

# **16th IFAC Conference on Programmable Devices and Embedded Systems (PDES 2019)**

IFAC PapersOnline Volume 52, Issue 27

High Tatras, Slovakia  
29 – 31 October 2019

**Editors:**

**Mikulas Huba  
Zdenek Slanina**

ISBN: 978-1-7138-0778-0

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

To the extent permissible under applicable laws, no responsibility is assumed by the Owner, the Publisher or the Licensee for any injury and/or damage to persons or property as a result of any actual or alleged libelous statements, infringement of intellectual property or privacy rights, or products liability, whether resulting from negligence or otherwise, or from any use or operation of any ideas, instructions, procedures, products or methods contained in the material therein.

The publication of an advertisement in the POD Edition does not constitute on the part of the Owner, the Publisher or the Licensee a guarantee or endorsement of the quality or value of the advertised products or services described therein or of any of the representations or the claims made by the advertisers with respect to such products or services.

Copyright© (2019) by IFAC (International Federation of Automatic Control)  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact the publisher, Elsevier Limited  
at the address below.

Elsevier Limited  
The Boulevard, Langford Lane  
Kidlington  
Oxford OX5 1GB UK

**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  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>DOUBLE THREE-PHASE PMSM STRUCTURES FOR FAIL OPERATIONAL CONTROL</b> .....	1
<i>M. Kozovsky, P. Blaha</i>	
<b>FUSING THE RGBD SLAM WITH WHEEL ODOMETRY</b> .....	7
<i>Adam Ligocki, Aleš Jelínek</i>	
<b>EXPERIMENTAL PARAMETRIC IDENTIFICATION IN CLOSED-LOOP FEEDBACK USING NOVEL APPROACH TO THE LINEAR CONTROL SYSTEMS</b> .....	13
<i>Rijad Saric, Dejan Jokic, Edhem Custovic, Željko Juric</i>	
<b>DEVELOPMENT OF APPLICATION FOR CONTROL OF SMART PARKING LOT</b> .....	19
<i>Jan Baros, Radek Martinek, Rene Jaros, Lukas Danys, Lukas Soustek</i>	
<b>USING MATLAB-BASED DRIVING SIMULATOR FOR HUMAN FACTOR ASSESSMENT</b> .....	27
<i>M. Jirgl, P. Fiedler, Z. Bradac</i>	
<b>RC SCALE VEHICLE FOR CONTROL EDUCATION</b> .....	33
<i>Peter Tapák, Matúš Hutár</i>	
<b>AN EVENT-BASED MULTI-PURPOSE APPROACH TO COMPUTATIONAL SPRINTING</b> .....	38
