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Welcome

The CISTER research centre welcomes you to the 11th Cyber-Physical Systems Week, this year in Porto, in the magnificent Palácio da Bolsa. Like 150 years ago, when business men from the city and around the world met here to trade, we are also meeting here now, coming from all corners of the world, to discuss Cyber-Physical Systems.

To this end, the 11th CPSWeek provides a rich set of events. On Tuesday we start with 12 parallel workshops on complementary perspectives of CPS, 8 tutorials on the history, design, deployment and operation of CPS, and 2 exciting competitions namely the F1/10 Autonomous Racing and the Microsoft Indoor Localization.

From Wednesday to Friday we have our 4 main conferences offering between 7 and 9 technical sessions: the 21st ACM Int. Conf. on Hybrid Systems, Computation and Control (HSCC); the 9th ACM/IEEE Int. Conf. on Cyber-Physical Systems (ICCPS); the 17th ACM/IEEE Int. Conf. on Information Processing in Sensor Networks (IPSN); and the 24th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS). Every conference day starts with a plenary keynote speech by distinguished members of our community, namely Henrique Madeira from the University of Coimbra on Wednesday, Chenyang Lu, from Washington University in St. Louis on Thursday and Frank Allgower from the University of Stuttgart on Friday.

The program also includes ample time for interaction and networking, during breaks and lunches, as well as in the featured social events. We believe you will be able to enjoy the rich technical content of this edition of CPSWeek, along with the culture and scenery Porto has to offer.

We would like to thank all the participants and we wish everyone a truly enjoyable and productive event.

Eduardo Tovar and Luís Almeida

General Chairs
Local Info

Palácio da Bolsa
Rua Ferreira Borges
4050-253 Porto
Main Conferences
Workshops
Competitions
Lunch, Cocktail & Reception

Palácio das Artes
Largo de S. Domingos, 16-22
4050-545 Porto
Tutorials/PhD Forum

Hotel Carris
Rua Infante Dom Henrique 1
4050-297 Porto
Workshops

Metro Stop
Network Connection
To connect to the wireless network of CPS Week 2018 at Palácio da Bolsa use the:
SSID: CPSWEEK
Password: Porto2018

Printing
To print boarding passes and the like, please send an e-mail to cpsweek_org@cister-isep.info or contact the registration desk.

Meetings
As the conference is not just about the technical presentations, but also to forge collaborations and serve as a meeting place for projects, we offer some meeting rooms at Palácio da Bolsa. Please contact the registration desk for more information.

Organiser’s Contacts
Landline: +351 228 340 502
Conference Cell Phone: +351 910 763 976
E-mail: cpsweek_org@cister-isep.info
## CPS Week 2018 Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Tuesday April, 10</th>
<th>Tue-Wed April, 10-11</th>
<th>Wednesday April, 11</th>
<th>Thursday April, 12</th>
<th>Friday April, 13</th>
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</thead>
<tbody>
<tr>
<td>08:00</td>
<td></td>
<td>Registration</td>
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<tr>
<td>09:00</td>
<td>Workshops/Tutorials</td>
<td>Competitions</td>
<td>Open + Keynote</td>
<td>Keynote</td>
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<tr>
<td>12:30</td>
<td></td>
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<td>Session 1</td>
<td>Session 4</td>
<td>Session 7</td>
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<td>12:30-14:00</td>
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<td>Lunch</td>
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<tr>
<td>14:00</td>
<td>Workshops/Tutorials</td>
<td>Competitions</td>
<td>Session 2</td>
<td>Session 5</td>
<td>Session 8</td>
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<tr>
<td>17:30</td>
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<td>Session 3</td>
<td>Session 6</td>
<td>Session 9</td>
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<tr>
<td>17:30</td>
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<td></td>
<td>ICCPS/HSCC joint panel</td>
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<tr>
<td>20:00</td>
<td>Cocktail Dinatoire*</td>
<td></td>
<td>Posters/Demos &amp; Reception*</td>
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<tr>
<td>20:00</td>
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<td></td>
<td>Fringe Event*</td>
<td>TPC Dinner</td>
<td>Banquet*</td>
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<td>22:00</td>
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*for social events see page 44
Palácio das Artes
Largo de S. Domingos, 16-22 | 4050-545 Porto

Tutorials/PhD Forum

Sala 1
T-ROS (full day)

Sala 3
T-DRTS (morning)
T-OPTIM (afternoon)

Sala 5
PhD Forum (morning)
T-POWER (afternoon)

Sala 6
T-MILP (full day)

Sala 7
T-ASEC (morning)
T-UAVEE (afternoon)

Coffee-Break

WC
Meeting Spaces

Rooms available for meetings at Casa das Associações. Please contact registration desk for more information.

