

# **2020 IEEE International Symposium on Systems Engineering (ISSE 2020)**

**Vienna, Austria  
12 October – 12 November 2020**



**IEEE Catalog Number: CFP20SYM-POD  
ISBN: 978-1-7281-8603-0**

**Copyright © 2020 by the Institute of Electrical and Electronics Engineers, Inc.  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP20SYM-POD
ISBN (Print-On-Demand):	978-1-7281-8603-0
ISBN (Online):	978-1-7281-8602-3
ISSN:	2687-881X

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

## Technical Program

### Cyber Security and Complex Systems

#### **A Strongly Non-Intrusive Methodology to Monitor and Detect Anomalous Behaviour of Wireless Devices...1**

*Parth Shah (University of Waterloo, Canada)*  
*Abdurhman Albasir (University of Waterloo, Canada)*  
*Ricardo Manzano (University of Waterloo, Canada)*  
*Kshirasagar Naik (University of Waterloo, Canada)*  
*Nitin Naik (Ministry of Defence, United Kingdom (Great Britain))*

#### **When Mini-AES Meets Machine Learning: Practice and Experience...9**

*Xian Liu (University of Arkansas at Little Rock, USA)*

#### **An Architecture-based Modeling Approach Using Data Flows for Zone Concepts in Industry 4.0...14**

*Matthias Kern (FZI Research Center for Information Technology, Germany)*  
*Emre Taspolatoglu (FZI Research Center for Information Technology, Germany)*  
*Fabian Scheytt (FZI Research Center for Information Technology, Germany)*  
*Thomas Glock (FZI Research Center for Information Technology, Germany)*  
*Bo Liu (FZI Research Center for Information Technology, Germany)*  
*Victor Pazmino Betancourt (FZI Research Center for Information Technology, Germany)*  
*Eric Sax (FZI Research Center for Information Technology, Germany)*  
*Juergen Becker (Karlsruhe Institute of Technology, Germany)*

#### **Governing Principles of Self-Sovereign Identity Applied to Blockchain Enabled Privacy Preserving Identity Management Systems...22**

*Nitin Naik (Ministry of Defence, United Kingdom (Great Britain))*  
*Paul Jenkins (University of Portsmouth & Ministry of Defence, United Kingdom (Great Britain))*

#### **Comparative Analysis of Cyber Security Approaches Using Machine Learning in Industry 4.0...28**

*Sumeyye Cebeloglu (Firat University, Turkey)*  
*Mehmet Karakose (Firat University, Turkey)*

#### **uPort Open Identity System: An Assessment of Self-Sovereign Identity and User-Centric Data Platform Built on Blockchain...33**

*Nitin Naik (Ministry of Defence, United Kingdom (Great Britain))*  
*Paul Jenkins (University of Portsmouth & Ministry of Defence, United Kingdom (Great Britain))*

### Energy Management and Sustainability

#### **Economic Load Dispatch with Short-Term Wind Power: Machine Learning through Radial Basis Neural Network...40**

*Xian Liu (University of Arkansas at Little Rock, USA)*

#### **Attack-Resilient Smart Grid Dynamic State Estimation Algorithm...48**

*Md Rana (University of Houston, USA)*  
*Ahmed Abdelhadi (University of Houston, USA)*

#### **Emulation Modeling on Rebound-Compensated Aggregation of Uncertain Demand Responses from a Large Number of Building Air-Conditioners...53**

*Chuzo Ninagawa (Gifu University, Japan)*  
*Asif Iqbal (Gifu University, Japan)*

Yoshifumi Aoki (Gifu University, Japan)  
Junji Morikawa (Mitsubishi Heavy Industries, Ltd., Japan)  
Seiji Kondo (Mitsubishi Heavy Industries, Ltd., Japan)

---

## Engineering Processes for Complex Systems

---

### Performance Assessment of Agile Hardware Co-development Process...59

Nicola Garzaniti (Skolkovo Institute of Science and Technology, Russia)  
Alessandro Golkar (Skolkovo Institute of Science and Technology, Russia)

### Integrated design methodology for improved system manufacturability...65

Arzu Kurgan (Skolkovo Institute of Science and Technology, Russia)  
Paolo Maggiore (Politecnico di Torino, Italy)  
Alessandro Golkar (Skolkovo Institute of Science and Technology, Russia)

