

Call for Papers for the Open Invited Track at the IFAC World Congress 2020 regarding

### **Models and methods for the engineering of Cyber-Physical Systems with increasing autonomy**

Cyber-Physical Systems (CPS) impose additional challenges regarding their design, implementation and operation, especially when they are intended to form systems of systems and to have some degree of autonomy. Their (desired) abilities to consider varying internet-based information sources, to show emerging behaviour in cooperation, to operate in varying context, and to learn and improve their behaviour during operation request suitable models and methods to ensure a safe and reliable operation. Within this Open Invited Track, new approaches will be presented how to cope with these challenges. Contributions should explicitly address where and how they can be embedded into a model-based engineering approach and how they fulfill the requirements of industrial applications.

The model-based engineering and operation of CPS has been subject to extensive research during recent years and comprises a variety of modelling approaches and methods for the design, implementation, and validation of control. While these methods have traditionally assumed that all operational requirements are known at design time, there is an increasing trend towards CPS, especially long-living systems, which are, or will be, operated under conditions which are, to some degree, unknown at design time. Possible approaches to cope with this requirement are

- to equip CPS with a-priori-knowledge (models, rules, semantics etc.) which extend their potential to “understand” their tasks and their environment,
- to enable CPS to become aware of changing environmental conditions and requirements (also known as open context)
- to enable CPS to adapt or re-build their model of their environment, i.e. to learn patterns, correlations and models based on the observations,
- to provide a CPS the possibility to communicate with others and to negotiate with them about the execution of given tasks and the fulfillment of requirements in united and shared activities.

Model-based Software Engineering, Autonomous Agents, Artificial Intelligence, Machine Learning and the Industrial Internet of Things are key technologies for these developments. This Open Invited Track offers a forum to present new approaches and to discuss experiences gathered in industrial applications. Therefore, the track addresses researchers and users from various industry sectors where automation is key, such as production, building automation, automotive, transport and telecommunication.

Contributions may cover, but are not limited to, the following research approaches:

#### **Model-based Engineering**

- seamless engineering chains, model-driven engineering
- software engineering methods suitable for CPS
- test, validation and verification
- ontologies and semantic technologies, knowledge representation
- meta models and domain-Specific Languages, such as AutomationML
- digital twins

#### Autonomous Agents

- engineering methods for agent-based systems
- methods to ensure desired behaviour of agent-based systems

#### Machine Learning Methods

- Machine Learning for security, intrusion detection, network data analysis
- usage of deep learning for Cyber Physical Systems such as recurrent networks, dimension reduction, clustering and classification or online learning.
- image processing, collaboration, machine to robot interaction

#### Edge and Cloud

- cloud services for automation
- distributed computing, machine learning for resource-constrained devices, distributed optimization

#### Artificial Intelligence

- diagnosis and root cause detection
- automatic reconfiguration and planning

#### **How to submit to this Open Invited Track:**

**Submission Site:** <https://ifac.papercept.net/conferences/scripts/start.pl>

→ select IFAC World Congress 2020 in Berlin

→ select “Open Invited Track Paper”

→ enter the code “m9rrj” to assign your submission to this track

**Submission deadline is October 31, 2019.**

The Open Invited Session will be Co-Chaired by

Alexander Fay, HSU Hamburg, Germany

Christian Diedrich, OvGU Magdeburg, Germany

Oliver Niggemann, HSU Hamburg, Germany

Carlos Eduardo Pereira, Federal University of Rio Grande do Sul, Brasil

Michael Weyrich, University of Stuttgart, Germany

Valeriy Vyatkin, Aalto University, Helsinki, Finland

Birgit Vogel-Heuser, Technical University Munich, Germany

Conference Homepage: <https://www.ifac2020.org/call/>