<i>Alberto Leva, Federico Terraneo, Chiara Cimino, Silvano Seva</i>	
<b>THE FOGDEVICES PLATFORM - A COMPREHENSIVE HARDWARE SOLUTION FOR IOT APPLICATIONS</b> .....	44
<i>Robert Brzoza-Woch, Tomasz Szydło, Mateusz Windak, Joanna Senderek</i>	
<b>SEMI-AUTOMATIC ASYNCHRONOUS LOGIC SYNTHESIS IN XILINX: DESIGN FLOW AND CASE STUDY</b> .....	50
<i>Igor Lemberski, Viktors Gopejenko</i>	
<b>ENHANCEMENT OF ADAPTIVE SOFTWARE-BASED SELF TEST GENERATION OF EMBEDDED PROCESSORS CORES</b> .....	56
<i>Ján Hudec</i>	
<b>ON SFC LOW POWER HARDWARE IMPLEMENTATION IN FPGAS</b> .....	62
<i>Adam Milik, Edward Hryniewicz</i>	
<b>SYNCHRONOUS DATA COLLECTION MEASURING SYSTEM USING A SINGLE-CHIP COMPUTER</b> .....	68
<i>Jirí Czebe, Pavel Šuránek, Jirí Tuma, Stanislav Žiaran</i>	
<b>BATTERY MANAGEMENT SYSTEM HARDWARE DESIGN FOR A STUDENT ELECTRIC RACING CAR</b> .....	74
<i>Martin Bata, Dávid Mikle</i>	
<b>AUTONOMOUS VEHICLE CONTROL BASED ON HOLOLENS TECHNOLOGY AND RASPBERRY PI PLATFORM: AN EDUCATIONAL PERSPECTIVE</b> .....	80
<i>Reza Moezzi, David Krcmarik, Haythem Bahri, Jaroslav Hlava</i>	
<b>BEV REMAINING RANGE ESTIMATION BASED ON MODERN CONTROL THEORY - INITIAL STUDY</b> .....	86
<i>Jan Dedek, Tomas Docekal, Stepan Ozana, Tadeusz Sikora</i>	
<b>EXPERIMENTAL AUTONOMOUS CAR MODEL WITH SAFETY SENSOR IN WIRELESS NETWORK</b> .....	92
<i>Frederik Valocky, Milos Orgon, Ina Fujdiak</i>	
<b>MODELING OF THE AIR-COOLED PEM FUEL CELL</b> .....	98
<i>Kristián Ondrejicka, Viktor Ferencey, Michal Stromko</i>	
<b>FILTERED PIDA CONTROLLER FOR THE DOUBLE INTEGRATOR PLUS DEAD TIME</b> .....	106
<i>M. Huba</i>	
<b>IMPLEMENTATION OF MICRO EMBEDDED OPC UNIFIED ARCHITECTURE SERVER-CLIENT</b> .....	114
<i>R. Pribiš, L. Beno, P. Drahoš</i>	
<b>BEHAVIOURAL APPROACH TO NETWORK ANOMALY DETECTION FOR RESOURCE-CONSTRAINED SYSTEM – PRESENTATION OF THE NOVEL SOLUTION – PRELIMINARY STUDY</b> .....	121
<i>Mariusz Pelc, Dawid Galus, Magda Zolubak, Stepan Ozana, Aleksandra Kawala-Stemiuk</i>	
<b>DESIGN PATTERN FOR THE RUNTIME MODEL-BASED CHECKING OF A REAL-TIME EMBEDDED SYSTEM</b> .....	127
<i>J. Arm, Z. Bradac, O. Bastan, J. Streit, S. Misik</i>	
<b>TIME-SENSITIVE NETWORKING AS THE COMMUNICATION FUTURE OF INDUSTRY 4.0</b> .....	133
<i>F. Zezulka, P. Marcon, Z. Bradac, J. Arm, T. Benesl</i>	

