# ANN**SIM**

Annual Modeling and Simulation Conference 2025

## MAY 26-29, 2025

Complutense University of Madrid, Madrid, Spain

# ANNSIM'26

## MAY 4 -6, 2026

### University of Central Florida, Orlando, FL
### L3Harris Engineering Building

THE SOCIETY FOR
**MODELING & SIMULATION**
INTERNATIONAL™

**General Chair**
Ghaith Rabadi
Ghaith.Rabadi@ucf.edu

For more information, contact scs@scs.org

# *Table of Contents*

**Personal Belongings**

SCS and Complutense University are not responsible for any items left in the breakout rooms. We recommend that you make sure to take your things during lunch and before the end of each day.

# *Conference Organization*

## Organizing Committee

**General Chair:** Jose L. Risco-Martin, Complutense University of Madrid

**Vice-General Chair:** Ghaith Rabadi, School of Modeling, Simulation and Training, University of Central Florida

**Program Co-Chairs:** Deniz Cetinkaya, Bournemouth University and Roman Cardenas, Universidad Politécnica de Madrid

**Proceedings Chairs:** Samuel Ferrero-Losada, Complutense University of Madrid, Madrid, Spain, Ahmad Bany Abdelnabi, School of Modeling and Simulation, University of Central Florida, Orlando, Florida

**Awards Chairs:** Andreas Tolk and Herbert Prähofer

# _Conference Organization_
## Tracks and Chairs

**Annual Simulation Symposium (ANSS)** Chairs: Joachim Denil, University of Antwerp, and Yilin Huang, Delft University of Technology

**Communications technologies and Networking Simulation (CNS)** Chairs: Abdolreza Abhari, Toronto Metropolitan University and Patricia Arroba, Universidad Politecnica de Madrid

**Cyber-Physical Systems and Digital Twins (CPS/DT)** Chairs: Soheil Sabri, University of Central Florida and Yon Vanommeslaeghe, University of Antwerp

**High Performance Computing and Simulation (HPC)** Chairs: James Nutaro, Oak Ridge National Laboratory and Francisco M. Garcia, Universidad Complutense de Madrid

**Humans Agents and Cooperative Artificial Societies (HACAS)** Chairs: Thomas Clemen, HAW Hamburg and Kathleen Salazar-Serna, Pontificia Universidad Javeriana

**Machine Learning and AI (MLAIS)** Chairs: Avleen Malhi, University of Warwick and Bianica Pieres, The MITRE Corporation

**Modeling and Simulation for Sustainability and Smart Energy Systems (S&SES)** Chairs: James Nutaro, Oak Ridge National Laboratory and Dominique Blouin, Telecom Paris

**Modeling and Simulation in Cyber Security (MSCS)** Chairs: Sachin Shetty, Old Dominion and Danda Rawat, Howard University

**Modeling and Simulation in Medicine** Chairs: Michel Audette, Old Dominion University and Jerzy W. Rozenblit, University of Arizona

**Simulation in Education and Training (SET)** Chairs: Ghaith Rabadi, School of Modeling, Simulation, and Training, University of Central Florida and Jalal Possik, Universite Catholique de Lille

**Symposium on Simulation for Architecture and Urban Design (SimAUD)** Chairs: Mohamed Aly Etman, University at Buffalo, Gabriel Wurzer, TU Wien and Angelos Chronis, Infrared City and Austrian Institute of Technology

**Theory and Foundations for Modeling and Simulation (TMS)** Chairs: Gabriel Wainer, Carleton University and Paolo Bocciarelli, University of Rome Tor Vergata

**Tutorials** Chairs: Scott Rosen, The MITRE Corporation, Gulesin Sena Das, De Montfort University, Souvik Barat, Tata Consultancy Services Research

**Ph.D. Colloquium** Chairs: Cristina Ruiz Martin, Carleton University and Josue Pagan, Technical University of Madrid

# Welcome

# Welcome from The Society for Modeling and Simulation International (SCS)

**Welcome from the ANNSIM'25 Conference Chairs**

Dear Colleagues and Friends,

On behalf of the Organizing Committee, welcome to the Annual Modeling and Simulation Conference (ANNSIM 2025)! We are delighted to host you here in Madrid at the Facultad de Informática of the Universidad Complutense de Madrid.

This year, ANNSIM brings together researchers, practitioners, and students from around the world to share the latest advances in modeling and simulation. Our program covers a wide range of topics, from the core theories and methods that underpin our field to exciting new areas like Artificial   Intelligence, Cloud and Quantum Computing, Digital Twins, and High-Performance Computing applied to simulation.

Over the next few days, you will have the opportunity to attend presentations across our diverse technical tracks. We are especially excited to feature two outstanding keynote speakers:

On Monday, **Prof. Rajkumar Buyya** from the University of Melbourne will discuss simulation toolkits for next-generation Cloud and Quantum Computing.

On Tuesday, **Prof. Carolina Cruz-Neira** from the University of Central Florida will share her insights on Visualization, Immersion, and Digital Twins.

In addition to the main tracks and keynotes, the program includes insightful tutorials, a PhD Colloquium for our emerging researchers, and a Work-in-Progress track showcasing the latest ongoing work. We hope you will also join us for the Conference Reception to connect with colleagues in a relaxed setting.

Putting together a conference like ANNSIM takes a tremendous amount of effort. We want to extend our sincere gratitude to the entire Organizing Committee, the Society for Modeling and Simulation International, the Track Chairs, the Program Committee members, and all the reviewers for their hard work and dedication. We also thank our authors and speakers for sharing their valuable research with us.

We encourage you to actively participate in the sessions, engage in discussions, and take advantage of the networking opportunities. We hope ANNSIM 2025 is a productive and enjoyable experience for everyone. Please also take some time to explore the wonderful city of Madrid.

Welcome once again!

Sincerely,

| **José L. Risco Martin** | **Ghaith Rabadi** | **Deniz Cetinkaya** | **Román Cárdenas** |
|---|---|---|---|
| ANNSIM 2025 General Chair *Universidad Complutense de Madrid, Spain* | ANNSIM2025Vice-General Chair *University of Central Florida, Orlando, FL, USA* | ANNSIM2025 Program Co-Chair *Bournemouth University, United Kingdom* | ANNSIM 2025 Program Co-Chair *Universidad Politécnica de Madrid* |

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# General Information

# General Information

## Registration

Your registration for SCS's 2025 Annual Modeling and Simulation Conference (ANNSIM'25) includes the following: morning, afternoon breaks, lunch on Monday and Tuesday, the Monday evening reception and access to all sessions and tutorials. The Monday reception will be located in the Cafeteria.