### Industry 4.0 Impact on Evolution of Product Development: The Bicycle Saddle Case Study...72

Mohsen Memaran (Politecnico di Torino, Italy)  
Cristiana Delprete (Politecnico di Torino, Italy)  
Eugenio Brusa (Politecnico di Torino, Italy)  
Abbas Razavykia (Politecnico di Torino, Italy)  
Paolo Baldissera (Politecnico di Torino, Italy)

### Towards defining role models in Advanced Systems Engineering...80

Eva-Maria Grote (Fraunhofer-Einrichtung für Entwurfstechnik Mechatronik IEM, Germany)  
Stefan Achilles Pfeife (Fraunhofer-Einrichtung für Entwurfstechnik Mechatronik IEM, Germany)  
Daniel Röltgen (Fraunhofer-Einrichtung für Entwurfstechnik Mechatronik IEM, Germany) Arno Kühn (Fraunhofer-Einrichtung für Entwurfstechnik Mechatronik IEM, Germany) Roman Dumitrescu (Fraunhofer-Einrichtung für Entwurfstechnik Mechatronik IEM, Germany)

### Squaring the System of Systems Project Management Circle...87

Charles Pickar (Naval Postgraduate School, USA)

### Model-based Development of a Dynamic Container-Based Edge Computing System...94

Victor Pazmino Betancourt (FZI Research Center for Information Technology, Germany) Bo Liu (FZI Research Center for Information Technology, Germany)  
Juergen Becker (Karlsruhe Institute of Technology, Germany)

---

## Model-Based Systems Engineering

---

### Improving OPM Conceptual Models by Incorporating Design Structure Matrix...99

Gil Sobol (Technion - Israel Institute of Technology, Israel)  
Dov Dori (Technion, Israel Institute of Technology, Israel & Massachusetts Institute of Technology, USA)

---

## Modeling and Simulation

---

### A contribution to Commissioning as enabler of nuclear infrastructure delivery: Tests and trials program elaboration and management...107

Alan Gaignebet (LSR, IMT Mines Alès & Assystem Energy and Operation, France); Vincent Chapurlat (IMT Mines Alès & Lab. de Génie Informatique et d'Ingénierie de Production, France); Greg Zacharewicz (IMT - Mines Ales & Lab LGI2P, France)  
Victor Richet (Technical Lead, France)  
Robert Plana (Laas-cnrs, France)

### **Using a model-based engineering approach for developing Industrial Internet of Things applications...115**

*Christoph Binder (Salzburg University of Applied Sciences, Austria)  
Christian Neureiter (Salzburg University of Applied Sciences, Austria)*

### **Systems Approach to Localize Tipping Points for the Emergency Services in Face of the COVID-19 Pandemic...121**

*Maximilian Vierlboeck (Stevens Institute of Technology, USA)  
Roshanak Rose Nilchiani (Stevens Institute of Technology, USA)  
Christine Edwards (Lockheed Martin & Stevens Institute of Technology, USA)*

### **System Design and Simulation of a Human Electric Hybrid Vehicle in AVL CRUISE...130**

*Mehmet A. Ongun (AVL Research and Engineering, Turkey)  
Utku Kiran (AVL Research and Engineering, Turkey)  
Ahmet Sakalli (AVL Research and Engineering, Turkey)*

### **Driving-Simulator-in-the-Loop - Virtual Function Design with Consideration of Human Behaviour...136**

*Xiaobo Liu-Henke (Ostfalia University of Applied Sciences, Germany)  
Marian Göllner (Ostfalia University of Applied Sciences, Germany)  
Sven Jacobitz (Ostfalia University of Applied Sciences, Germany)  
Soeren Scherler (Ostfalia University of Applied Sciences, Germany)  
Jie Zhang (Ostfalia University of Applied Sciences, Germany)  
Or Yarom (Ostfalia University of Applied Sciences, Germany)*

### **Optimization of Mass Customization Process using Quantum-inspired Evolutionary Algorithm in Industry 4.0...142**

*Hasan Yetis (Firat University, Turkey)  
Mehmet Karakose (Firat University, Turkey)*

### **Deploying MBSE in SME context: revisiting and equipping Digital Mock-Up...147**

*Vincent Chapurlat (IMT Mines Alès & Lab. de Génie Informatique et d'Ingénierie de Production, France)  
Blazo Nastov (Axelience, France)*

### **Agent Based Cyber Security Model for Business Entity Risk Assessment...155**

*Lirim Ashiku (Missouri University of Science and Technology, USA)  
Cihan H Dagli (Missouri University of Science and Technology, USA)*

### **Genetic Algorithm Based Fuzzy Cognitive Map Concept Relationship Determination and Sigmoid Configuration...161**

*Turan Goktug Altundogan (Manisa Celal Bayar University, Turkey)  
Mehmet Karakose (Firat University, Turkey)*