<b>HIGH SPEED CURRENT SENSING SYSTEM FOR WELDING .....</b>	<b>139</b>
<i>P. Podešva, J. Gebauer, D. Fojtík, M. Mahdal</i>	
<b>MONITORING THE CONDITION OF THE PROTECTIVE FENCE ABOVE THE RAILWAY TRACK.....</b>	<b>145</b>
<i>Radovan Hajovsky, Martin Pies, Jan Velicka</i>	
<b>REAL-TIME CONTROL IN SINGLE-PHASE POWER INVERTERS .....</b>	<b>151</b>
<i>Krzysztof Górecki</i>	
<b>THE VEHICLE MODEL ACCELERATION CONTROL FOR PLATOONING .....</b>	<b>157</b>
<i>Igor Bélai</i>	
<b>TORQUE VECTORING FOR AN ELECTRIC ALL-WHEEL DRIVE VEHICLE.....</b>	<b>163</b>
<i>Dávid Mikle, Martin Bat'A</i>	
<b>POSSIBILITIES OF INTELLIGENT CAMERA SYSTEM BASED ON VIRTUAL INSTRUMENTATION: TECHNOLOGY OF BROADBAND LIGHT FOR "SMART CITY" CONCEPT.....</b>	<b>170</b>
<i>Lukas Soustek, Radek Martinek, Radim Kuncicky, Lukas Danys, Jan Baros</i>	
<b>NATURAL NOTIFICATION SYSTEM FOR THE INTERIOR OF SHARED CAR .....</b>	<b>175</b>
<i>Richard Balogh, Michala Lipková, Viktor Luckanic, Peter Tapajna</i>	
<b>DRIVER BEHAVIOUR MODELING WITH VEHICLE DRIVING SIMULATOR .....</b>	<b>180</b>
<i>D. Michalik, O. Mihalik, M. Jirgl, P. Fiedler</i>	
<b>CONTROLLER DESIGN FOR VARIABLE PITCH PROPELLER PROPULSION DRIVE .....</b>	<b>186</b>
<i>Jan Gebauer, Renata Wagnerová, Pavel Smutný, Petr Podešva</i>	
<b>DESIGN OF A PROTOTYPE FOR A MODULAR MOBILE ROBOTIC PLATFORM .....</b>	<b>192</b>
<i>Milan Tkácik, Adam Brezina, Slávka Jadlovská</i>	
<b>PARAMETER VARYING DESCRIPTOR SYSTEM CONTROL VIA GAIN SCHEDULING .....</b>	<b>198</b>
<i>M. Hypišová, D. Rosinová</i>	
<b>EXPLORING PID TUNING STRATEGIES CONSIDERING NOISE IMPACT IN THE IPDT PLANT CONTROL.....</b>	<b>204</b>
<i>M. Huba</i>	
<b>ALTERNATIVE ACCESS TO HUMUSOFT MAGNETIC LEVITATION SYSTEM .....</b>	<b>212</b>
<i>Štefan Chamraz, Katarína Žáková</i>	
<b>ARDUINO SUPPORT FOR PERSONALIZED LEARNING OF CONTROL THEORY BASICS .....</b>	<b>217</b>
<i>Pavol Bisták</i>	
<b>SPP 2.0: SIMPLE PACKET PROTOCOL FOR ULTRA LOW COST WIRED NETWORKS .....</b>	<b>222</b>