- **Registration Hours**              Location:  Main Hall
    - ◊ **Monday**, May 26, 2025        8:30 a.m.—5:00 p.m.
    - ◊ **Tuesday**, May 27, 2025       8:30 a.m.—5:00 p.m.
    - ◊ **Wednesday**, May 28, 2025     8:30 a.m.—5:00 p.m.
    - ◊ **Thursday**, May 29, 2025      8:30 a.m.—12:00 p.m.

    *Please note that the Registration Desk will be closed for lunch from Monday through Thursday.*

- **Continental Breakfast**            Location:  Cafeteria
    - ◊ **Monday,** May 26, 2025        8:00 a.m.—9:00 a.m.
    - ◊ **Tuesday,**  May 27, 2025      8:00 a.m.—9:00 a.m.
    - ◊ **Wednesday,**  May 28, 2025    8:00 a.m.—9:00 a.m.
    - ◊ **Thursday,**  May 29, 2025     8:00 a.m.—9:00 a.m.

- **Coffee Breaks**                    Location:  Cafeteria
    - ◊ **Monday,** May 26, 2025     10:30 a.m.—11:00 a.m. | 3:00 p.m.—3:30 p.m.
    - ◊ **Tuesday,** May 27, 2025    10:30 a.m.—11:00 a.m. | 3:00 p.m.—3:30 p.m.
    - ◊ **Wednesday,** May 28, 2025  10:30 a.m.—11:00 a.m.  | 3:00 p.m.—3:30 p.m.
    - ◊ **Thursday**, May 29, 2025     10:30 a.m.—11:00 a.m.

- **Plenary Session with Keynotes  (Conference Hall )**
    - ◊ **Monday**   9:00 a.m.—10:30 a.m.—SCS Keynote:

    **Professor Rajkumar Buyya**

    - ◊ **Tuesday**  9:00 a.m.—10:30 a.m.—SCS Keynote:

    **Professor Carolina Cruz-Neira**

# *General Information*

## Conference Meetings & Events Summary

••**Monday**      Plenary Session with Welcome and Keynote
               (9:00 a.m.—10:30 a.m.)
               Technical Sessions (11:00 a.m.—5:00 p.m.)
               Lunch (12:30 p.m.—1:30 p.m.)
               Tutorial I (1:30 p.m.—3:00 p.m.)
               Welcome Reception (5:00 p.m.—7:00 p.m.)

••**Tuesday**      Plenary Session with Keynote and Awards
               (9:00 a.m.—10:30 a.m.)
               Technical Sessions (11:00 a.m.—5:00 p.m.)
               Lunch (12:30 p.m. —1:30 p.m.)
               Tutorial II (1:30 p.m.—3:00 p.m.)

••**Wednesday**   Technical Sessions (9:00 a.m.—5:00 p.m.)
               Tutorial III (1:30 p.m.—3:00 p.m.)
               Ph.D. Colloquium (11:00 a.m.—3:00 p.m.)

••**Thursday**    Technical Sessions (9:00 a.m.—12:30 p.m.)

# *Keynotes*

# *Keynote Information*

**Systems and Simulation Toolkits for Building and Evaluating Solutions for Next-Gen Cloud and Quantum Computing**

**Professor Rajkumar Buyya, Director, Cloud Computing and Distributed Systems (CLOUDS) Lab,** The University of Melbourne, Australia
CEO, Manjrasoft Pvt Ltd, Melbourne, Australia

**Location: Conference Hall:**

Monday, May 26, 2025
9:15 a.m.—10:30 a.m.

**Abstract:**

The twenty-first-century digital infrastructure and applications are driven by Cloud computing and emerging Quantum computing paradigms. The Cloud computing paradigm has been transforming computing into the 5th utility wherein "computing utilities" are commoditized and delivered to consumers like traditional utilities such as water, electricity, gas, and telephony. It offers infrastructure, platform, and software as services, which are made available to consumers as subscription-oriented services on a pay-as-you-go basis over the Internet. Its use is growing exponentially with the continued development of new classes of applications such as AI-powered models (e.g., ChatGPT) and the mining of crypto currencies such as Bitcoins. To make Clouds pervasive, Cloud application platforms need to offer (1) APIs and tools for rapid creation of scalable and elastic applications and (2) a runtime system for deployment of applications on geographically distributed Data Centre infrastructures (with Quantum computing nodes) in a seamless manner.

# *Keynote Information (Continued)*

These wide ecosystems of cloud architectures integrated with new accelerators such as Quantum processing capabilities, along with the increasing demand for energy-efficient IT technologies, require timely, repeatable, and controllable methodologies for evaluation of algorithms, applications, and policies before their implementation in cloud products. As utilization of real testbeds limits the experiments to the scale of the testbed and makes the reproduction of results an extremely difficult undertaking, alternative approaches for testing and experimentation leverage development of new Cloud technologies. A suitable alternative is the utilization of simulations tools, which open the possibility of evaluating the hypothesis prior to software development in an environment where one can reproduce tests. Specifically in the case of Cloud computing, where access to the infrastructure incurs payments in real currency, simulation-based approaches offer significant benefits, as it allows Cloud customers to test their services in a repeatable and controllable environment free of cost, and to tune the performance bottlenecks before deploying on real Clouds and quantum processors. At the provider side, simulation environments allow evaluation of different kinds of resource leasing scenarios under varying load and pricing distributions. Such studies could aid the providers in optimizing the resource access cost with focus on improving profits.

This keynote presentation covers (1) 21st century vision of computing and identifies various emerging IT paradigms that make it easy to realize the vision of computing utilities, (2) different approaches for evaluation of resource management and application scheduling algorithms, (3) latest CloudSim 7G toolkit supporting modeling, simulation, and experimentation of emerging Cloud computing infrastructures and application services,   (4) case studies on the use of CloudSim in development

# _**Keynote Information (Continued)**_

and evaluation of policies for (a) management of Cloud Data Centre resource to minimise energy-consumption, (5) use of Aneka 6G software system for scheduling of applications to minimise the cost of computation, yet meeting users QoS requirements, and (6) new directions on modelling and simulation of Quantum computing systems and applications.