Palácio da Bolsa

Casa das Associações
Palácio da Bolsa

Main entrance

Floor 0

Floor 1
Main Conferences

- **Registration Desk**
- **Pátio das Nações**
  - Keynotes
  - Lunch
  - F1/10 Competition
- **Sala do Tribunal**
  - Day 11: IPSN Conference
  - Day 12: ICCPS Conference
  - Day 13: HSCC Conference
- **Sala das Assembleias Gerais**
  - Day 11: RTAS Conference
  - Day 12: IPSN Conference
  - Day 13: ICCPS Conference
- **Salão Árabe**
  - Day 11: ICCPS Conference
  - Day 12: HSCC Conference
  - Day 13: RTAS Conference
- **Auditório António Calém**
  - Day 11: HSCC Conference
  - Day 12: RTAS Conference
  - Day 13: IPSN Conference
- **Main Stairs**
  - Microsoft Indoor Localization Competition
- **Floor 2**

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13 • CPS Week 2018 Brochure
Workshops

**MT-CPS** [R11](#) Palácio da Bolsa
3rd Workshop on Monitoring and Testing of Cyber-Physical Systems

**CPSBench** [R15](#) Palácio da Bolsa
1st Workshop on Benchmarking Cyber-Physical Networks and Systems

**CPS-SR** [R12](#) Palácio da Bolsa
1st Workshop on Cyber-Physical Systems Security and Resilience

**CPS-INTL** [R17](#) Palácio da Bolsa
A Visioning Workshop for International Networks to Advance CPS Research, Development, and Education Worldwide

**CySWater** [C02](#) Hotel Carris
4th International Workshop on Cyber-Physical Systems for Smart Water Networks

**SmartFarming** [R13](#) Palácio da Bolsa
SmartFarming Workshop

**EITEC** [R21](#) Palácio da Bolsa
4th International Workshop on Emerging Ideas and Trends in Engineering of Cyber-Physical Systems

**SCAV** [R14](#) Palácio da Bolsa
2nd Safe Control of Autonomous Vehicles Workshop

**SCOPE** [C01](#) Hotel Carris
3rd International Science of Smart City Operations and Platforms Engineering Workshop
*in partnership with Global City Teams Challenge*

**MCPS** [R18](#) Palácio da Bolsa
7th Medical Cyber Physical Systems Workshop

**MSCPES** [C11](#) Hotel Carris
6th Modeling and Simulation of Cyber-Physical Energy Systems Workshop

**DARS** [R22](#) Palácio da Bolsa
3rd Design and Analysis of Robust Systems Workshop
Tutorials/PhD Forum

T-DRTS [morning only] P13 Palácio das Artes
The Long Journey of Distributed Real-Time Systems: from Embedded Systems to Autonomous Cooperating Objects

T-ASEC [morning only] P17 Palácio das Artes
Design of adaptive and secure CPS

T-ROS [full day] P11 Palácio das Artes
Fundamentals of the Robot Operating System (ROS)

T-MILP [full day] P16 Palácio das Artes
Mixed Integer Linear Programming models of Scheduling Problems

T-SMRTE [full day]
Computational Approaches for Smart Energy Management

T-POWER [afternoon only] P15 Palácio das Artes
Transiently-powered Embedded Computing: Opportunities and Challenges

T-UAVEE [afternoon only] P17 Palácio das Artes
uavEE: Unmanned Aerial Vehicle Emulation Environment for Rapid Software Prototyping and Testing

T-OPTIM [afternoon only] P13 Palácio das Artes
System-wide Optimization of Logistics in Manufacturing Systems

IPSN PhD Forum [morning only] P15 Palácio das Artes

18:45-20:30
Workshops/Tutorials Cocktail Dinatoire

Tuesday, April 10
Competitions

**MILC**
Microsoft Indoor Localization Competition

**F1/10**
F1/10 Autonomous Racing Competition

R91 - Main Stairs @Palácio da Bolsa

R01 - Pátio das Nações @Palácio da Bolsa

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CPS Student Forum

Portugal 2018

**Friday, April 13**

14:00-15:00  Panel

15:00-15:30  Poster Madness

15:30-17:30  Poster Session + Coffee

R22 - Auditório António Calém, Palácio da Bolsa

R01 - Pátio das Nações, Palácio da Bolsa
Get the latest in your phone

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Cyber-physical systems (CPS) are made of software. Lots of it. Small embedded devices may easily reach millions of lines of code. Large scale CPS have billions. Even using the most skeptic bug density estimations for deployed software, there is no escape from the conclusion that most CPS have many thousands of residual bugs. Unfortunately, no one knows exactly where they are in the code, when they will reveal themselves, and, above all, what the consequences of their activation can be. In CPS with demanding safety requirements or exposed to security attacks (which may exploit residual bugs that may also represent security vulnerabilities), residual bugs represent a serious risk. Worse than that, it is not easy to estimate such risk.

Hence, paraphrasing a famous Jim Gray's question: Why are residual software bugs a serious threat to CPS and what can be done about it? Attempting to answer this question, the talk provides field data illustrating some key problems, surveys software reliability limits, discusses why it is not trivial to use classic fault tolerance techniques in many CPS, and proposes some futuristic scenarios that may help deal with the residual software bug problem.
IoT-driven control underpins numerous cyber-physical systems from Industrial Internet to smart cities. In contrast to best-effort IoT often found in consumer markets, there remain daunting challenges to develop IoT systems that must not only monitor but also control physical systems in a dependable fashion. We will highlight the dependability challenges caused by communication delays, data loss and resource constraints of IoT. We will further discuss cyber-physical co-design as a fundamental approach to achieve dependability in IoT-driven control systems.
Keynote April 13  09:00

From Rags to Riches: Distributed Economic Model Predictive Control in Industry 4.0

Frank Allgower
Director, Institute for Systems Theory and Automatic Control, University of Stuttgart

During the past decades model predictive control (MPC) has become a preferred control strategy for the control of a large number of industrial processes. Systems theoretic properties of MPC, like stability and robustness, are rather well understood by now, as are computational issues in connection with the MPC implementation.