---

## **Research in Systems Engineering**

### **Review on Domain Specific Systems Engineering...166**

*Christian Neureiter (Salzburg University of Applied Sciences, Austria)  
Christoph Binder (Salzburg University of Applied Sciences, Austria)  
Goran Lastro (Salzburg University of Applied Sciences, Austria)*

### **Distributed Attack-Resilient Grid State Estimation Algorithm Using Optimal Filter and Graph Theory...174**

*Md Rana (University of Houston, USA)  
Ahmed Abdelhadi (University of Houston, USA)  
Ray Bo (University of Houston, USA)*

## **Functions in the Early Phase of Product Development: A Systematic Literature Review...179**

*Joshua Fahl (Karlsruhe Institute of Technology (KIT), Germany)*  
*Tobias Hirschter (Karlsruhe Institute of Technology (KIT), Germany)*  
*Steffen Haag (Karlsruhe Institute of Technology (KIT), Germany)*  
*Tim Staiger (Karlsruhe Institute of Technology (KIT), Germany)*  
*Albert Albers (Karlsruhe Institute of Technology (KIT), Germany)*

## **Defining, Formulating and Modeling Product Functions in the Early Phase in the Model of PGE - Product Generation Engineering...188**

*Albert Albers (Karlsruhe Institute of Technology (KIT), Germany)*  
*Joshua Fahl (Karlsruhe Institute of Technology (KIT), Germany)*  
*Tobias Hirschter (Karlsruhe Institute of Technology (KIT), Germany)*  
*Steffen Haag (Karlsruhe Institute of Technology (KIT), Germany)*  
*Sebastian Huenemeyer (Karlsruhe Institute of Technology (KIT), Germany)*  
*Tim Staiger (Karlsruhe Institute of Technology (KIT), Germany)*

---

## **Socio-technical Systems**

### **Implementation of Real-Time Passenger Safety Alert System...198**

*Aaron Krouse (University of Houston, USA)*  
*Ahmed Abdelhadi (University of Houston, USA)*

### **Coordinated Multipoint User Scheduling for 5G Cloud Radio Access Network...204**

*Driss Benhaddou (University of Houston, USA)*  
*Ahmed Abdelhadi (University of Houston, USA)*  
*Mayuri Harikumar (University of Houston, USA)*  
*Ji Chen (University of Houston, USA)*  
*Zhu Han (University of Houston, USA)*  
*Vidhyacharan Baskar (SRM University, India)*

### **System Design Approach to Medical Device Development...211**

*Mark Wehde (Mayo Clinic, USA)*

### **Impact of Gender on Doctor-Patient Communication and Emotion: Exploratory Analysis...214**

*Avishek Choudhury (Stevens Institute of Technology & Syracuse University, USA)*  
*Safa Elkefi (Stevens Institute of Technology, USA)*  
*Onur Asan (Stevens Institute of Technology, USA)*

### **A Dependent Activities Elicitation Method for Designing Area Business Continuity Management...224**

*Akira Kodaka (Keio University, Japan)*  
*Takahiro Ono (Mitsubishi Corporation Insurance Co., Ltd., Japan)*  
*Kenji Watanabe (Nagoya Institute of Technology, Japan)*  
*Natt Leelawat (Chulalongkorn University, Thailand)*  
*Chatpan Chintanapakdee (Chulalongkorn University, Thailand)*  
*Jing Tang (Chulalongkorn University, Thailand)*  
*Eri Ino (Nagoya Institute of Technology, Japan)*  
*Naohiko Kohtake (Keio University, Japan)*

### **Leveraging Regular Expressions for Flexible Scenario Detection in Recorded Driving Data...230**

*Philip Elspas (Porsche AG, Germany)*  
*Jacob Langner (FZI Research Center for Information Technology, Germany)*  
*Michael Aydinbas (Exxeta AG, Germany)*  
*Johannes Bach (Porsche AG, Germany)*  
*Eric Sax (FZI Research Center for Information Technology, Germany)*

### **Wearable Glove Based Approach for Human-UAV Interaction...238**

*Taha Müezzinoğlu (Firat University Elaziğ, Turkey)*

*Mehmet Karakose (Firat University, Turkey)*

### **QoP and Secrecy of a Cooperative Communication System...244**

*Xian Liu (University of Arkansas at Little Rock, USA)*

### **An Application of Systems Thinking: Upgrading Modular Systems through the Incorporation of New Technologies or Innovations...251**