**Biography:**

Dr. Rajkumar Buyya is a Redmond Barry Distinguished Professor and Director of the Quantum Cloud Computing and Distributed Systems (qCLOUDS) Laboratory at the University of Melbourne, Australia. He is also serving as the founding CEO of Manjrasoft, a spin-off company of the University, commercializing its innovations in Cloud Computing. He has authored over 850 publications and seven textbooks including "Mastering Cloud Computing" published by McGraw Hill, China Machine Press, and Morgan Kaufmann for Indian, Chinese and international markets respectively. Dr. Buyya is one of the highly cited authors in computer science and software engineering worldwide (h-index=172, g-index=380, i10-index=809, and 157,600+ citations). A bibliometric study by Stanford University and Elsevier since 2019 (for six consecutive years), Dr. Buyya is recognized as the Highest-Cited author in the Distributed Computing field worldwide. He graduated 60 PhD students who are working in world-leading research universities and high-tech companies such as Microsoft, Google, and IBM. He has been recognized as IEEE Fellow, a "Web of Science Highly Cited Researcher" for seven times since 2016, the "Best of the World" twice for research fields (in Computing Systems in 2019/2024 and Software Systems in 2021/2022/2023) as well as "Lifetime Achiever" and "Superstar of Research" in "Engineering and Computer Science" discipline twice (2019 and 2021) by the Australian Research Review.

# *Keynote Information (Continued)*

Software technologies for Grid, Cloud, Fog, Quantum computing developed under Dr.Buyya's leadership have gained rapid acceptance and are in use at several academic institutions and commercial enterprises in 50+ countries around the world. Manjrasoft's Aneka Cloud technology developed under his leadership has received "Frost New Product Innovation Award". He served as founding Editor-in-Chief of the IEEE Transactions on Cloud Computing. He is currently serving as Editor-in-Chief of Software: Practice and Experience, a long-standing journal in the field established in 1970. He has presented over 750 invited talks (keynotes, tutorials, and seminars) on his vision on IT Futures, Advanced Computing technologies, and Spiritual Science at international conferences and institutions in Asia, Australia, Europe, North America, and South America. He has recently been recognized as a Fellow of the Academy of Europe. For further information on Dr.Buyya, please visit his cyberhome: www.buyya.com

# Keynote Information

**Unlocking the Future: 30 Years of Innovation at the Crossroads of Visualization, Immersion, and Digital Twins**
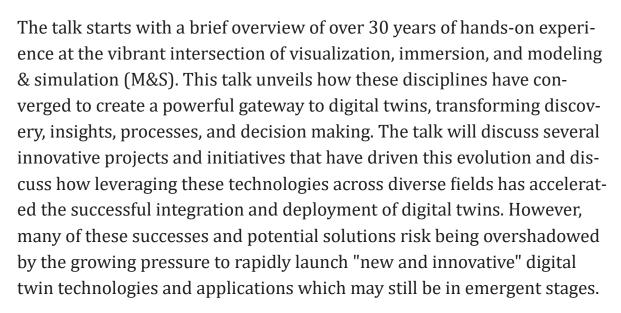
**Carolina Cruz-Neira, Agere Chair Professor in Computer Science**
College of Engineering and Computer Science
University of Central Florida, Orlando, FL, USA

**Location: Conference Hall:**

Tuesday, May 27, 2025
9:15 a.m.—10:30 a.m.

**Abstract:**

The talk starts with a brief overview of over 30 years of hands-on experience at the vibrant intersection of visualization, immersion, and modeling & simulation (M&S). This talk unveils how these disciplines have converged to create a powerful gateway to digital twins, transforming discovery, insights, processes, and decision making. The talk will discuss several innovative projects and initiatives that have driven this evolution and discuss how leveraging these technologies across diverse fields has accelerated the successful integration and deployment of digital twins. However, many of these successes and potential solutions risk being overshadowed by the growing pressure to rapidly launch "new and innovative" digital twin technologies and applications which may still be in emergent stages.

 This presentation shares "from-the trenches" experiences on developing technologies and applications that have been critical to accelerate the deployment, integration, and acceptance of digital twins to yield successful outcomes.  In particular, the presentation discusses visualization's critical role in the emerging digital twins and AI ecosystem. The presentation focuses on where the true innovation opportunities are today and how to get there.

# *Keynote Information (Continued)*

The talk's intention is to understand the complexity, gaps and challenges we face, while revealing insights that can guide us toward more sustainable, impactful solutions in the digital twin landscape.

**Biography:**

Dr. Carolina Cruz-Neira, a member of the National Academy of Engineering, is a pioneer in the areas of virtual reality (VR), interactive visualization, and digital twins. Her work has translated to standard tools in industry, government, and academia. She is known world-wide for being the creator of the CAVE VR system, for transferring research into practice by spearheading several Open-Source initiatives, such as VRJuggler, and by leading entrepreneurial initiatives to commercialize research. She has over 150 publications and, together with her collaborators, has been awarded over $400 million in grants, contracts, and donations. She is recognized for founding successful VR research centers: the Virtual Reality Applications Center at Iowa State University, the Louisiana Immersive Technologies Enterprise, and the Emerging Analytics Center at the University of Arkansas. She serves in international technology boards, government technology advisory committees.

One of her recent roles was being part of the National Academies report on Foundational Research Gaps and Future Directions for Digital Twins. She enjoys intersecting her research with the arts and the humanities through dance performances and museum installations. She has been named one of the top innovators in virtual reality and one of the top three greatest women visionaries in VR. She is the first person inducted to the National Academy of Engineering for contributions to immersive technologies and VR, she is a member of the IEEE VR Academy, an IEEE Fellow, an ACM Computer Pioneer,

# Keynote Information (Continued)

an AWE XR Hall of Fame member, and a Modeling and Simulation Hall of Fame; She received the IEEE VR Achievement Award and the International Digital Media & Arts Society Distinguished Career Award among many national and international recognitions. She has given numerous keynote addresses, and she advises governments on how VR can help to give industries a competitive edge leading to regional economic growth. She has appeared in numerous national and international TV shows and podcasts as an expert on her discipline and several documentaries have been produced about her life and career. Currently, Dr. Cruz is the Agere Chair in Computer Science at the University of Central Florida where she is the co-lead of the UCF Digital Twin Initiative.

