

Special Session

Code: m8p91

Title

Design, Modeling, and Analysis of Controllers for Cyber-Physical Systems

Proposer / Main Organizer

1. Remigiusz Wiśniewski (r.wisniewski@issi.uz.zgora.pl), University of Zielona Gora, Poland

Remigiusz Wisniewski is Professor and Head of the Division of Information Systems and Cybersecurity (Institute of Control & Computation Engineering) at the University of Zielona Góra, Poland. He received his M.Sc. and Ph.D. degrees in computer science from University of Zielona Góra in 2003 and 2008, respectively. In 2018 he obtained a D.Sc. degree (habilitation) in computer science from the Silesian University of Technology, Gliwice, Poland. From 1999 to 2002 he was with Aldec Inc. (Henderson, NV, USA), where he conducted specialized trainings for companies, such as Xilinx (San Jose, CA, USA), Intel (Austin, TX, USA). In 2001 he conducted presentations for Aldec Inc. at DAC and DATE conferences (Las Vegas, NV, USA and Munich, Germany, respectively). In 2019 he was a visiting professor at the University of California, Berkeley, CA, USA, where he took up an internship.

He has published more than 100 publications, including 2 books, 50 journal papers, and 6 book chapters. His main research interests include cryptography, modeling, design, decomposition and analysis of concurrent control systems, cyber-physical systems, Petri nets, programmable devices, field programmable gate arrays (FPGAs). Prof. Wisniewski is a Senior Member of IEEE, and a member of IES and SMC societies, as well as IEEE IES Technical Committee on Industrial Informatics. He is a member of Advisory Board at Polish Ministry of Science and Higher Education ("Industrial Doctorate" program).

Prof. Wisniewski currently serves as an Associate Editor for the journal IEEE Transactions on Systems, Man, and Cybernetics: Systems, IEEE Industrial Informatics, and for the journal IEEE Access. He is an Editorial Board Member of the journal Energies ("Critical Energy Infrastructure" Section). He led or served as a guest editor for several special sections organized within IEEE Transactions on Systems, Man, and Cybernetics: Systems, Computer Communications, Energies, International Journal of Applied Mathematics and Computer Science, Mathematics, Applied Sciences, IEEE Access. He was a chairman or co-organizer of special sessions and technical tracks organized during conferences: IEEE Annual Conference of the Industrial Electronics Society (IEEE IES IECON), IEEE International Conference on Human System Interaction (IEEE HSI), IEEE International Conference on Industrial Informatics, (IEEE INDIN), and others.

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2. Luis Gomes (lugo@fct.unl.pt), Technical University of Lisbon, Portugal

Luis Gomes received his Electrotech. Eng. Degree from Technical University of Lisbon, Portugal, in 1981, and a PhD degree in Digital Systems from University NOVA Lisbon, Portugal, in 1997. He is an Associate Professor with Habilitation at the Electrical and Computer Engineering Department, Faculty of Sciences and Technology of NOVA University Lisbon, Portugal and a researcher at UNINOVA Institute, Portugal. From 1984 to 1987, he was with EID, a Portuguese medium enterprise, in the area of electronic system design, in the R&D engineering department.

His main interests include the usage of Petri nets and other models of concurrency, applied to reconfigurable and embedded systems co-design and cyber-physical systems. He was made Honorary Professor of Transilvania University of Brasov, Brasov, Romania, in 2007, as well as Honorary Professor of Óbuda University, Budapest, Hungary, in 2014. He received the IEEE Industrial Electronics Society Anthony J Hornfeck Service Award in 2016.

Professor Gomes is author/co-author of more than 300 papers and chapters published in journals, books and conference proceedings, as well as co-author of one book and co-editor for three books. He is currently serving/was recently serving as associate editor for IEEE Transactions on Industrial Informatics, IEEE Transactions on Industrial Electronics, and IEEE Industrial Electronics Magazine, and also served as guest co-editor for several special sections on the referred IEEE Transactions, as well as IEEE ACCESS.

3. MengChu Zhou (mengchu.zhou@njit.edu), New Jersey Institute of Technology, USA

MengChu Zhou (S'88-M'90-SM'93-F'03) received his B.S. degree in Control Engineering from Nanjing University of Science and Technology, Nanjing, China in 1983, M.S. degree in Automatic Control from Beijing Institute of Technology, Beijing, China in 1986, and Ph. D. degree in Computer and Systems Engineering from Rensselaer Polytechnic Institute, Troy, NY in 1990. He joined New Jersey Institute of Technology (NJIT), Newark, NJ in 1990, and is now a Distinguished Professor of Electrical and Computer Engineering.

His interests are in intelligent automation, complex systems and networks, Petri nets, Internet of Things, edge/cloud computing, and big data analytics. He has over 900 publications including 12 books, over 600 journal papers including over 500 IEEE Transactions papers, 30 patents and 29 book-chapters.

He is the founding Editor of IEEE Press Book Series on Systems Science and Engineering and Editor-in-Chief of IEEE/CAA Journal of Automatica Sinica. He is a recipient of Humboldt Research Award for US Senior Scientists from Alexander von Humboldt Foundation, Franklin V. Taylor Memorial Award and the Norbert Wiener Award from IEEE Systems, Man and Cybernetics Society for which he serves as VP for Conferences and Meetings. He is a life member of Chinese Association for Science and Technology-USA and served as its President in 1999. He is a Fellow of International Federation of Automatic Control (IFAC), American Association for the Advancement of Science (AAAS) and Chinese Association of Automation (CAA).

IEEE Member or SMC Society Member

Remigiusz Wiśniewski (Senior IEEE member, SMC society member)

Luis Gomes (Senior IEEE member)

MengChu Zhou (IEEE Fellow, SMC society member)

Category

Please select one of the following categories:

- Systems Science and Engineering*

Number of Expected Paper Submissions:

6 or more

Keywords

Cyber-physical system, control, design, modeling, analysis

Brief Description and Justification (200-250 words):

A cyber-physical system (CPS) is an integration of computation with physical processes, defined by cyber and physical parts of the system. The cyber part makes decisions and controls the objects, while the physical part is prone to communicate with the real world. This special session concerns the control aspects of the design, modeling, and analysis of a cyber-physical system. Topics of interest include, but are not limited to:

Design methodologies of controllers for CPS:

- *Design techniques of CPS*
- *Distributed and networked control of CPS*
- *Hardware realization (including FPGAs, embedded processors, PLCs, etc.)*
- *Decomposition (splitting) and synchronization techniques of CPS*
- *Cyber-related aspects in the design of CPS*

Modeling techniques of controllers for CPS:

- *Modeling dynamic behaviors of CPS*
- *Model-based development, including Unified Modeling Language (UML, SysML), etc.*
- *Concurrency models of CPS, including Petri net-based specification*
- *Sequential modeling of CPS, including finite-state machines*

Analysis of controllers for CPS:

- *Performance evaluation*
- *Verification of CPS (including formal methods, model checking, etc.)*
- *Validation and simulation techniques of CPS*
- *Optimization techniques of CPS*
- *Security aspects of CPS (including algorithms, protocols, e-services, etc.)*
- *Analysis of the concurrency and sequentiality relations in the controllers for CPS*