<i>Robert Brzoza-Woch, Tomasz Szydło, Paweł Wandzel, Małgorzata Zajecka</i>	
<b>A SIMPLE AND EFFECTIVE ADO.NET-BASED ORM LAYER.....</b>	<b>228</b>
<i>Václav Kaczmarczyk, Zdeněk Bradác, Jakub Arm, Ondřej Baštán, Zuzana Kaczmarczyková</i>	
<b>EFFICIENT USE OF MIXED REALITY FOR BIM SYSTEM USING MICROSOFT HOLOLENS .....</b>	<b>235</b>
<i>Haythem Bahri, David Krčmarik, Reza Moezzi, Jan Kocí</i>	
<b>PROCESSING DATA FROM OPC UA SERVER BY USING EDGE AND CLOUD COMPUTING .....</b>	<b>240</b>
<i>L. Beno, R. Pribiš, R. Leskovský</i>	
<b>ENVIRONMENTAL WSN EDGE COMPUTING CONCEPT BY WAVELET TRANSFORM DATA COMPRESSION IN A SENSOR NODE .....</b>	<b>246</b>
<i>Monika Borová, Michal Prauzek, Jaromír Konečný, Karolína Gaiová</i>	
<b>THREE-LEVEL NPC INVERTER SVM IMPLEMENTATION ON DELFINO DSC .....</b>	<b>252</b>
<i>Krzysztof Górecki, Krzysztof Rogowski, Ryszard Beniak</i>	
<b>DISTRIBUTED INDICATION IN LUT-BASED ASYNCHRONOUS LOGIC .....</b>	<b>257</b>
<i>Igor Lemberski, Marina Uhanova, Artjoms Suponenkovs</i>	
<b>TECHNOLOGICAL OBJECTS DEFINITION SOFTWARE ANALYSIS AND DESIGN .....</b>	<b>265</b>
<i>Zdeněk Slanina, Sarka Mikolajkova, Jakub Nemcik, Matej Golembiovsky</i>	
<b>CHARACTERIZING THE SIMULINK-BASED CODE GENERATION TOOLCHAIN FOR SAFETY-CRITICAL APPLICATIONS IN AN ARM CORTEX-R TARGET .....</b>	<b>271</b>
<i>J. Arm, Z. Bradac, P. Fiedler, V. Kaczmarczyk</i>	
<b>UPGRADE OF THE BALL AND PLATE LABORATORY MODEL .....</b>	<b>277</b>
<i>Adam Brezina, Milan Tkácik, Tomáš Tkácik, Slávka Jadlovská</i>	
<b>BUILDING OF THE FAN DRIVEN BALL LEVITATION SYSTEM .....</b>	<b>283</b>
<i>Matej Rábek, Katarína Žáková</i>	
<b>PID CONTROL OF TOWERCOPTER SYSTEM.....</b>	<b>288</b>
<i>Jakub Matišák, Danica Rosinová, Peter Tapák, Katarína Žáková</i>	
<b>ADAPTIVE ECHO SUPPRESSION BASED ON LABVIEW AND C# IMPLEMENTATION .....</b>	<b>293</b>
<i>Michaela Sidikova, Martina Ladrova, Radek Martinek, Matej Kahane, Rene Jaros</i>	