# *TMS Session Keynote Information*

**AI-assisted Metamorphic Testing for Domain-specific Modelling and Simulation**

**Professor Dr. Juan de Lara**

Computer Science at Universidad Autónoma, Madrid Spain

**Location: Classroom 14:**

Wednesday, May 28, 2025
9:00 a.m.—10:30 a.m.

**Abstract:**

Testing is essential to improve the correctness of software systems. Metamorphic testing (MT) is an approach especially suited when the system under test lacks oracles, or they are expensive to compute. However, building an MT environment for a particular domain (e.g., cloud simulation, automated driving simulation, production system simulation, etc) requires substantial effort.

To alleviate this problem, we propose a model-driven engineering approach to automate the construction of MT environments, which is especially useful to test domain-specific modelling and simulation systems. Starting from a meta-model capturing the domain concepts, and a description of the domain execution environment, our approach produces an MT environment featuring comprehensive support for the MT process. This includes the definition of domain-specific metamorphic relations, their evaluation, detailed reporting of the testing results, and the automated search-based generation of follow-up test cases.

In this talk, I will present the approach, along with ongoing work and perspectives for integrating intelligent assistance based on large language models in the MT process. The work is a joint collaboration with Pablo Gómez-Abajo, Pablo C. Cañizares and Esther Guerra from the miso research group.

# *TMS  Session Keynote  Information*

**Biography:**

Juan de Lara is full professor at the computer science department of the Universidad Autónoma of Madrid (Spain), where he leads the modelling and software engineering research (miso) team together with Esther Guerra. His main research interests are in automated software engineering, model-driven development, low-code development, domain-specific languages and language engineering, conversational agents and intelligent assistants. This research has led to building many practical tools including Asymob, AToM3, metaDepth, merlin, and Gotten – and the publication of more than 270 papers in international journals and conferences. He has been the PC co-chair of several conferences within his research areas, like MODELS, SLE, ICGT, ICMT and FASE, he is on the editorial board of the SoSyM journal (Springer), and has been involved in the organization of workshops on topics like flexible modelling, multi-level modelling and low-code development.

# *MSM  Session Keynote Information*

**Quantum Discrete Optimization and Its Applications in Healthcare**
**Professor Wojciech Bożejko**

Head of Department of Control Systems and Mechatronics, Faculty of Information and Telecommunication Technologies, Wroclaw, University of Science and Technology

**Location: Classroom 14:**

Monday, May 26, 2025
3:30 p.m.—5:00 p.m.

(see page 33 for more information)

# *Tutorials Information*

**Tutorial I:** Introduction to Quantum Computing: Designing Quantum Circuits and Running Them on Quantum Simulators

**Date | Time: Monday, May 26, 2025 | 1:30 p.m.– 3:00 p.m.**
Presenter: Deniz Cetinkaya
Location: Classroom 14


**Tutorial II:** Defining a Shared Standard of Verification and Validation for Agent-Based Models

**Date | Time:  Tuesday, May 27, 2025| 1:30 p.m.– 3:00 p.m.**

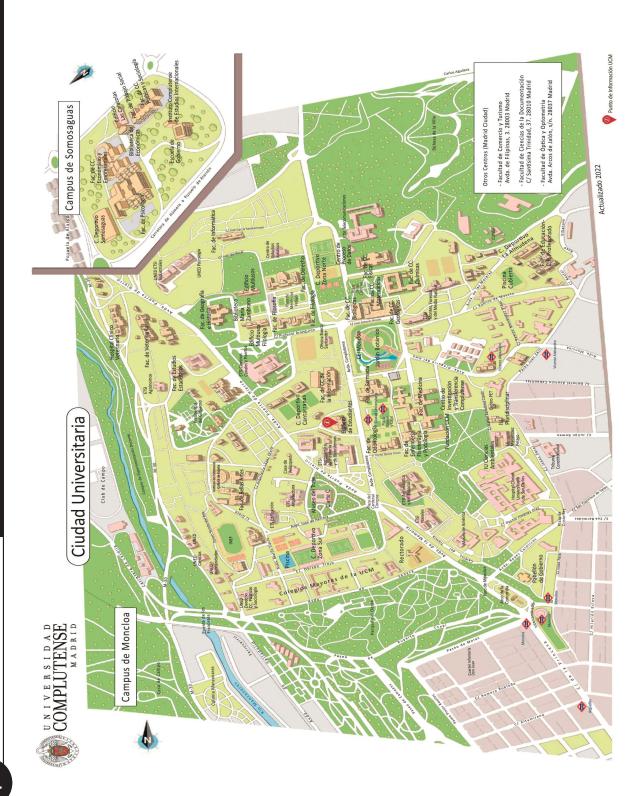Presenter:  Sarah Wise
Location:  Classroom 14