*Romulo J Broas (Stevens Institute of Technology, USA)*

### **Towards an On-Demand Redundancy Concept for Autonomous Vehicle Functions using Microservice Architecture...254**

*Bo Liu (FZI Research Center for Information Technology, Germany)*

*Victor Pazmino Betancourt (FZI Research Center for Information Technology, Germany)*

*Yimeng Zhu (FZI Research Center for Information Technology, Germany)*

*Juergen Becker (Karlsruhe Institute of Technology, Germany)*

---

## **Software Systems Engineering**

### **Implementation of a Fiware-based Integration Platform and a Web Portal as Aids to Inland Navigation Improvement and Control in a River...259**

*Francisco de la Vega (Future Internet Consulting and Development Solutions S. L. (FICODES), Spain)*

*Juan Pablo García-Martín (Universidad de Sevilla, Spain)*

*Germán Santos (Portel Logistic Technologies, Spain)*

*Antonio Torralba (Universidad de Sevilla, Spain)*

### **SCRUM++ Framework concepts...262**

*Régis Plateaux (Laboratoire QUARTZ & Supmeca, France)*

*Olivia Penas (SUPMECA & Laboratoire Quartz EA 7393, France)*

*Sagar Mule (University of Applied Sciences Upeer Austria, Austria)*

*Peter Hehenberger (University of Applied Sciences Upper Austria, Austria)*

*Stanislao Patalano (University of Naples Federico II, Italy)*

*Ferdinando Vitolo (University of Naples Federico II, Italy)*

### **Optimized Deep Reinforcement Learning Approach for Dynamic System...270**

*Ziya Tan (Turkey)*

*Mehmet Karakose (Firat University, Turkey)*

---

## **System Architecture and Architectural Frameworks**

### **Product Line Architecture Design of Software-Intensive Physical Protection Systems...274**

*Bedir Tekinerdogan (Wageningen University, The Netherlands)*

*İskender Yakin (ASELSAN, Turkey)*

*Sevil Yagiz (ASELSAN, Turkey)*

*Murat Kaan Ozcan (ASELSAN, Turkey)*

### **Systems Engineering Architecture Framework for Physical Protection Systems...282**

*Bedir Tekinerdogan (Wageningen University, The Netherlands)*

*Murat Kaan Ozcan (ASELSAN, Turkey)*

*Sevil Yagiz (ASELSAN, Turkey)*

*İskender Yakin (ASELSAN, Turkey)*

### **Early Assessment Dashboard of Complex Systems for New Technology Insertion...290**

*Carolina Moreno (Skolkovo Institute of Science and Technology, Russia)*

*Clement Fortin (Skolkovo Institute of Science and Technology, Russia)*

## Systems Reliability

### **Optimization of Fail-Operational Vehicle Traction Battery System Design...298**

*Christian Ebner (Robert Bosch GmbH, Germany)*

*Kirill Gorelik (Robert Bosch GmbH, Germany)*

*Armin Zimmermann (Ilmenau University of Technology & Systems and Software Engineering, Germany)*

### **Reliability evaluation of an HVAC ventilation system with FTA and RBD analysis...306**

*Lorenzo Ciani (University of Florence, Italy)*

*Giulia Guidi (University of Florence, Italy)*

*Diego Galar (Luleå University of Technology, Sweden)*

### **Improvement of Maintenance Orders Lead Time in Public Universities: DMAIC Approach...311**

*Ammar Y. Alqahtani (King Abdulaziz University & Faculty of Engineering, Saudi Arabia)*

### **Optimizing the Total Production and Maintenance Cost of an Integrated Multi-Product Process and Maintenance Planning (IPPMP) Model...319**

*Mohammad Arani (University of Arkansas at Little Rock, USA)*

*Mousaalreza Dastmard (Sapienza University of Rome, Italy)*

*Zhila Dehdari Ebrahimi (North Dakota State University, USA)*

*Momenitabar Mohsen (1010, 13th Avenue North, Unit 1, USA & North Dakota State University, Italy)*

*Xian Liu (University of Arkansas at Little Rock, USA)*

## Systems Verification and Validation

### **A Taxonomy and Survey on Validation Approaches for Automated Driving Systems...327**

*Christian King (FZI Research Center for Information Technology, Germany)*

*Lennart Ries (FZI Research Center for Information Technology, Germany)*

*Jacob Langner (FZI Research Center for Information Technology, Germany)*

*Eric Sax (FZI Research Center for Information Technology, Germany)*