CHECKING APPLICATION ON FUNCTION BLOCK DIAGRAM MODEL..... 1807  
*Tomáš Ausberger, Karel Kubíček, Pavla Medvecová, Tomáš Myslivec, Milan Štetina*



RIGOROUS MACHINE LEARNING FOR SECURE AND AUTONOMOUS CYBER  
PHYSICAL SYSTEMS..... 1815  
*Muhammad Taimoor Khan, Dimitrios Serpanos, Howard Shrobe, Muhammad Murtaza  
Yousuf*

TOWARDS FORMAL ANALYSIS OF VEHICLE PLATOONS USING ACTOR MODEL..... 1820  
*Zeinab Sharifi, Ramtin Khosravi, Marjan Sirjani, Ehsan Khamespanah*

**Author Index**