**Tutorial III:** Python-Based Simulation Platforms

**Date | Time:  Wednesday, May 28, 2025| 1:30 p.m.—3:00 p.m.**

Presenter:  Wenbing Zhao
Location:  Classroom 15

# Map

# Complutense University Campus

# *Agenda at a Glance*

| | | ANSS | CNS | CPS/DT | HACAS | TMS |
|---|---|---|---|---|---|---|
| **Monday, May 26, 2025** | | | | | | |
| 9:00 a.m. — 10:30 a.m. | SCS Plenary | ■ | ■ | ■ | ■ | ■ |
| 10:30 a.m.—11:00 a.m. | Break | | | | | |
| 11:00 a.m.—12:30 p.m. | Session Block I | | | | | ■ |
| 12:30 p.m.—1:30 p.m. | Kick Off Lunch | | | | | |
| 1:30 p.m. — 3:00 p.m. | Session Block II | | | | | |
| 3:00 p.m. — 3:30 p.m. | Break | | | | | |
| 3:30 p.m. — 5:00 p.m. | Session Block III | ■ | | ■ | | |
| **Tuesday, May 27, 2025** | | | | | | |
| 9:00 a.m. —10:30 a.m. | SCS Plenary | ■ | ■ | ■ | ■ | ■ |
| 10:30 a.m.—11:00 a.m. | Break | | | | | |
| 11:00 a.m.—12:30 p.m. | Session Block IV | ■ | | | ■ | |
| 12:30 p.m.—1:30 p.m. | Lunch on your own | | | | | |
| 1:30 p.m. — 3:00 p.m. | Session Block V | | ■ | | | |
| 3:00 p.m. — 3:30 p.m. | Break | | | | | |
| 3:30 p.m. — 5:00 p.m. | Session Block VI | | | ■ | | ■ |
| **Wednesday, May 28, 2025** | | | | | | |
| 9:00 a.m. — 10:30 a.m. | Session Block VII | | | | ■ | ■ |
| 10:30 a.m.—11:00 a.m. | Break | | | | | |
| 11:00 a.m.—12:30 p.m. | Session Block VIII | ■ | | | | |
| 12:30 p.m.—1:30 p.m. | Lunch on your own | | | | | |
| 1:30 p.m. — 3:00 p.m. | Session Block IX | | | | | ■ |
| 3:00 p.m. — 3:30 p.m. | Break | | | | | |
| 3:30 p.m. — 5:00 p.m. | Session Block X | | ■ | | | |
| **Thursday, May 29, 2025** | | | | | | |
| 9:00 a.m. — 10:30 a.m. | Session Block XI | | | | | |
| 10:30 a.m.—11:00 a.m. | Break | | | | | |
| 11:00 a.m.—12:30 p.m. | Session Block XII | | | | | ■ |

| | HPC | SimAUD | MLAIS | S&SES | MSCS | SET | MSM | Ph.D. |
|---|---|---|---|---|---|---|---|---|

# *Daily Agendas*

# *Monday*

# Annual Modeling and Simulation Conference 2025

# Agenda

## Monday, May 26, 2025

## Theory and Foundations for Modeling and Simulation (TMS)

**Session Block I          11:00 a.m.—12:30 p.m.          Room: Classroom 13**

*Incorporating Human-in-the-loop Interactivity through the Integration of Discrete Event Simulation and Virtual Reality* by Joseph Jabbour, Jalal Possik, Adriano O. Solis, Charles Yaacoub, Danny Kieken and Greg Zacharewicz

*Data-driven Simulation-based Analysis of Collaborative Business Processes in Distributed Environments* by Paolo Bocciarelli and Andrea D'Ambrogio

*Robustify Simulation Uncertainty Quantification against Input Data Outlier* by Haoting Zhang and Jingxu Xu

## High Performance Computing and Simulation (HPC)

**Session Block I          11:00 a.m.—12:30 p.m.          Room: Classroom 14**

*Comparison of the Performance Evaluation of the Intel Quantum Simulator on the HPC Systems* by Daniel Talaván-Vega, Pablo Fernández-Alonso, Paloma Rodríguez-Oliver, Moisés Gaitán-Fernández, Javier Corral-García and Juan-Antonio Rico-Gallego

*Quantum Emulation for High-performance Computing Centers: Qaptiva HPC* by Cyril Allouche, Jefferson Andres Bravo Montes and Miriam Bastante Chichon

*Simulating Quantum Circuits with Hard-core Bosons* by David da Costa

# Annual Modeling and Simulation Conference 2025
## Agenda

## Monday, May 26, 2025

## Modeling and Simulation in Cyber Security (MSCS)

**Session Block I     11:00 p.m.—12:30 p.m.     Room:  Classroom 15**

*A Modeling and Simulation Framework to Support Cybersecurity Engineering* by Moussa Koita, Youssouf M. Diagana, Oumar Y. Maiga and Mamadou Kaba Traoré

*Automatic Generation of CNN Models for Radiofrequency Fingerprinting* by Rogelio García-Aguirre, Carlos Mex-Perera and Eva M. Navarro-López

## Machine Learning and AI in Simulation (MLAIS)

**Session Block II     1:30 p.m.—3:00 p.m.        Room:  Classroom 13**

*BuilDa: A Thermal Building Data Generation Framework for Transfer Learning* by Thomas Krug, Fabian Raisch, Markus Wirnsberger, Dominik Aimer, Ferdinand Sigg, Benjamin Schäfer and Benjamin Tischler

*Real-Time Efficiency Control for Sim-to-Real Systems Using Spiking-Neural-Networks-based Reinforcement Learning* by Yijing Fan, Chun Zhao, Lin Zhang and Heming Zhang

*Towards a Validity Frame of Multi-modal Surrogate Models for Traffic Simulation* by Raheleh Biglari, Claudio Gomes and Joachim Denil

# Annual Modeling and Simulation Conference 2025

## Agenda

## Monday, May 26, 2025

## Annual Simulation Symposium (ANSS)

**Session Block III**        **3:30 p.m.—5:00 p.m.**        **Room: Classroom 13**

*Minimum Time Search and Rescue Missions Involving UAVs with a Framework Supported by DEVS, RHC and PEA* by Juan Bautista Bordón Ruiz, Jose L. Risco-Martin, Eva Besadas-Porta and José A. López-Orozco

*Simulating Combinatorial Double Auctions: A Devs and Multi-agent Approach with Different Participant Behavior* by Juan De Anton Heredero, Cristina Ruiz Martin, Félix Villafáñez and David Poza

*Simulating Web3 Tokenomics with Agent-Based Models* by Don Berndt and Ricardo Lasa

## Cyber-Physical Systems and Digital Twins (CPS/DT)

**Session Block III**        **3:30 p.m.—5:00 p.m.**        **Room: Classroom 15**

*FMI-based Distributed Co-simulation with Enhanced Security and Intellectual Property Safeguards* by Santiago Gil, Ecem E. Bas, Chirstian D. Jensen, Sebastian Engelsgaard, Giuseppe Abbiati and Cláudio Gomes

*Towards a Standardized Framework for Developing Trustworthy Self-Adaptive Robotic Systems* by Sahar Nasimi Nezhad, Bert Van Acker and Paul De Meulenaere

*Towards Federating IoT and Simulation Systems: An HLA-Based Approach* by Michel El Haddad, Jalal Possik, Emilio Jimenez, Marco Gotelli, Roy Abi Zeid Daou and Charles Yaacoub