With the vision of the smart factory of the future, generally termed Industry 4.0, the industrial environment, and thus the involved control tasks, are however undergoing a fundamental new orientation on the basis of the Cyber-Physical Systems and Internet of Things and Services paradigms. In the future all parts along the production chain will be equipped with embedded computing, communication and networking capabilities and are expected to interact in an optimal way towards the goal of a quality oriented, energy and resource efficient, save and reliable production process. Through decentralized optimal decision-making and an appropriate communication among the networked individual parts, the whole production process of the future is expected to operate optimally. The generation of economic value through control will step in the foreground while the stabilization of predetermined setpoints will not play the same role as it has in the past.

In this presentation an introduction to the state of the art in Model Predictive Control will be given and the challenges and opportunities of Industry 4.0 for the field of control are discussed. We will in particular investigate the potential impact of Model Predictive Control (MPC) for the fourth industrial revolution and will argue that some new developments in MPC, especially connected to distributed and economic model predictive control, appear to be ideally suited to have a potential impact in the new Industry 4.0 environment.
RTAS
24th IEEE Real-Time and Embedded Technology and Applications Symposium

HSCC
21st ACM International Conference on Hybrid Systems: Computation and Control

ICCPS
9th ACM/IEEE International Conference on Cyber-Physical Systems

IPSN
17th ACM/IEEE Conference on Information Processing in Sensor Networks
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</tbody>
</table>
| 9:00   | Opening and CPS Week Keynote: How Can We Rely on Cyber-Physical Systems with Thousands of Software Bugs
Henrique Madeira, University of Coimbra |
| 10:00  | Coffee-Break                                                          |
| 10:30  | Opening Remarks                                                       |
| 10:30  | **Networks**                                                          |
|        | *Session Chair: Cong Liu*                                            |
|        | FD-PaS: A Fully Distributed Packet Scheduling Framework for Handling Disturbances in Real-Time Wireless Networks
Tianyu Zhang, Tao Gong, Zelin Yun, Song Han, Qingxu Deng and X. Sharon Hu |
|        | IEEE 802.1Qbv Gate Control List Synthesis using Array Theory Encoding
Ramon Serna Oliver, Silviu Craciunas and Wilfried Steiner |
|        | Timing Analysis of AVB Traffic in TSN Networks using Network Calculus
Luxi Zhao, Paul Pop, Zhong Zheng and Qiao Li |
|        | Buffer-Aware Worst-Case Timing Analysis of Wormhole NoCs Using Network Calculus
Frédéric Giroudot and Ahlem Mifdaoui |

**Stochastic Systems**

*Session Chair: Pavithra Prabhakar*

|        | Scalable Underapproximative Verification of Stochastic LTI Systems using Convexity and Compactness
Abraham P. Vinod and Meeko M. K. Oishi |
|        | Global Almost-Sure Reachability in Stochastic Constant-Rate Multi-Mode Systems
Fabio Somenzi, Behrouz Touri and Ashutosh Trivedi |
|        | From Dissipativity Theory to Compositional Construction of Finite Markov Decision Processes
Abolfazl Lavaei, Sadegh Soudjani and Majid Zamani |
|        | Bisimulations, logics, and trace distributions for stochastic systems with rewards
Daniel Gburek and Christel Baier |
| 12:30  | Lunch                                                                 |
Software Bugs? Henrique Madeira, University of Coimbra

Opening Remarks

CPS Security
Session Chair: Peng Cheng

SAT-based Synthesis of Spoofing Attacks in Cyber-Physical Control Systems Omar Inverso, Alberto Bemporad and Mirco Tribastone

Guaranteed Physical Security with Restart-Based Design for Cyber-Physical Systems Fardin Abdi Taghi Abad, Chien-Ying Chen, Monowar Hassan, Songran Liu, Sibin Mohan and Marco Caccamo

Cyber-Physical System Checkpointing and Recovery Fanxin Kong, Meng Xu, James Weimer, Oleg Sokolsky and Insup Lee.

Cloaking the Clock: Emulating Clock Skew in Controller Area Networks Sang Uk Sagong, Xuhang Ying, Andrew Clark, Linda Bushnell and Radha Poovendran

Sybil-Attack Resilient Traffic Networks: A Physics-Based Trust Propagation Approach Yasser Shoukry, Shaunak Mishra, Zutian Luo and Suhas Diggavi

Opening Remarks

Large-Scale Applications
Session Chair: Jie Gao and Pei Zhang

Plug-and-play Irrigation Control at Scale Daniel A. Winkler, Miguel Carreira-Perpi, Alberto E. Cerpa

Walkway Discovery from Large Scale Crowdsensing Chu Cao, Zhidan Liu, Mo Li, Qin Zheng, Wenqiang Wang

Monitoring Meteorological Parameters With Crowdsourced Air Traffic Control Data Roman Trueb, Daniel Moser, Matthias Schaefer, Rui Pinheiro and Vincent Lenders

Crazy Ideas Session
(Starting at 11:30 - 60 minutes)
14:00 Virtualization
Session Chair: Francisco J. Cazorla
QuartzV: Bringing Quality of Time to Virtual Machines
Sandeep D’souza and Raj Rajkumar
Predictable Virtualization on Memory Protection Unit-based Microcontrollers
Runyu Pan, Gregor Peach, Yuxin Ren and Gabriel Parmer
BlueVisor: A Scalable Real-Time Hardware Hypervisor for Heterogeneous Many-core Embedded Systems
Zhe Jiang, Neil Audsley and Pan Dong