<b>WIRELESS DATA ACQUISITION FROM AUTOMATED WORKPLACES BASED ON RFID TECHNOLOGY</b> .....	299
<i>Marek Vagaš, Alena Galajdová, Dušan Šimšík, Daniela Onofrejová</i>	
<b>ENGINEERING BASED ROBOT OPTIMIZATION METHODOLOGY</b> .....	305
<i>Martin Švejda, Arnold Jáger</i>	
<b>VISIBLE LIGHT COMMUNICATION SYSTEM BASED ON VIRTUAL INSTRUMENTATION</b> .....	311
<i>Lukas Danys, Radek Martinek, Rene Jaros, Jan Baros, Petr Bilik</i>	
<b>GENERAL METHODOLOGY FOR BUILDING OF OPC UA GATEWAYS</b> .....	317
<i>Tomáš Ausberger, Milan Štetina</i>	
<b>ENVIRONMENT DETECTION SYSTEM FOR LOCALIZATION AND MAPPING PURPOSES</b> .....	323
<i>P. Neduchal, L. Bureš, M. Železný</i>	
<b>MUSCLE ACTIVITY MEASUREMENT USING VISIBLE LIGHT AND INFRARED</b> .....	329
<i>Mariusz Sikora, Szczepan Paszkiel</i>	
<b>THE NEW DESCRIPTOR IN PROCESSING OF VIBROACOUSTIC SIGNAL OF KNEE JOINT</b> .....	335
<i>Adam Lysiak, Anna Fron, Dawid Baczkowicz, Mirosław Szmajda</i>	
<b>DESIGN AND IMPLEMENTATION OF AN EMBEDDED SYSTEM FOR RESPIRATORY RATE EXAMINATIONS</b> .....	341
<i>M. Chylinski, M. Szmajda</i>	
<b>HUMANOID RECEPTIONIST CONNECTED TO IOT SUBSYSTEMS AND SMART INFRASTRUCTURE IS SMARTER THAN EXPECTED</b> .....	347
<i>Michal Podpora, Arkadiusz Gardecki, Aleksandra Kawala-Sterniuk</i>	
<b>A PROPOSAL OF MEASURING TELEMETRY SYSTEM FOR PATIENT BREATHING RECORDING WITHIN RADIOTHERAPY</b> .....	353
<i>Jakub Karasek, Vladimír Kasík, Jaroslav Vondrak, Marek Penhaker, Daniel Barvik</i>	
<b>ADAPTIVE FETAL ECG SIGNAL EXTRACTION BASED ON LABVIEW AND C# IMPLEMENTATION</b> .....	359
<i>Michaela Sidikova, Martina Ladrova, Radek Martinek, Matej Kahanek, Rene Jaros</i>	
<b>ENHANCED APPROACHES TO AUTOMATED MONITORING ENVIRONMENTAL QUALITY IN NON-ISOLATED THERMODYNAMIC SYSTEM</b> .....	365
<i>Ondrej Kainz, František Jakab, Miroslav Michalko, Miroslav Hudák, Rastislav Petija</i>	
<b>AN FPGA-BASED PRIORITY PACKET QUEUES</b> .....	377
<i>David Smekal, Frantisek Nemeth, Jan Dvorak</i>	
<b>REDUNDANCY AS AN IMPORTANT SOURCE OF RESILIENCE IN THE SAFETY II CONCEPT</b> .....	382
<i>Ondrej Bastan, Petr Fiedler, Tomas Benesl, Jakub Arm</i>	
<b>SPECTRAL SUPER-RESOLUTION AND BAND-LIMITED EXTRAPOLATION USING SLEPIAN SERIES</b> .....	388
<i>O. Mihálik, D. Michalík, P. Jura, P. Fiedler</i>	
<b>CLASSIFICATION OF USER ATTITUDES IN TWITTER -BEGINNERS GUIDE TO SELECTED MACHINE LEARNING LIBRARIES</b> .....	394
<i>Marta Sokolowska, Maciej Mazurek, Marcin Majer, Michal Podpora</i>	
<b>SECURE REMOTE DATA COLLECTION SYSTEM USING DATA ENCRYPTION</b> .....	400
<i>Bruno Rodrigues, Alberto Cardoso, Jorge Bernardino, Nuno Simões, José Marques</i>	
<b>ESTIMATION OF WIRELESS SENSOR NETWORK LIFE EXPECTANCY USING DYNAMIC COORDINATOR METHOD</b> .....	406
<i>A. Jurenoks, I. Gorbans, F. Khafizov</i>	
<b>MULTIMODAL SENTIMENT ANALYSIS APPLIED TO INTERACTION BETWEEN PATIENTS AND A HUMANOID ROBOT PEPPER</b> .....	411
<i>Agnieszka Rozanska, Michal Podpora</i>	
<b>ADAPTIVE HUMAN CONTROL MODEL AND ITS USABILITY IN MODELING OF HUMAN-IN-THE-LOOP CYBER PHYSICAL SYSTEMS</b> .....	415
<i>M. Jirgl, Z. Bradac, P. Fiedler</i>	
<b>INFLUENCE OF SYSTEM CONFIGURATION ON THE QUALITY OF NON-INVASIVE FETAL ELECTROCARDIOGRAPHY MEASUREMENT</b> .....	421
<i>Jindrich Brablik, Radana Kahankova, Radek Martinek</i>	
<b>HAND REHABILITATION AND HAPTIC SURFACES: A TENTATIVE PROTOTYPE</b> .....	427
<i>R. Pinto, P. Abreu, J. Falcão Carneiro, T. Restivo</i>	
<b>NEW ADJUSTABLE FLOW RESISTANCE DESIGN FOR MECHANICAL LUNG SIMULATOR XPULM</b> .....	434
<i>Oleksii Kozynets, Andreas Drauschke</i>	
<b>ELIMINATION OF INTERFERENCE IN PHONOCARDIOGRAM SIGNAL BASED ON WAVELET TRANSFORM AND EMPIRICAL MODE DECOMPOSITION</b> .....	440
<i>Martina Ladrova, Michaela Sidikova, Radek Martinek, Rene Jaros, Petr Bilik</i>	