## Annual Modeling and Simulation Conference 2025
## Agenda

## Monday, May 26, 2025

## Modeling and Simulation in Medicine (MSM)

**Session Block III**  **3:30 p.m.—5:00 p.m.**  **Room: Classroom 14**
*Keynote: Quantum Discrete Optimization and Its Applications in Healthcare*
by Professor Wojciech Bożejko, Head of Department of Control Systems and
Mechatronics, Faculty of Information and Telecommunication Technologies, Wroclaw
University of Science and Technology

**Abstract:** The presentation concerns the application of quantum computing
in discrete optimization, with a special focus on the D-Wave quantum
annealer. After an introduction to the concept of quantum computing and
the differences between the quantum gate approach (e.g. IBM, IQM,
Google) and quantum annealing (D-Wave), the application of the latter in
solving optimization problems is discussed. Modeling of problems for
D-Wavequantum annealer  is based on the QUBO (Quadratic Unconstrained
Binary Optimization) model as well as the Ising model. The presentation
describes a case study of tasks scheduling optimization. The
mathematical model takes into account time constraints and binary
decision variables. The potential applications are very wide: from
production planning to scheduling nurses in a hospital. The use of a
quantum machine already increases the possibilities of hybrid CPU+QPU
algorithms, and in the future, with larger quantum computers, it will
allow solving problems of sizes that are not yet possible to calculate.

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# *Tuesday*

# Annual Modeling and Simulation Conference 2025
# Agenda

## Tuesday, May 27, 2025

## 57th Annual Simulation Symposium (ANSS)

**Session Block IV**     **11:00 a.m.—12:30 p.m.**     **Room: Classroom 13**

*Discrepancy of Lane Flow Distribution and Lane-Wise Speed Distribution When Simulating Lane-Drop Bottleneck in Simulation of Urban Mobility (SUMO): A Comparison of Two Car-Following  Models* by Chukun Gao

*A Multiscale Model for Australian Army Recruitment and Training Planning* by Katie Mortimer, Cameron Pike and Terry Caelli

*Simulation Analysis of Sensor Placement and Target Interaction in DEVS Formalism* by Yeeun Park, Hyungho Na and Il-Chul Moon

## Humans Agents and Cooperative Artificial Societies (HACAS)

**Session Block IV**     **11:00 a.m.—12:30 p.m.**     **Room:  Classroom 14**

*Using Virtual Reality to Simulate and Study the Movements of School Shooters* by Christopher A. McClurg and Alan R. Wagner

*Toward a Quantitative Science of Nonviolence: Sensitivity Analysis of an Agent-Based Model of Nonviolent Resistance* by Joshua Steakelum, Hang Trung Dinh and Lance Fiondella

# Annual Modeling and Simulation Conference 2025

## Agenda

## Tuesday, May 27, 2025

## Simulation of Architectural and Urban Design (SimAUD)

**Session Block IV          11:00 a.m.—12:30 p.m.     Room: Classroom 15**

*Enhancing Environmental Performance-driven Design Decisions through Immersive Exploration* by Amir Malka, Naga Venkata Sai Kumar Manapragada and Jonathan Natanian

*Towards Quantifying Visual Exposure and the Resulting Privacy Concerns in Residential Building* by Jaeha Kim, Katharina Kral and Timur Dogan

*A Simulation-based Approach to Teaching HVAC Design to Architecture Students* by Ali Irani and Christoph Reinhart

# Annual Modeling and Simulation Conference 2025

## Agenda

## Tuesday, May 27, 2025

## Communication technologies and Networking Simulation (CNS)

**Session Block V**       **1:30 p.m.—3:00 p.m.**       **Room: Classroom 15**

*Modeling and Simulation of Virtual Cut-through Routing in Multidimensional Interconnection Networks* by Benjamin Ehrlich, Yelena Rykalova and Lev B. Levitin

*An Adaptive Data Transfer Technique for Sensor-based Systems* by Juan Contreras and Shikharesh Majumdar

*Simulation of Deep Neural Networks by Data Parallelization* by Jorge A. Lopez and Abdolreza Abhari

## Modeling and Simulation in Medicine (MSM)

**Session Block V**       **1:30 p.m.—3:00 p.m.**       **Room:  Classroom 15**

*A Virtual Coaching Approach for the Computer-Assisted Surgical Trainer* by Jonas Bloem, Jerzy Rozenblit and Klaus Buchenrieder

*Towards a Prototype for Virtual Reality and Haptic Feedback Integration in Computer-Assisted Surgical Training* by Ashlee Diggles, Nimra Anjum, Jason F. Zhang, Vaidehi Pujary, Jerzy W. Rozenblit and Eugene H. Chang

# Annual Modeling and Simulation Conference 2025

## Agenda

## Tuesday, May 27, 2025

## Cyber-Physical Systems and Digital Twins (CPS/DT)

**Session Block VI        3:30 p.m.—5:00 p.m.        Room: Classroom 15**

*Dynamic Development of Traffic Simulations for Urban Digital Twins* by Martin McCarthy, Carolina Cruz-Neira and Dirk Reiners

*Developing Urban Digital Twin for Mobility* by Zeeshan ALI, Mama Diakité and Mamadou Kaba Traore

## Theory and Foundations for Modeling and Simulation (TMS)

**Session Block VI        3:30 p.m.—5:00 p.m.        Room: Classroom 13**

*A Framework for Iterative Verification and Validation of MILP Scheduling Models Based on Petri Nets* by Shengrui Peng and Helena Szczerbicka

*Toward Models of Collective Intelligence for Goal-Directed Search in Exploratory Simulation and Analysis* by Levent Yilmaz

*Simulation of Cyanobacteria Behavior in Water Bodies with cell-DEVS and Lattice -Boltzmann Methods* by Samuel Ferrero-Losada, Jose L. Risco-Martin, José Antonio López-Orozco and Roman Cardenas

## Simulation in Education and Training (SET)

**Session Block VI        3:30 p.m.—5:00 p.m.        Room:  Classroom 14**

*Advancing Digital Twin Education through Graduate Certification* by Ghaith Rabadi, Bulent Soykan, Soheil Sabri and Sean Mondesire

