



Proposal for ISIE 2021 Tutorial

Title of Tutorial:

Engineering Industrial Systems of Cyber-Physical Systems (ISoCPS) from an Industry 4.0-Perspective

Contact Information of Speakers:

A. Prof. Dr.-Ing. Armando Walter Colombo (corresponding speaker)

Affiliation: Institute for Industrial Informatics, Automation and Robotics (I2AR), Hochschule Emden/Leer, Germany

Address: Constantiaplatz 4, D-26723 Emden Germany

TEL: +49-172-659-6428, FAX:

e-mail: awcolombo@ieee.org

personal website: <https://ieeesystemscouncil.org/contact/armando-walter-colombo>

B. Stamatis Karnouskos

Affiliation: SAP, Germany

Address: Dietmar-Hopp-Allee 16, 69190, Walldorf, Germany

TEL: +496227752515, FAX:

e-mail: karnouskos@ieee.org

personal website: <https://scholar.google.com/citations?user=WkLswkoAAAAJ>

Background of Speakers:

Prof. A. W. Colombo

- Industrial Digitalization
- Industrial Cyber-Physical Systems
- Industry 4.0-compliant solutions
- Robotics and CIM

S. Karnouskos

- Industrial Internet of Things / Industrial Cyber-Physical Systems
- Next Generation Enterprise Systems
- Emerging Technologies and Industrial/Societal Implications

Brief description of the tutorial (500 words max):

In this tutorial an overview of key challenges appearing across the value chain of an organization that utilizes Cyber-Physical Systems is presented. Specifically, the challenges related to specification,

design, implementation, and operation of Cyber-Physical System(s) in the larger context of the Industry 4.0, Service-oriented and Systems-of-Systems paradigms, will be addressed.

Industrial Systems of Cyber-Physical Systems (ISoCPS) is a collective term for technologies, concepts, and novel business approaches of the whole value chain organization, combining Cyber-Physical Systems, the Internet-of-Things and the Internet-of-Services into a Digitalized and Networked Industrial / Business Ecosystem.

After presenting the scientific and technical background behind ISoCPS, highlighting features such as structural, operational, and managerial independence of the shop floor and supply chain constituent systems, interoperability, plug and play, self-adaptation, reliability, energy-awareness, high-level cross-layer (vertical and horizontal) integration, cooperation and management, security, ethical aspects, among others, the audience/participants of the Tutorial will get a deep view about:

- Digitalization and Networking of the economy. Principles.
- Building industrial eco-systems of digitalized and networked things/assets. Industry 4.0.
- Formalizing the digitalization and networking principles with the 3D RAMI4.0 DIN SPEC 91345 and Implementing the Asset-Administration-Shell Technology.
- Understanding why and how to fulfill the major requirements for an adequate industrial digitalization, engineering, and operation of ISoCPS?
- Understanding how to migrate from Industry 3.0 to Industry 4.0 environments. Analysis and discussion of results of exemplary innovation projects.
- Emerging technologies and implications e.g. Artificial Intelligence, Security, Ethics

Biography:

Speaker A, Prof. Dr.-Ing. Armando Walter Colombo (FIEEE), joined the Department of Electrotechnical and Industrial Informatics at the University of Applied Sciences Emden-Leer, Germany, became Full Professor in August 2010 and Director of the Institute for Industrial Informatics, Automation and Robotics (I2AR) in 2012. Prof. Colombo worked also during 17 years (2001-2018) as Manager Director for Collaborative Innovation Projects and also as Edison Level 2 Group Senior Expert at Schneider Electric, Industrial Business Unit.

Prof. Colombo received the BSc. on Electronics Engineering from the National Technological University of Mendoza, Argentina, in 1990, the MSc. on Control System Engineering from the National University of San Juan, Argentina, in 1994, and the Doctor degree in Engineering from the University of Erlangen-Nuremberg, Germany, in 1998. From 1999 to 2000 was Adjunct Professor in the Group of Robotic Systems and CIM, Faculty of Technical Sciences, New University of Lisbon, Portugal. During the last 15 years he has also been working as Invited Professor at the University of Loughborough and University of Warwick (UK), University of Tampere (Finland), ITMO University (Russia), Universidad Tecnológica Nacional (UTN) (Argentina), BUAP (Mexico).

Prof. Colombo has extensive experience in managing multi-cultural research teams in multi-regional projects. He has participated in leading positions in many international research and innovation projects related to the area of Industrial Informatics. His research interests are in the fields of industrial cyber-physical systems, industrial digitalization and system-of-systems engineering, Internet-of-Services, Industry 4.0-compliant solutions.

Prof. Colombo has over 30 industrial patents and more than 300 per-review publications in journals, books, chapters of books and conference proceedings (<https://scholar.google.de/citations?user=FgFDTMEAAAJ&hl=en>). He is member of the IEEE IES Administrative Committee (AdCom), member of the Fellow Committees of the IEEE IES, IEEE SMS and IEEE CS, and IES representative by the IEEE Systems Council. He is co-founder of three IEEE IES Technical Committees (i) on Industrial Agents, (ii) on Industrial Informatics and (iii) on Industrial Cyber-Physical Systems. He is Co-Editor-in-Chief of the IEEE Open Access Journal of the Industrial

Electronics Society (OJIES).

Prof. Colombo served/serves as advisor/expert for the definition of the Research and Innovation priorities within the Framework Programs FP6, FP7, FP8 (HORIZON 2020) and FP9 (Horizon Europe, ECSEL SRA) of the European Union. He is working as expert/evaluator in the European Research Executive Agency (REA), ECSEL Platform, Eureka- and German BMBF/DLR Programs, as well as Digital Supercluster Canada, National R&D-Programs in Sweden, Denmark, Italy, Switzerland, Norway, etc. Prof. Colombo is listed in Who's Who in the World /Engineering 99-00/01 and in Outstanding People of the XX Century (Bibliographic Centre Cambridge, UK).

Speaker B, Stamatis Karnouskos is with SAP in Germany, dealing with technology foresight, especially in the scope of industrial technologies and enterprise systems. He has extensive experience in industrial research and technology management. For more than twenty years, Stamatis has led efforts in several European Commission and industry-funded projects related to industrial automation, smart cities, cloud-based services and architectures, software agents, security, and mobility. Stamatis has co-authored/edited several books relevant to the Industrial Internet of Things and Cyber-Physical Systems and published over 200 papers in these areas (<https://scholar.google.com/citations?user=WkLswkoAAAAJ>). He is the general co-chair of the IEEE Industrial Cyber-Physical Systems (ICPS) conference series and within IES, he is leading Industrial Activities Committee and chairs the Technical Committee on Technology Ethics and Society.

Brief description of the intended audience

The intended audiences are professionals related to industrial electronics and industrial informatics engineering. Graduate and post-graduate students in the scientific and technical areas: electrical engineering and mechatronics, industrial informatics, digitalization and industrial communication, robotics, and industrial engineering, as well as e-business. Technicians and practitioners working in industrial automation and digitalization related areas. Managers and Decision-makers related to Circular Economy.

Support technical committee in IES (if any)

IEEE IES Technical Committee on Industrial Cyber-Physical Systems (Chair: Yang Shi, yshi@uvic.ca); IEEE IES Technical Committee on Technology Ethics and Society (Chair: Stamatis Karnouskos, karnouskos@ieee.org).