14:30 Reachability
Session Chair: Sayan Mitra
Reach Set Approximation through Decomposition with Low-dimensional Sets and High-dimensional Matrices
Sergiy Bogomolov, Marcelo Forets, Goran Frehse, Andreas Podelski, Christian Schilling and Frédéric Viry
Under-Approximating Reach Sets for Polynomial Continuous Systems
Bai Xue, Martin Fränzle and Naijun Zhan
Accurate reachability analysis of uncertain nonlinear systems
Matthias Rungger and Majid Zamani

15:30 Coffee-Break
Smart Cities and Smart Transportation
Session Chair: Qi Zhu

CityResolver: A Decision Support System for Conflict Resolution in Smart Cities
Meiyi Ma, John Stankovic and Lu Feng

Dynamic Integration of Heterogeneous Transportation Modes under Disruptive Events
Yukun Yuan, Desheng Zhang, Fei Miao, John A. Stankovic, Tian He, George Pappas and Shan Lin

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Dynamic Integration of Heterogeneous Transportation Modes under Disru...
16:00 Brief Presentations and Demos

(finishing at 17:00)

See page 39

17:30 Demos & Posters Session [see page 39]
Reception [see page 44]
Cooperative Key Generation for Data Dissemination in Cyber-Physical Systems
K. Li, H. Kurunathan, R. Severino and Eduardo Tovar

Underwater AUV Localization with Refraction Consideration
Jiajun Shen, Xuwei Fan, Qixin Wang.

Toward a Green and Secure Architecture for Reconfigurable IoT End-Devices
D. Oliveira, T. Gomes, and S. Pinto

SOH aware Battery Management Optimization on Decentralized Energy Network
Daichi Watari, Itetsu Taniguchi, and Takao Onoye

KRS-DGIST: A Resilient CPS Testbed for Radio-Based Train Control
Yuchang Won, Buyeon Yu, Jaegeun Park, In-Hee Park, Haegeon Jeong, Jeanseong Baik, Kyungtae Kang, Insup Lee, Kyung-Joon Park, and Yangsoo Eun

ROS-based Support System for Supervision of Multiple UAVs by a Single Operator
Hiroki Hayakawa, Takuya Azumi, Akinori Sakaguchi, Toshiimitsu Ushio

An Industrial Control System Testbed for the Encrypted Controller
Xing Li, Mengxiang Liu, Rui Zhang, Peng Cheng, Jiming Chen

Secure Estimation Using Partially Homomorphic Encrypted Industrial Cyber-Physical Systems Data
Zhenyong Zhang, Junfeng Wu, David Yau, Peng Cheng, Jiming Chen

Towards a Cognitive Assistant System for Emergency Response
Sarah Preum, Sile Shu, Jonathan Ting, Vincent Lin, Ronald Williams, John Stankovic, Homa Alemzadeh

Learning-Based Control Design for Deep Brain Stimulation
Ilija Jovanov, Michael Naumann, Karthik Kumaravelu, Vuk Lesi, Aditya Zutshi, Warren Grill, Miroslav Pajic

Predicting Malicious Intention in CPS under Cyber-Attack
Nicola Bezzo

Cyber-Physical Systems Virtual Organization: Active Resources
Janos Sztipanovits, Matthew Banting, Vijay Kumar, Paulo Tabuada

Formation Control and Persistent Monitoring in the OpenUAV Swarm Simulator on the NSF CPS-VO
Anna Lukina, Arjun Kumar, Matt Schmittle, Abhijeet Singh, Jnaneshwar Das, Stephen Rees, Christopher P. Buskirk, Janos Sztipanovits, Radu Grosu, Vijay Kumar.

Interference-Resilient Ultra-Low Power Aperiodic Data Collection
Timofei Istomin, Matteo Trobinger, Amy L. Murphy, Gian Pietro Picco

A Stitch in Time and Frequency Synchronization Saves Bandwidth
Anh Luong, Peter Hillyard, Alemayehu Solomon Abrar, Charissa Che, Thomas Schmid, Anthony Rowe, Neal Patwari

Poster Demo Madness
(starting at 16:40)

See page 42
Thursday

8:00 Registration

9:00 Opening and CPS Week Keynote: Dependable Industrial Internet of Things Chenyang Lu, Washington University

10:00 Coffee-Break

10:30 Multi-mode and mixed-critical systems
Session Chair: Bjorn Andersson

SafeMC: A system for the design and evaluation of mode change protocols
Tianyang Chen and Linh Thi Xuan Phan

Multi-Mode Virtualization for Soft Real-Time Systems
Haoran Li, Meng Xu, Chong Li, Chenyang Lu, Chris Gill, Linh Thi Xuan Phan, Insup Lee and Oleg Sokolsky

Physical-State-Aware Dynamic Slack Management for Mixed-Criticality Systems
Hoon Sung Chwa, Kang Shin, Hyeongboo Baek and Jinkyu Lee

Mixed Criticality Systems with Varying Context Switch Costs
Robert Davis, Sebastian Altmeyer and Alan Burns

11:30 Stabilization and Control Design
Session Chair: Jim Kapinski

Stabilizing switched nonlinear systems under restricted switching Atreyee Kundu

Lyapunov Design for Event-Triggered Exponential Stabilization
Anton Proskurnikov and Manuel Mazo Jr

Multi-Layered Abstraction-Based Controller Synthesis for Continuous-Time Systems Kyle Hsu, Rupak Majumdar, Kaushik Mallik and Anne-Kathrin Schmuck

(T) ROCS: A Robustly Complete Control Synthesis Tool for Nonlinear Dynamical Systems Yinan Li and Jun Liu

