

<b>Modulbezeichnung (eng.)</b>	<b>Industrial Cyber-Physical Systems</b> (Industrial Cyber-Physical Systems)
<b>Semester</b>	WPM
<b>ECTS-Punkte (Dauer)</b>	5 (1 Semester)
<b>Art</b>	Wahlpflichtmodul
<b>Sprache(n)</b>	Englisch
<b>Studentische Arbeitsbelastung</b>	60 h Kontaktzeit + 90 h Selbststudium
<b>Voraussetzungen (laut MPO)</b>	
<b>Empf. Voraussetzungen</b>	Teilnahme am Modul Digitalisation & Virtualisation of ICPS
<b>Verwendbarkeit</b>	MaMb
<b>Prüfungsform und -dauer</b>	Mündliche Prüfung oder Studienarbeit
<b>Lehr- und Lernmethoden</b>	Vorlesung
<b>Modulverantwortlicher</b>	A. W. Colombo

#### Qualifikationsziele

The rapid advances in computational power, communication and storage coupled with the benefits of the cloud and services, has the potential to give rise to a new generation of industrial systems whose communication features are based on Industrial-Internet-Technology (IoT), whose functionalities reside on-device and/or in-cloud and are exposed and/or consumed based on the application of the Industrial-Internet-of-Services (IoS) paradigm, resulting to the formation of Industrial Cyber-Physical Systems (ICPS). The same trend is evident also in other domains e.g., Energy, Healthcare, Transportation, Robotics, Smart Cities etc.. ICPS are the backbone, the enabler of digitalization, connectivity, composability and interoperability between those seemingly disparate domains and application sectors. Since ICPS are real-world networked industrial infrastructures having a cyber-representation through digitalization of data and information across the enterprise and the whole value chain, students will be qualified to understand and work with standard industrial frameworks covering “digitalization of industrial systems based on the ICPS technologies“ and enabled to apply this knowledge in a scientific environment.

#### Lehrinhalte

A set of technologies and architectural patterns to enable the specification, implementation and operation of industrial cyber-physical systems under the DIN SPEC 91345:2016-04 (RAMI4.0: Reference Architecture Model for Industrie 4.0) and Industrial Internet-Reference Architecture (IIRA) standards will be a core part of the lecture’s contents. In this context, the major specifications of the (i) enterprise standard architectures PERA, ISA’88, ISA’95 (IEC 62264, IEC 61512), (ii) Life Cycle and Value Stream (IEC 62890) and (iii) OPC-Unified Architecture will be presented, complemented with studies and analysis (technology and trend screening) of currently implemented industrial solutions for ICPS, performed by the students.

#### Literatur

A. W. Colombo et.al. Eds., Industrial Cloud-based Cyber-Physical Systems: The IMC-AESOP Approach. Springer, 2014.  
DIN SPEC 91345:2016-04: Reference Architecture Model Industrie 4.0 (RAMI4.0). DIN - VDI/VDE 2016.  
A W Colombo, S. Karnouskos: “The emergence of Industrial Cyber-Physical Systems based on SoA and Cloud Technologies, Realizing the Internet of Automation Things“. Tutorial, IEEE IECON 2015, Yokohama, Japan.  
Industrial Internet Reference Architecture (IIRA). Industrial Internet Consortium. [Online]. Available: <http://www.iiconsortium.org>.  
Industrial Cyber-Physical Systems. Special Issue of the IEEE Proceedings, May 2016. A W Colombo et.al (Eds.)

#### Lehrveranstaltungen

<b>Dozent</b>	<b>Titel der Lehrveranstaltung</b>	<b>SWS</b>
A. W. Colombo	Industrial Cyber-Physical Systems	4