*Simulation as Transformative Approach for Enhancing Lean Performance Impact Assessment, Lean Sustainability, and Lean Learning* by Anne Zouggar, Jalal Possik and Adriano Solis

*Data-Driven Design for Developing a Virtual Laboratory for STEM Education* by Yiyang Li and Yuzhong Shen

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# *Wednesday*

# Annual Modeling and Simulation Conference 2025

## Agenda

## Wednesday, May 28, 2025

### Humans Agents and Cooperative Artificial Societies (HACAS)

**Session Block VII**      **9:00 a.m.—10:30 a.m.**      **Room: Classroom 13**

*The Transparency Imperative: The Need for Model Documentation for Engaging with Public Policy Following the EU AI Act* by Michael Frank Belfrage, Fabian Lorig, Christopher Frantz, Jason Tucker and Paul Davidsson

*Combination of Agent-based Social Simulation Models: Approaches and Challenges* by Emil Johansson, Fabian Lorig and Paul Davidsson

*Realistic Social Networks in Agent-based Modeling* by Maxim Malikov and Kathleen Salazar-Serna

### Theory and  Foundations for Modeling and Simulation (TMS)

**Session Block VII**      **9:00 a.m.—10:30 a.m.**      **Room: Classroom 14**

**KEYNOTE:** *AI-assisted Metamorphic Testing for Domain-specific Modelling and Simulation* by Juan de Lara (see page 20 for more details)

# Annual Modeling and Simulation Conference 2025

## Agenda

## Wednesday, May 28, 2025

## Simulation of Architectural and Urban Design (SimAUD)

**Session Block VII      9:00 a.m.—10:30 a.m.          Room:  Classroom 15**

*Validation of the Shape Transformation Protocol for Simulating Non-cuboid Compartments in CFAST using FDS Simulations* by Chengde Wu, Wei Yan and Mark J. Clayton

*Brute-Force Optimization Workflow with Parallel Computing for Building Lifecycle Analysis: A Comparison with Multi-Objective Optimization with the Evolutionary Approach* by Yang Yang and Marco Cimillo

*SyncPerception: A Real-time Urban Perception Prediction Tool Based on Graph Neural Networks by Ziqi Cui and Shangyu Lou*

# Annual Modeling and Simulation Conference 2025

## Agenda

## Wednesday, May 28, 2025

## Annual Simulation Symposium (ANSS)

**Session Block VIII**      **11:00 a.m.—12:30 p.m.**      **Room:  Classroom 13**

*Quality in DES, SD and ABM: An Algorithmic Analysis of Literature* by Chris Lawrence

*Reproducibility and Replicability of Simulation Models* by Yilin Huang

*A Review of Quantum Modeling and Simulation Approaches for Lithium-ion Batteries* by Deniz Cetinkaya and Amor Abdelkader

## Modeling and Simulation for Sustainability and Smart Energy Systems (S&SES)

**Session Block VIII**      **11:00 a.m.—12:30 p.m.**      **Room:  Classroom 14**

*Economy and Sustainability Analysis with a Novel Modular Configurable Multi-modal White-box Building Model* by Haozhen Cheng, Veit Hagenmeyer and Hüseyin K. Çakmak

*Effect of Electric Vehicle Charging Scheduling and Battery Energy Storage System on Grid Load at an Airport* by Primoz Godec and Steve McKeever

# Annual Modeling and Simulation Conference 2025

## Agenda

## Wednesday, May 28, 2025

## Modeling and Simulation in Medicine (MSM)

**Session Block VIII     11:00 a.m.—12:30 p.m.     Room: Classroom 15**

*Simulation of Breast Deformation Due to Ultrasound Probe* by Motaz M. Alqaoud, John Plemmons, Eric Feliberti, Oleksandr Kravchenko, Krishnanand Kaipa, Gabor Fichtinger and Michel Audette

*Impact of a Dynamic Nurse-to-patient Ratio Policy in the ICU: A Hybrid Simulation Model* by Qootalkoloub Heissat and Lena Abu-El-Haija

## Ph.D. Colloquium

**Session Block VIII    11:00 a.m.—12:30 p.m.     Room: Classroom 12**

*Proximal Policy Optimization for Multi-Agent Engagements in beyond Visual Range Air Combat* by Joao Dantas

*Discrete Event Simulation Model for Comprehensive Cervical Cancer Care in India: A Case Study of AIIMS Bhopal* by Varad Puntambekar

*On Structural Adaptivity in Region-based Process Mining* by Shengrui Peng

*Model Directed Systems Engineering for Cyanobacteria Bloom Management* by Samuel Ferrero-Losada

*DEVSMAP: On the Path of Standardized DEVS Model Representation* by Sasisekhar Mangalam Govind

# Annual Modeling and Simulation Conference 2025

## Agenda

## Wednesday, May 28, 2025

## Theory and  Foundations for Modeling and Simulation (TMS)

**Session Block IX**　　　**1:30 p.m.—3:00 p.m.**　　　**Room: Classroom 13**

*DEVSMap: On the Path of Standardized DEVS Model Representation* by Sasisekhar Mangalam Govind, Roman Cardenas and Gabriel Wainer

*A Theoretical Framework for Model-Based Life Cycle Engineering of Simulation Models* by Philipp Zech, Hans Vangheluwe and Ruth Breu

*Parallel-DEVS Specification Language for Modeling: Mathematical Approach and Grammar* by Gaston Batchoudi, Clément Foucher and Eric Ramat

## Ph.D. Colloquium

**Session Block IX**　　　**1:30 p.m.—3:00 p.m.**　　　**Room: Classroom 12**

*Microfluidic Systems Enhanced by Artificial Intelligence for Water Analysis: Simulation and Sensing Perspectives* by Juan Sandubete-López

*Container Based Simulation: A Framework for Large Simulation Experiments* by Daniel Seufferth

*Modeling and Simulating the Behavior of a Non-verbal Autistic Individual: The Digital Twin Approach* by Dominik Mukrecki

*Modeling and Simulation of Logistic Flows in Container Ports GOLF - Generator of Logistic Flow* by Farshad Shamlu