12:30 Lunch

12:20 Best Demo/Poster Award & Best Repeatability Evaluation Award Ceremony (starting at 12:20)
Controller Design, Implementation, and Applications  
Session Chair: Rahul Mangharam

Towards a Framework for Realizable Safety Critical Control through Active Set Invariance  
Thomas Gurriet, Andrew Singletary, Jake Reher, Laurent Ciarletta, Eric Feron and Aaron Ames

Ordering Events Based on Intentionality in Cyber-Physical Systems  
Wajeb Saab, Maaz Mohiuddin, Simon Bludze and Jean-Yves Le Boudec

Co-Regulation of Computational and Physical Effectors in a Quadrotor UAS  
Xinkai Zhang, Seth Doebbeling and Justin Bradley

OpenUAV: A UAV Testbed for the CPS and Robotics Community  
Matt Schmittle, Anna Lukina, Lukas Vacek, Jnaneswar Das, Christopher P. Buskirk, Stephen Rees, Janos Sztipanovits, Radu Grosu and Vijay Kumar

Learning and Control using Gaussian Processes  
Achin Jain, Truong Nghiem, Manfred Morari and Rahul Mangharam

Pervasive Hardware  
Session Chair: Rong Zheng

Battery-Free 802.15.4 Receiver  
Carlos Pérez Penichet, Claro Noda, Ambuj Varshney, Thiemo Voigt

Glimpse.3D: A Motion-Triggered Stereo Body Camera for 3D Experience Capture and Preview  
Bashima Islam, Md Tamzeed Islam, Shahriar Nirjon

The Signpost Platform for City-Scale Sensing  
Joshua Adkins, Branden Ghena, Neal Jackson, Pat Pannuto, Samuel Rohrer, Bradford Campbell, Prabal Dutta

Localization Competition Results (starting at 11:30)  
Session Chair: Dimitrios Lymberopoulos

Learning and Control using Gaussian Processes, Achin Jain, Truong Nghiem, Manfred Morari and Rahul Mangharam
Resource Sharing
Session Chair: Sibin Mohan

Scalable Memory Reclamation for Multi-Core, Real-Time Systems
Yuxin Ren, Guyue Liu, Gabriel Parmer and Björn Brandenburg

Shared-Resource-Centric Limited Preemptive Scheduling: A Comprehensive Study of Suspension-base Partitioning Approaches
Zheng Dong, Cong Liu, Soroush Bateni, Kuan-Hsun Chen, Jian-Jia Chen, Georg von der Brüggen and Junjie Shi

Analytical Enhancements and Practical Insights for MPCP with Self-Suspensions
Pratyush Patel, Iljoo Baek, Hyoseung Kim and Ragunathan (Raj) Rajkumar

Compositional Methods
Session Chair: Jyotirmoy Vinay Deshmukh

Keynote: Compositional Synthesis for Symbolic Control
Antoine Girard

Constructing Control System Abstractions from Modular Components
Eric Kim, Murat Arcak and Majid Zamani

15:30 Coffee-Break
Synthesis and Verification
Session Chair: Justin Bradley

Efficient Verification for Stochastic Mixed Monotone Systems
Maxence Dutreix and Samuel Coogan

Distributed Optimal Control Synthesis for Multi-Robot Systems under Global Temporal Tasks
Yiannis Kantaros and Michael Zavlanos

Receding Horizon Multi-Robot Coverage
Sankar Narayan Das and Indranil Saha

Fly-by-Logic: Control of Multi-Drone Fleets with Temporal Logic Objectives
Yash Vardhan Pant, Houssam Abbas, Rhudii A. Quaye and Rahul Mangharam

Learning with Sensor Data
Session Chair: Neal Patwari

A Deep Data Augmentation Training Method to Address Software and Hardware Heterogeneities in Wearable and Smartphone Sensing Devices
Akhil Mathur, Tianlin Zhang, Sourav Bhattacharya, Petar Veličković, Leonid Joffe, Nicholas D. Lane, Fahim Kawsar, Pietro Lio

Moving Convolutional Neural Networks to Embedded Systems: the AlexNet and VGG-16 case
Cesare Alippi, Simone Disabato, Manuel Roveri

(Short Paper) Data-Driven Monitoring and Optimization of Classroom Usage in a Smart Campus
Thanchanok Sutjarittham, Hassan Habibi Gharakheili, Salil Kanhere, Vijay Sivaraman

ODDS: Real-Time Object Detection using Depth Sensors on Embedded GPUs
Niluthpol Chowdhury Mithun, Sirajum Munir, Karen Guo, Charles Shelton
Session 6

16:00

**GPU**

**Session Chair:** Marko Bertogna

- **S^3DNN:** Supervised Streaming and Scheduling for GPU-accelerated Real-Time DNN Workloads
  - **Husheng Zhou, Soroush Bateni and Cong Liu**

- **A GPU Kernel Transactionization Scheme for Preemptive Priority Scheduling**
  - **Hyeonsu Lee, Jaehun Roh and Euiseong Seo**

- **MERLOT:** Architectural Support for Energy-Efficient Real-time Processing in GPUs
  - **Muhammad Santriaji and Henry Hoffmann**

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**Data-driven Design**

**Session Chair:** Ashutosh Trivedi

- **Formal Guarantees in Data-Driven Model Identification and Control Synthesis**
  - **Sadra Sadraddini and Calin Belta**

- **From Uncertainty Data to Robust Policies for Temporal Logic Planning**
  - **Pier Giuseppe Sessa, Damian Frick, Tony A. Wood and Maryam Kamgarpour**

