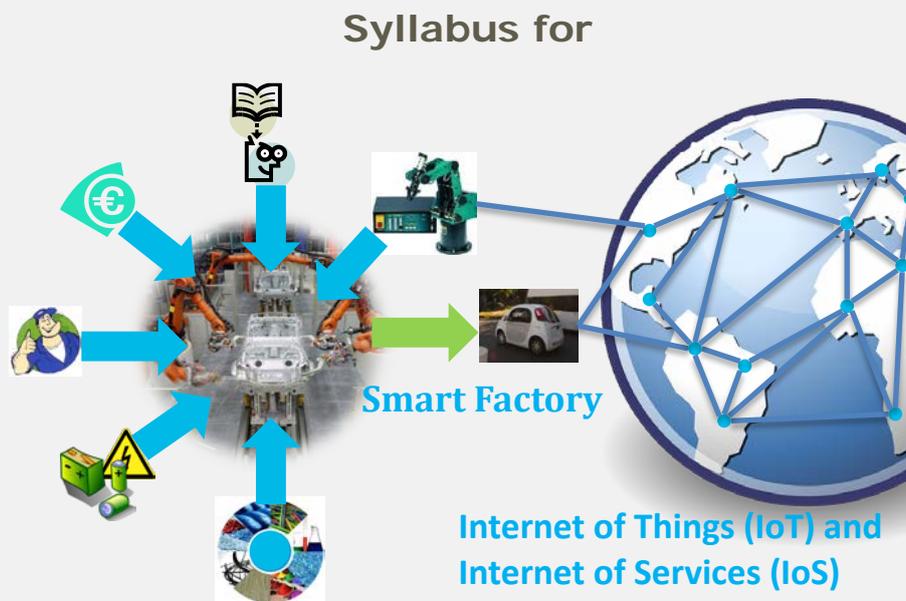




Updated: 12/10/2018



P31 – International Summer School on Intelligent Agents in Automation, Introductory/Advanced

Credits	6 credits
Examiner	Luis Ribeiro, Linköping University
Contact	Luis Ribeiro luis.ribeiro@liu.se +46 (0) 13 - 28 46 77
Target group	This event is designed to provide advanced training for PhD students and practitioners on the advanced automation technologies that will be the basis for Industry 4.0.
Fee for industrial members	Early registration fee: 275 € (before 17 th of May 2019) Regular registration fee 325 € Discounted registration fee: 175€ (for the second participant from the same institution)

Prerequisites On the introductory track no previous knowledge is required except from extremely basic notions of programming and automation compatible with most higher education curricula in engineering.

For the advanced track the participants are expected to have a more solid knowledge of programming and automation acquired for example by having participated in the first edition of the course.

Aim The 4th industrial revolution offers a vision of a smart and cyber-physical factory which is composed by many intelligent components that constantly adjust their operation depending on the production requirements and context. They will be able to understand and communicate and take over each other's roles dynamically in case of faults and failures. They will constantly collect system information which used later to improve and adjust their own operation. The technology for creating such a factory is being developed today. The students have a unique opportunity to learn about: the design principles, the current state of development and the challenges in developing these systems.

Teachers/tutors The course is examined by Luis Ribeiro, Lecturer at Linköping University which is also one of the main teachers at the course. However the course will also be taught by well-known international scientists, scholar and researchers.

As of 12/10/2018 the confirmed lecturers are:

Paulo Leitão

Paulo Leitão received the MSc and PhD degrees in Electrical and Computer Engineering, both from the University of Porto, in 1997 and 2004, respectively. He joined the Polytechnic Institute of Braganca in 1995, where he is Professor at the Department of Electrical Engineering. His research interests are in the field of intelligent and reconfigurable systems, cyber-physical systems, Internet of Things, multi-agent systems and self-organized systems. He participated in several R&D projects (e.g., EU GOODMAN, PERFoRM, ARUM and GRACE) and Networks of Excellence (e.g. IMS and CONET), served as general co-chair of several international conferences, namely IFAC IMS'10, HoloMAS'11, IEEE ICARSC'16 and SOHOMA'16, and published more than 200 papers in international scientific journals and conference proceedings. He is co-author of three patents and received four paper awards at INCOM'06, BASYS'06, INDIN'10 and INFOCOMP'13 conferences. Dr. Leitão is Senior member of IEEE Industrial Electronics Society (IES) and Systems, Man and Cybernetics Society (SMCS), past Chair of the IEEE IES Technical Committee on Industrial Agents and member at-large of the IEEE IES Administrative Committee (AdCom). Currently he is chair of the IEEE Standards Association

P2660.1 Working Group.

