2021 IEEE 27th International Conference on Embedded and **Real-Time Computing Systems** and Applications (RTCSA 2021)

Virtual Conference 18 – 20 August 2021



IEEE Catalog Number: CFP21066-POD ISBN:

978-1-6654-4189-6

Copyright © 2021 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:
 CFP21066-POD

 ISBN (Print-On-Demand):
 978-1-6654-4189-6

 ISBN (Online):
 978-1-6654-4188-9

ISSN: 2325-1271

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 Web: www.proceedings.com



2021 IEEE 27th International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA)

RTCSA 2021

Table of Contents

Message from the General and Program Chairs ix Organizing Committee x Program Committee xi Sponsors xiv
Architecture
Adaptive Runtime Estimate of Task Execution Times using Bayesian Modeling .1
Read/Write Disturbance-Aware Design for MLC STT-RAM-Based Cache .11. Yao-Hung Huang (National Taiwan University of Science and Technology, Taiwan) and Jen-Wei Hsieh (National Taiwan University of Science and Technology, Taiwan)
Processor and Bus Co-Scheduling Strategies for Real-Time Tasks with Multiple Service-Levels 21
Sanjit Kumar Roy (Indian Institute of Technology Guwahati, India), Arnab Sarkar (Indian Institute of Technology Kharagpur, India), and Rahul Gangopadhyay (St. Petersburg State University, Russia)
WE-HML: Hybrid WCET Estimation using Machine Learning for Architectures with Caches .31 Abderaouf Nassim Amalou (Univ. Rennes, France), Isabelle Puaut (Univ. Rennes, France), and Gille Muller (Inria, France)
RTOS, Virtualization, Security
RAPLET: Demystifying Publish/Subscribe Latency for ROS Applications 41. Keisuke Nishimura (The University of Tokyo), Takahiro Ishikawa (The University of Tokyo), Hiroshi Sasaki (Tokyo Institute of Technology), and Shinpei Kato (The University of Tokyo, Tier IV, Inc.)

Enhanced Schedulability Tests for Real-Time Regularity-Based Virtualized Systems with Dependent and Self-Suspension Tasks .51
Guangli Dai (University of Houston, USA), Pavan Kumar Paluri (University of Houston, USA), and Albert Mo Kim Cheng (University of Houston, USA)
Recovery-by-Learning: Restoring Autonomous Cyber-Physical Systems from Sensor Attacks .61 Francis Akowuah (Syracuse University, USA), Romesh Prasad (Syracuse University, USA), Carlos Omar Espinoza (Syracuse University, USA), and Fanxin Kong (Syracuse University, USA)
A Homomorphic Encryption-Based Adaptive Image Filter Using Division Over Encrypted Data .67. Sharmila Kannivelu (University of Washington, USA) and Sunwoong Kim (University of Washington, USA)
Invited Papers
A Multi-Domain Software Architecture for Safe and Secure Autonomous Driving .73
A Generic Approach for the Certified Schedulability Analysis of Software Systems .83
Formalizing an Architectural Model of a Trustworthy Edge IoT Security Gateway .93
Real-Time Scheduling
Reserving Processors by Precise Scheduling of Mixed-Criticality Tasks .103. Tianning She (Texas State University), Zhishan Guo (University of Central Florida), Qijun Gu (Texas State University), and Kecheng Yang (Texas State University)
A Soft Real-Time Memory Request Scheduler for Phase Change Memory Systems .109
Timing-Anomaly Free Dynamic Scheduling of Periodic DAG Tasks with Non-Preemptive Nodes .119 Gaoyang Dai (Uppsala University, Sweden), Morteza Mohaqeqi (Uppsala University, Sweden), and Wang Yi (Uppsala University, Sweden)
Graph-Based Optimizations for Multiprocessor Nested Resource Sharing .129

Is This Still Normal? Putting Definitions of Timing Anomalies to the Test .139
Demand Characterization of CPS with Conditionally-Enabled Sensors .149
Applications
Thermal-Aware Scheduling for MPSoC in the Avionics Domain: Tooling and Initial Results .159 Ondrej Benedikt (Czech Technical University in Prague, Czech Republic), Michal Sojka (Czech Technical University in Prague, Czech Republic), Pavel Zaykov (Honeywell International s.r.o., Czech Republic), David Hornof (Czech Technical University in Prague, Czech Republic), Matej Kafka (Czech Technical University in Prague, Czech Republic), Premysl Sucha (Czech Technical University in Prague, Czech Republic), and Zdenek Hanzálek (Czech Technical University in Prague, Czech Republic)
On Exploring Image Resizing for Optimizing Criticality-Based Machine Perception .169
Optimal Recharging of Teams of Mobile Robots .179
An FTL-Aware Host System Alleviating Severe Long Latency of NAND Flash-Based Storage .189. Jung-Hoon Kim (Samsung Electronics Co., Ltd., Republic of South Korea)
Work-in-Progress Papers
Work-in-Progress Abstract: On the Relationship between Scheduling Theory and Real-Time Calculus 195. Frank Slomka (Ulm University, Germany) and Mohammadreza Sadeghi (Ulm University, Germany)
Work-in-Progress Abstract: A New Criterion for Job Switching in Semi-Clairvoyant Systems .198 Vlad Radulescu (Alexandru Ioan Cuza University of Iasi, Romania), Stefan Andrei (Lamar University, USA), and Albert M.K. Cheng (University of Houston, USA)
Work-in-Progress Abstract: WKS, a Local Unsupervised Statistical Algorithm for the Detection of Transitions in Timing Analysis 201. Marwan Wehaiba El Khazen (n/a), Liliana Cucu-Grosjean (n/a), Adriana Gogonel (n/a), Hadrien Clarke (n/a), and Yves Sorel (n/a)

Work-in-Progress Abstract: The Impact of the Period Variation on Execution Time Distributions of Programs 204
Liliana Cucu-Grosjean (Inria), Avner Bar-Hen (n/a), Yves Sorel (n/a), and Hadrien Clarke (n/a)
Work-in-Progress Abstract: Revealing and Analyzing Architectural Models in Open-Source ArduPilot 207.
Sergey Staroletov (Polzunov Altai State Technical University/Institute of Automation and Electrometry, Russia)
Work-in-Progress: A Static Partition for Shared Cache in Mixed-Time-Sensitive System with Balanced Performance .210.
Pan Yang (National University of Defense Technology, China), Pan Dong
(National University of Defense Technology, China), Zhe Jiang
(Computer Science Department, University of York, UK), Jintao Xia
(National University of Defense Technology, China), and Yan Ding
(National University of Defense Technology, China)
Author Index 213