17:10

**Joint ICCPS-HSCC Panel Session**

18:30

**IPSN Business Meeting**

17:30

**End of Sessions**

20:00

**Banquet** [for social events see page 44]
Machine Learning and Big Data: Where do they fit in CPS?
Moderator: Jie Liu

IPSN Business Meeting

Optimization
Session Chair: Indranil Saha

The Impact of Packet Dropouts on the Reachability Energy
A. Sanand Amita Dilip, Nikolaos Athanasopoulos and Raphael Jungers

Sound Mixed-Precision Optimization with Rewriting
Eva Darulova, Einar Horn and Saksham Sharma

Parameter Optimization in Control Software using Statistical Fault Localization Techniques
Jyotirmoy Deshmukh, Xiaoqing Jin, Rupak Majumdar and Vinayak Prabhu

SCC Panel Session
Do CPS theory by modern applications?
8:00 Registration
9:00 Opening and CPS Week Keynote: From Rags to Riches - Distributed Economic Model Predictive Control in Industry 4.0
Frank Allgower, Institute for Systems Theory and Automatic Control, University of Stuttgart
10:00 Coffee-Break
10:30 Models, synthesis and analysis
Session Chair: Linh Thi Xuan Phan
Timed C: An Extension to the C Programming Language for Real-Time Systems
Saranya Natarajan and David Broman
Achieving Predictable Multicore Execution of Automotive Applications Using the LET Paradigm
Alessandro Biondi and Marco Di Natale
Mining Task Precedence Graphs from Real-Time Embedded System Traces
Oleg Iegorov and Sebastian Fischmeister
Schedulability Analysis and Software Synthesis for Graph-Based Task Models with Resource Sharing
Jakaria Abdullah, Gaoyang Dai, Morteza Mohaqeqi and Wang Yi

Temporal Logic and its Applications
Session Chair: Necmiye Ozay
Specifying Timed Patterns using Temporal Logic
Dogan Ulus and Oded Maler
Efficient Parametric Identification for STL
Alexey Bakhirkin, Thomas Ferrère and Oded Maler
Parameter Invariant Monitoring for Signal Temporal Logic
Nima Roohi, Ramneet Kaur, James Weimer, Oleg Sokolsky and Insup Lee
Localizing Faults in Simulink/Stateflow Models with STL
Ezio Bartocci, Thomas Ferrère, Niveditha Manjunath and Dejan Nickovic
12:30 Lunch
Medical Applications

Session Chair: Sam Coogan

Context-Aware Detection in Medical Cyber-Physical Systems
Radoslav Ivanov, James Weimer and Insup Lee

A Data-Driven Approach to Artificial Pancreas Verification and Synthesis
Taisa Kushner, David Bortz, David Maahs and Srim Sankaranarayanan

Model and Integrate Medical Resource Available Times and Relationships in Verifiably Correct Executable Medical Best Practice Guideline Models
Chunhui Guo, Zhicheng Fu, Zhenyu Zhang, Shangping Ren and Lui Sha

Platform for Model-Based Design and Testing for Deep Brain Stimulation
Ilija Jovanov, Michael Naumann, Karthik Kumaravelu, Warren Grill and Miroslav Pajic

Re-thinking EEG-based non-invasive brain interfaces: modeling and analysis
Gaurav Gupta, Sergio Pequito and Paul Bogdan

Localization and Tracking

Session Chair: Shahriar Nirjon

Slocalization: Sub-μW, Static, Decimeter-Accurate Localization with Ultra Wideband Backscatter
Pat Pannuto, Benjamin Kempke, Prabal Dutta

Based Angle-of-Arrival Estimation, Localization, and Target Tracking
Chitra R. Karanam, Belal Korany, Yasamin Mostofi

(Short Paper) Data Fusion for Hybrid and Autonomous Time-of-Flight Positioning
Aymen Fakhreddine, Domenico Giustiniano, Vincent Lenders

(Short Paper) Nanosecond-precision Time-of-Arrival Estimation for Aircraft Signals with low-cost SDR Receivers
Roberto Calvo-Palomino, Fabio Ricciato, Blaz Repas, Domenico Giustiniano, Vincent Lenders

Enhancing Indoor Smartphone Location Acquisition using Floor Plans
Niranjini Rajagopal, Patrick Lazik, Nuno Pereira, Sindhura Chayapathy, Bruno Sinopoli, Anthony Rowe

Orientation-aware RFID Tracking with Centimeter-level Accuracy
Chengkun Jiang, Yuan He, Xiaolong Zheng, Yunhao Liu
Session 8

14:00

Scheduling
Session Chair: Hyoseung Kim

- FIFO with Offsets: High Schedulability with Low Overheads
  Mitra Nasri, Robert Davis and Björn Brandenburg

- The Concept of Response Time Estimation Range for Optimizing Systems Scheduled with Fixed Priority
  Yecheng Zhao and Haibo Zeng

- Firmness analysis of real-time applications under static-priority preemption scheduling
  Amir Behrouzian, Dip Goswami, Twan Basten, Marc Geilen, Hadi Alizadeh Ara and Martijn Hendriks

Algorithms and Foundations
Session Chair: Maria Prandini

- Algorithms for exact and approximate linear abstractions of polynomial continuous systems
  Michele Boreale

- State Estimation of Dynamical Systems with Unknown Inputs: Entropy and Bit Rates
  Hussein Sibai and Sayan Mitra

- Improving validated computation of Viability Kernels
  Benjamin Martin and Olivier Mullier

15:30 Coffee-Break
Autonomous Vehicles
Session Chair: Nicola Bezzo

Autoware on Board: Enabling Autonomous Vehicles with Embedded Systems

Optimal Input Design for Affine Model Discrimination with Applications in Intention-Aware Vehicles
Yuhao Ding, Farshad Harirchi, Sze Zheng Yong, Emil Jacobsen and Necmiye Ozay

CoDrive: Cooperative Driving Scheme For Vehicles in Urban Signalized Intersections
Yiran Zhao, Shuochao Yao, Huajie Shao and Tarek Abdelzaher.