<b>DESIGN AND SIMULATION OF SOLUTIONS TO REDUCE THE THERMAL RESISTANCE OF LIGHTING SYSTEMS</b> .....	446
<i>I. Janakova, P. Honec, V. Tulis</i>	
<b>OFDM VLC SYSTEM BASED ON VIRTUAL INSTRUMENTATION AND SDR</b> .....	453
<i>Lukas Danys, Radek Martinek, Rene Jaros, Jan Baros, Petr Bilik</i>	
<b>EDUCATIONAL CASE STUDY ON NONLINEAR MODEL PREDICTIVE CONTROL</b> .....	459
<i>F. Krupa, J. Nemic, S. Ozana, Z. Slanina</i>	
<b>WIRELESS POWER QUALITY ANALYSER BASED ON VIRTUAL INSTRUMENTATION</b> .....	465
<i>Jan Baros, Lukas Danys, Rene Jaros, Radek Martinek</i>	
<b>INDUSTRY 4.0 AND SMART CITY IN MOBILE MACHINE’S CONTROL SYSTEMS</b> .....	473
<i>A. Sorokac, L. Rigali</i>	
<b>SKUBATCH - SYSTEM FOR CONTROL OF TECHNOLOGICAL PROCESSES</b> .....	477
<i>Václav Kaczmarczyk, Tomáš Beneš, Zdenek Bradác, Petr Fiedler, Zuzana Kaczmarczyková</i>	
<b>USING A HIERARCHICAL INDUSTRIAL COMMUNICATION MODEL VIA THE COMMON INDUSTRIAL PROTOCOL IN A SMALL DISTILLATION COLUMN</b> .....	484
<i>Radek Štohl, Sona Šedivá</i>	
<b>PREDICTING SAFETY SOLUTIONS VIA AN ARTIFICIAL NEURAL NETWORK</b> .....	490
<i>Radek Štohl, Karel Stibor</i>	
<b>ANGLE TRACKING OBSERVER FOR THE VELOCITY ESTIMATION WITH THE FILTERED CONTROL VARIABLE</b> .....	496
<i>Ondrej Bartik, Ludek Buchta</i>	
<b>IMPLEMENTATION OF LOGARITHMIC NUMBER SYSTEMS IN CONTROL APPLICATION USING FPGA</b> .....	502
<i>Ivan Klimo, Michal Kocúr, Peter Drahoš</i>	
<b>TRANSPARENT LAYER COMPENSATION AT THE ACTIVE TRIANGULATION SYSTEMS</b> .....	508
<i>I. Janakova, S. Sediva, P. Benes</i>	
<b>A COMPARATIVE ANALYSIS OF FETAL PHONOCARDIOGRAPH ACOUSTICAL PERFORMANCE</b> .....	514
<i>Radana Kahankova, Jakub Kolarik, Radek Martinek, Alzbeta Durikova</i>	
<b>APPLICATION OF COGNITIVE CHANGES MARKERS FOR DIAGNOSTICS’ PURPOSES AND IN NEUROFEEDBACK THERAPY</b> .....	520
<i>Magda Zolubak, Mariusz Pelc, Michal Podpora, Wojciech Chlewicki, Aleksandra Kawala-Sterniuk</i>	
<b>DEVICE FOR EVALUATION OF ELECTRICAL PARAMETERS OF BIOPOTENTIAL ELECTRODES</b> .....	524
<i>Jaroslav Adžima, Marek Penhaker, Tomas Klinkovsky, David Oczka, Daniel Barvik</i>	
<b>OPTIMIZATION OF RLS ALGORITHM FOR HYBRID METHOD ICA-RLS</b> .....	530
<i>Rene Jaros, Radek Martinek, Radana Kahankova, Lukas Danys, Michaela Sidikova</i>	
<b>IMPLEMENTATION OF MATLAB MODULAR PROCESSING SYSTEM FOR BIOLOGICAL SIGNALS</b> .....	536
<i>Martina Ladrova, Michaela Sidikova, Radek Martinek, Rene Jaros, Petr Bilik</i>	
<b>ANALYSIS OF UPPER LIMB MOVEMENT FOR BIOFEEDBACK IN REHABILITATION</b> .....	545
<i>Klara Fiedorova, Veronika Baladova, Lukas Peter</i>	
<b>COMPARISON OF SCG AND ECG BASED CARDIAC ACTIVITY MONITORING IN LABORATORY CONDITIONS</b> .....	550
<i>Jakub Kolarik, Radana Kahankova, Jindrich Brablik, Radek Martinek</i>	
<b>ANALYSIS OF POSSIBILITIES OF THE OPTICAL FIBERS USAGE IN THE MICROPROCESSOR PULSE - OXIMETER</b> .....	556
<i>Jacek Kuszniar, Wojciech Wojtkowski</i>	
<b>FIBER OPTIC PULSE OXIMETER BASED ON A 32 BIT MICROCONTROLLER</b> .....	562
<i>Wojciech Wojtkowski, Jacek Kuszniar</i>	
<b>Author Index</b>	