José Barbosa

José Barbosa has a PhD in Automation and Computer Science from the University of Valenciennes and Hainaut-Cambresis (France). He is a senior researcher at Polytechnic Institute of Braganca, Portugal, participating in several European funded projects, namely in the EU FP7 ARUM, in the EU FP7 GRACE project and in the EU H2020 ERASMUS+ DA.RE, EU H2020 GOODMAN, EU H2020 PERFoRM. He is also an invited professor at the Department of Electrical Engineering of the Polytechnic Institute of Braganca. José Barbosa has more than 40 papers published at international journals and proceedings of international conferences. His main research topics focus on the development of self-organizing and evolvable manufacturing control architectures following the holonic and multi-agent system paradigms enriched with biological inspired mechanisms, particularly applied into Cyber-Physical Systems. He is also member of several IEEE and IFAC Technical Committees.

Luis Ribeiro

Luis Ribeiro is an Associate Professor in Manufacturing Engineering at The Division of Manufacturing Engineering from the Department of Management and Engineering of Linköping University, Sweden. He holds a Swedish Docent degree in Manufacturing Engineering from Linköping University and a PhD in Electrical and Computer Engineering with Specialization in Robotics and Computer Integrated Manufacturing from Universidade Nova de Lisboa. He has been involved, in different roles, in several international research projects from the 6th, 7th and H2020 European Research Programmes, and several Portuguese and Swedish national projects. These projects have focused on smart automation and plug and produce systems, for various industries including automotive, white goods and aerospace, and have explored and developed many concepts and technologies that are now considered some of the foundational ideas of the so called 4th Industrial Revolution. His main research areas include: design, development and implementation of intelligent manufacturing systems based in cyber-physical components, distributed architectures to support intelligent systems and self-organization and emergence in manufacturing. His interests in these areas are in control, reconfiguration and monitoring/diagnosis. He is involved in several technical communities that are actively engaged in this research area for example the IEEE Technical Committees on: Industrial Agents, Cybernetics for Intelligent Industrial Systems and Industrial Cyber-Physical Systems. He is also a member of the expert group on flexible processes of the Swedish Production 2030 initiative and one of the leaders

of the expert group in Virtual Production of the same initiative.

Birgit Vogel-Heuser

Professor Vogel-Heuser (b. 1961) conducts research on the development and system evolution of distributed intelligent embedded systems in mechatronic products and production systems, with the aim of improving product quality, the efficiency and consistency of engineering activities and operational availability. She develops methods, descriptive aids and tools for integrating the various perspectives of mechatronic systems (mechanical, electrical/electronic and software) and phases in the life cycle and their interactions. Key non-functional requirements are real-time behavior, modularity, availability and usability. Her research projects range from fundamental research in automation technology to the derivation of requirements from industrial applications and the development of prototype tools. After graduating in electrical engineering from the Technical University of Aachen (RWTH), Prof. Vogel-Heuser earned her doctorate degree there (1990) in the area of robot programming in mechanical engineering. She acquired industrial experience over a ten year period, including a position as Engineering Director for the Siempelkamp Group (systems engineering). After various professorships (Hagen 1996; Wuppertal 2000; Kassel 2006), she assumed a professorship in the Department of Automation and Information Systems (formerly: Department of Information Technology) at TUM (2009). She is chairwomen of the German agents in automation working group of the GMA (NMO of IFAC) and heads the agents group in IFAC TC 3.1. More information

<http://www.professoren.tum.de/en/vogel-heuser-birgit/>

Arndt Lüder

Arndt Lüder, attended the Otto-von-Guericke University at Magdeburg, Germany, and completed his diploma degree in mathematics in 1995 and in mathematics-economics in 1997. From 1995 to 2000 he worked as research engineer at Otto-von-Guericke-University Magdeburg and Martin-Luther-University Halle-Wittenberg where he finished his PhD in 2000. Since 2001 he has been working at the IAF. Since January 2006 he has been working as head of center of Distributed Systems at the IAF. He was promoted to professor in 2007 on "Distributed Control Systems". End of 2011 he was bestowed the title "Associate Professor" in the field of research and teaching "Factory Automation".