Dynamic Intersections and Self-Driving Vehicles
Shunsuke Aoki and Raj Rajkumar

14:00-15:00
Panel

15:00-15:30
Poster Madness

15:30-17:30
Poster Session

www.cister.isep.ipp.pt/cps.edu.pt/
16:00

Cyber-Physical Systems

Session Chair: David Broman

A Clockless Synchronisation Framework for Cooperating Mobile Robots
Luis Oliveira, Luís Almeida and Daniel Mosse

A Real-Time and Non-Cooperative Task Allocation Framework for Social Sensing Applications in Edge Computing Systems
Daniel (Yue) Zhang, Yue Ma, Yang Zhang, Suwen Lin, X. Sharon Hu and Dong Wang

Closing the Gap between Stability and Schedulability: A New Task Model for Cyber-Physical Systems
Hoon Sung Chwa, Kang Shin and Jinkyu Lee

Best Presentation Award and Farewell Ceremony (starting at 17:30)

Modeling and Verification

Session Chair: Dejan Nickovic

Modeling the Impact of Vehicle Platooning on Highway Congestion: A Fluid Queuing Approach
Li Jin, Mladen Cicic, Saurabh Amin and Karl Johansson

(T) Graphical Modeling of Hybrid Dynamics with Simulink and Stateflow
Akshay Rajhans, Srinath Avadhanula, Alongkrit Chutinan, Pieter Mosterman and Fu Zhang

(T) DSValidator: An Automated Counterexample Reproducibility Tool for Digital Systems
Lennon Chaves, Iury Bessa, Lucas Cordeiro and Daniel Kroening

(T) AVERIST: Algorithmic Verifier for Stability of Linear Hybrid Systems
Miriam Garcia Soto and Pavithra Prabhakar

HSCC business meeting, announcements about next HSCC (starting at 17:30)
RTAS Demos & Posters Session

Work-in-Progress

A Flattened Priority Framework for Mixed-Criticality Real-time Systems. Zonghui Li, Hai Wan, Yangdong Deng and Ming Gu


RWS - A Roulette Wheel Scheduler For Preventing Execution Pattern Leakage. Ying Zhang, Lingxiang Wang, Wei Jiang and Zhishan Guo

Work-Already-Published

Reliability Optimization on Multi-Core Systems with Multi-Tasking and Redundant Multi-Threading. Kuan-Hsun Chen, Georg von der Brüggen and Jian-Jia Chen

mRPL+: a mobility management framework in RPL/6LoWPAN. Hossein Fotouhi

Demos

6TiSCH in Full Bloom: From Dynamic Resource Management to Cloud-based Network Analytics. Tao Gong, Huayi Ji, Tianyu Zhang, Jianwei Zhou, Xiaolin Lu, Xiaobo Sharon Hu and Song Han

Industrial IoT Field Gateway Design for Heterogeneous Process Monitoring and Control. Tao Gong, Shaobo Zheng, Mark Nixon, Eric Rotvold and Song Han

Real-time Heterogeneous Edge Computing System for Social Sensing Applications. Daniel (Yue) Zhang, Nathan Vance and Dong Wang

Slate XNS - An Online Management Tool for Deterministic TSN Networks. Silviu Craciunas, Ramon Serna Oliver and Wilfried Steiner
HSCC Demos & Posters Session

Demos

**ROCS - A Robustly Complete Control Synthesis Tool for Nonlinear Dynamical Systems.** Yinan Li and Jun Liu

**Graphical Hybrid Automata with Simulink and Stateflow.** Akshay Rajhans, Srinath Avadhanula, Alongkrit Chutinan, Pieter Mosterman and Fu Zhang

**DryVR 2.0 - A Tool For Verification and controller synthesis of black-box cyber-physical systems.** Bolun Qi, Chuchu Fan, Minghao Jiang and Sayan Mitra

Posters

**Formal Controller Synthesis from Hybrid Programs.** Vladimir Sinyakov and Antoine Girard

**Compositional Synthesis of Interconnected Stochastic Control Systems based on Finite MDPs.** Abolfazl Lavaei, Sadegh Soudjani and Majid Zamani

**Compositional Synthesis of Finite Abstractions for Networks of Systems: A Dissipativity Approach.** Abdalla Swikir, Antoine Girard and Majid Zamani

**Contract based Design of Symbolic Controllers for Vehicle Platooning.** Adnane Saoud, Antoine Girard and Laurent Fribourg

**Recent Results in State Estimation of Dynamical Systems with Inputs under Bandwidth Constraints.** Hussein Sibai and Sayan Mitra

**CODEV: Automated Model Predictive Control Design and Formal Verification.** Nicole Chan and Sayan Mitra

**Sim-ATAV: Simulation-Based Adversarial Testing Framework for Autonomous Vehicles.** Cumhur Erkan Tuncali, Georgios Fainekos, Hisahiro Ito and James Kapinski

**Major Computational Breakthroughs in the Synthesis of Symbolic Controllers via Decomposed Algorithms.** Eric Kim, Mahmoud Khaled, Murat Arcak and Majid Zamani
ICCPS Demos & Posters Session

Demos

Learning-Based Control Design for Deep Brain Stimulation. Ilija Jovanov, Michael Naumann, Karthik Kumaravelu, Vuk Lesi, Aditya Zutshi, Warren Grill, Miroslav Pajic
An Industrial Control System Testbed for the Encrypted Controller. Xing Li, Mengxiang Liu, Rui Zhang, Peng Cheng, Jiming Chen
Formation Control and Persistent Monitoring in the OpenUAV Swarm Simulator on the NSF CPS-VO. Anna Lukina, Arjun Kumar, Matt Schmittle, Abhijeet Singh, Jnaneshwar Das, Stephen Rees, Christopher P. Buskirk, Janos Sztipanovits, Radu Grosu, Vijay Kumar

Posters

Cooperative Key Generation for Data Dissemination in Cyber-Physical Systems. Kai Li, Harrison Kurunathan, Ricardo Severino and Eduardo Tovar
Cyber-Physical Systems Virtual Organization: Active Resources. Janos Sztipanovits, Matthew Banting, Vijay Kumar, Paulo Tabuada
SOH aware Battery Management Optimization on Decentralized Energy Network. Daichi Watari, Ittetsu Taniguchi, and Takao Onoye
IPSN Demos & Posters Session

Demos

**EMeasure: Using A Smart Device With Consumer-Grade Accelerometer as an Accurate Measuring Scale.** V. Chandel, A. Ghose

**Attributed-based Authentication and Access Control for IoT Home Devices.** A. Neto, Y. Pereira, A. Souza, I. Cunha, L. Oliveira

**Applications on the Signpost Platform for City-Scale Sensing.** J. Adkins, B. Ghena, N. Jackson, P. Pannuto, B. Campbell, P. Dutta

**Battery-free 802.15.4 Receiver.** C. Pérez-Penichet, C. Noda, A. Varshney, T. Voigt

**A Motion-Triggered Stereo Camera for 3D Experience Capture.** B. Islam, M. Islam, S. Nirjon

**Federated Authentication of Things.** M. Santos, J. Carneiro, F. Teixeira, A. Franco, M. Henriques, L. Oliveira

**The OpenChirp Low-Power Wide-Area Network and Ecosystem.** A. Dongare, A. Luong, A. Balanuta, C. Hesling, K. Bhatia, B. Iannucci, S. Kumar, A. Rowe

**A Tool to Access and Visualize Classroom Attendance Data from a Smart Campus.** T. Sutjarittham, H. Gharakheili, S. Kanhere, V. Sivaraman

**PosePair: Pairing IoT Devices Through Visual Human Pose Analysis.** C. Ruiz, S. Pan, A. Sadde, H. Noh, P. Zhang

**Welcome to My World: Demystifying Multi-user AR with the Cloud.** N. Rajagopal, J. Miller, K. Kumar, A. Luong, A. Rowe

**Walkway Discovery from Large Scale Crowdsensing.** C. Cao, Z. Liu, M. Li, W. Wang, Z. Qin

Posters

**Smart Saline Management System.** H. Amarasekara, R. Manage, K. Abeywickrama, K. Perera, R. Achchige, J. Wijekoon


**Pulse Shot: Photo Shooting and Retrieval System Using Heartbeat Information.** H. Oshita, N. Segawa

**Fast Indoor Localization using WiFi Channel State Information.** A. Ahmed, N. Bergmann, R. Arablouei, F. de Hoog, B. Kusy, R. Jurdak
Energy Efficient Mobile Data Collection from Sensor Networks with Range-Dependent Data Rates. N. Annuar, N. Bergmann, R. Jurdak, B. Kusy


Runtime Adaptation of PHY Settings for Dependable UWB Communications. B. Großwindhager, C. Boano, M. Rath, K. Römer


Road Quality Classification for road repair authorities and regular drivers, Using an on-board Data Logger. H. Tariq, S. Mazhar, H. Hameed

Zero-power Receiver for Touch Communication and Touch Sensing. S. Raphael, M. Magno

Reliable Push Notification for Mobile Users in Interactive Smart Mobile Applications. T. Yang, C. Kim, S. Kim, S. Kim, S. Park

Building IoT Nodes - A Flexible Approach. S. Manurkar, K. Ramamritham


Toward Fast Closed-loop Control over Multi-hop Low-power Wireless Networks. F. Mager, D. Baumann, S. Trimpe, M. Zimmerling

Combining LoRa and RTK to Achieve a High Precision Self-Sustaining Geo-localization System. M. Magno, S. Rikli, J. Quack, O. Bunecker, L. Benini

10/April
18:45-20:30
Workshop/Tutorial
Cocktail Dinatoire
Palácio da Bolsa
Cocktails in a relaxing environment
for workshop/tutorial participants

11/April
17:30-19:30
Reception
Palácio da Bolsa
Food and drinks for the body,
posters & demos for the mind

19:30-21:30
Fringe Event
More drinks, more food and music

20:00-22:00
TPC Dinner

12/April
19:30-22:00
Banquet
Casa Ferreira
Portwine cellars in the Douro riverbank
Social Program

Reception
Palácio da Bolsa
Rua Ferreira Borges
4050-253 Porto
www.palaciadabolsa.com

Banquet
Caves Ferreira
Av. Ramos Pinto, 70
4400-266 Vila Nova de Gaia
www.sograpevinhos.pt

Taxi Douro
www.dourorivertaxi.com