Armando W. Colombo

Prof. Dr.-Ing. Armando Walter Colombo (Fellow IEEE) 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. He worked during the last 17 years as Manager for Collaborative Projects and also as Edison Level 2 Group Senior Expert at Schneider Electric, Industrial Business Unit. 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 peer-review publications in journals, books, chapters of books and conference proceedings (see <https://scholar.google.de/citations?user=FgFDTMEAAAAJ&hl=en>). He has extensive experience in managing multi-cultural research teams in multi-regional projects and has participated in leading positions in many international research and innovation projects in the last 16 years. With his contributions, he has performed scientific and technical seminal contributions that are nowadays being used as one of the basis of what is recognized as "The 4th Industrial Revolution": networked collaborative smart cyber-physical systems that are penetrating the daily life, producing visible societal changes and impacting all levels of the society. He is co-founder of the IEEE IES TC on Industrial Agents and TC on Industrial Informatics. He is founder and currently Chairman of the IEEE IES TC on Industrial Cyber- Physical Systems, member of the IEEE IES Administrative Committee (AdCom) and of the IEEE Systems Engineering Council. 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).

Stamatis Karnouskos

Stamatis Karnouskos (<https://scholar.google.com/citations?user=WkLswkoAAAAJ>) is with SAP, dealing with emerging industrial technologies related to the Internet of Things and Enterprise systems. He investigates the added value of integrating networked embedded devices and enterprise systems. For more than 20 years Stamatis leads efforts in several European Commission and industry-funded projects related to industrial automation, smart grids, Internet/cloud-based services and architectures, software agents, security, and mobility. Stamatis is the current chair of the IEEE IES Technical Committee on Industrial Agents (<http://tcia.ieee-ies.org>).

Thomas Strasser

Thomas Strasser received a master's and a PhD degree from Vienna University of Technology and was awarded with the *venia docendi* (habilitation) in the field of automation from the same university. For several years, he has been a senior

scientist in the Center for Energy of the AIT Austrian Institute of Technology. His main responsibilities involve strategic development of smart grid automation and validation research projects and mentoring/supervising junior scientist and PhD candidates. Before joining AIT, Dr. Strasser spent more than 6 years as senior researcher investigating advanced and reconfigurable automation and control systems at PROFACTOR research. He is active as a senior lecturer (Privatdozent) at the Vienna University of Technology.

Learning outcomes

After the course the participants will be able to:

- Discuss the vision and the main challenges related to the fourth industrial revolution (also known as Industry 4.0) and the main research initiatives in this area.
- Understand the main design and implementation principles that support cyber-physical production system and the system that motivate Industry 4.0.
- Understand what why a cyber-physical system is different from today's conventional system.
- Understand the requirements on the computational and physical infrastructures required to support such a system.
- Design a simple cyber-physical production system.
- Use at a basic level the main technologies supporting such systems:
- Understand how to use today's technologies to create an industrial cyber-physical system.
- Use Intelligent Agents as a mechanism to design the cyber part of a cyber-physical system.

Contents

The course provides, through the view of several international experts, different core subjects involved in the design, development and implementation of very intelligent productions systems. Such systems are able, by design, to take autonomous decisions as a reaction to continuously changing production environments where products being produced change frequently and the system can be seamlessly changed to cater for the new production requirements. Products and production equipment are considered individual intelligent units that have a mechanical/physical part and a cyber component (cyber-physical formulation). The cyber part ensures that the system components interpret each other's actions and needs and behave as a society of intelligent artificial being that can cater for different production disturbances and actively collect data that is further transformed in knowledge used to improve the autonomous response of the system as an whole. Such a vision has lately been put in evidence by several research agendas and in particular the German "Industrie 4.0" that coined the term Industry 4.0. However most of the contributions far precede the existence of I4.0 and all the teachers in the course of a very significant track record in these previous contributions dating back in time more than 10

years.

Organisation Please see the scheduling here:

<http://issia2019.ipb.pt/>

The modules highlighted in green are part of the starting track of the course. The modules highlighted in orange belong to the advanced track of the course. All the other events are for both tracks.

Literature Will be provided by the different teachers during the course. Other literature or preparation work such as set-up of software tools will be communicated to the students shortly before the course.

Examination

- Course attendance (full course): 1,5 credits
- Approval on the practical exercises: 1,5 credits
- Final written assignment consisting on a 4000 word essay summarizing the new scientific and technical knowledge acquired: 3 credits

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