# Annual Modeling and Simulation Conference 2025

## Agenda

## Wednesday, May 28, 2025

## Communication technologies and Networking Simulation (CNS)

**Session Block X**         **3:30 p.m.—5:00 p.m.**         **Room: Classroom 13**

*DEVS over MQTT to Enable Distributed Real-Time Simulation* by Roman Cardenas, Patricia Arroba, Segundo Esteban and Jose L. Risco-Martin

*Optimizing Energy Efficiency Performance in RIS-assisted Near-field Mimo System Using Deep Rl* by Amjad AI Iqbal, Ala'a Al-Habashna, Gabriel Wainer and Gary Boudreau

## Simulation of Architectural and Urban Design (SimAUD)

**Session Block X**         **3:30 p.m.—5:00 p.m.**         **Room: Classroom 15**

*Evaluating Window-to-wall Ratio in Generative AI Architectural Design: Insights from SHAP Analysis and Predictive Modeling* by Kaiheng Zhang, Muxin Jia and Taro Narahara

*Carbon Neutral Solar Powered Outdoor Cooling Shelter* by Ji Yoon Bae, Kayleigh Houde, Eric Teitelbaum and Dorit Aviv

*Modeling the Joint Effects of Thermal Comfort, Built Environment, and Socio-Demographics on Active Mobility: A Data-driven Approach* by Xiaoyue Yan, Timur Dogan and Yang Yang

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# *Thursday*

# Annual Modeling and Simulation Conference 2025

## Agenda

## Thursday,  May 29, 2025

## Simulation of Architectural and Urban Design (SimAUD)

**Session Block XI        9:00 a.m.—10:30 a.m.           Room:  Classroom 15**

*Methods for Analyzing and Mapping the Spatiotemporal Dynamics of Light and Temperature in Architectural Design* by Vasiliki Fragkia and Isak Worre Foged

*Assessing Urban Wind Environments: A Design Optimization Framework* by Vasiliki Fragkia and Kaushik Lalitha

*Advanced Weather Data Morphing for Future Climate-based Building Simulation a Modular Python Tool Utilizing Enhanced Morphing Algorithms for EPW File Generation* by Sophie Maximiliane Hamann, Angelos Chronis, Oana Taut and Theodoros Galanos

## Modeling and Simulation in Medicine (MSM)

**Session Block XI        9:00 a.m.—10:30 p.m.           Room: Classroom 13**

*A Phenomenological Model of the Endometrial Cycle: Sensitivity Analysis of Prostaglandin Imbalances in Heavy Menstrual Bleeding* by Alexandria Johnson, Carolina Ramirez Mazo, David Archer, Andrew Moore, Enrico Tronci, Michel Audette and Mette Olufsen

*Computational Analysis of the Novel LQT3 Mutations G1481V and Q1491H in Myocardial and Purkinje Cells* by Anthony Owusu-Mensah, Omer Berenfeld, Quentin Plumereau and Michel Audette

*Effects of Torso Impedance on in Silico Voltage Mapping of Cardiac Dipoles of Rotors* by Estela Sánchez-Carballo, Francisco-Manuel Melgarejo-Meseguer, Jose Luis Rojo-Alvarez and Omer Berenfeld

## Thursday, May 29, 2025

## Theory and Foundations for Modeling and Simulation (TMS)

**Session Block XII      11:00 a.m.—12:30 p.m.      Room: Classroom 13**

*A Unified Benchmarking Framework for Evaluating Discrete Event Simulation Engines* by Beatriz Herguedas, Roman Cardenas, Patricia Arroba, Eva Besada Portas and Jose L. Risco-Martin

*PROMETHeUS: Bridging Accessibility and Flexibility in DEVS* by Curtis Edward Winstanley, Gabriel Wainer and Iryna Borshchova

*Translating StateCharts+Class Diagrams (SCCD) to the Discrete-EVent System Specification (DEVS)* by Sam Pieters and Hans Vangheluwe

## Simulation of Architectural and Urban Design (SimAUD)

**Session Block XII        11:00 a.m.—12:30 p.m.       Room:  Classroom 15**

*Graph-based Analysis of Best Practices in Autism Centre Design* by Dania Al-Harasis and Wassim Jabi

*Case Study on Applying Multi-criteria Genetic Algorithms for Hotel Design Optimisation* by Agnieszka Adamska-Idzikowska and Radoslaw Idzikowski

*Living Lab Digital Twin: Case Study of the Development of a Research-oriented Digital Twin in a LEED Platinum Academic Building* by David Gerber, Niko McGlashan, Simon Breslav and Azam Khan

# Annual Modeling and Simulation Conference 2025

## Agenda

## Work in Progress

## Wednesday, May 28, 2025

**Session Block IX**       **1:30 p.m.—3:00 p.m.**       **Room: Classroom 14**

*Multi-Sensor Fusion and SLAM-Based Digital Twin Integration for Simulated Accessibility Assessments in Complex Architectural Environments by* Luis Borunda

*Real-Time Prediction of Brain Deformation in Surgical Simulators Using Transformer-Based Surrogates* by Fabian Greifeneder, Wolfgang Fenz, Benedikt Alkin, Johannes Brandstetter and Philipp Moser

*Comparative Analysis between Different Optimization Methods for Indoor Daylight across Six Different Locations* by Manal Anis, Sumedh Pendurkar, Yun Kyu Yi and Guni Sharon

*Postural Stability Assessment Based on Deep Learning, Cameras, and Low-cost Sensor Technology* by Shiyang Li, Josue Pagan, Milagros Jaén-Vargas and Jose Javier Serrano Olmedo

**Session Block X**       **3:30 p.m.—5:00 p.m.**       **Room:  Classroom 14**

*Automated Fact-Checking Using Discrete Event System Specification Based on Concept of Concurrent Simulation* by Quy Thanh Le, Maamar el Amine Hamri, Aznam Yacoub and Ismail Badache

*Towards a Modeling and Simulation Approach for Socio-ecosystems Based on the Minsky's Triad and Digital Twins* by Chevenslove Edouard, Paul-Antoine Bisgambiglia, Raphael Duboz and Gauthier Quesnel

*Towards Composite Discrete Event and Agent-based Simulations* by Kevin A. Brown, Jonathan Ozik, Swann Perarnau, Nicholson Collier, Jamie Cook and Jason Liu

*Towards a Model of the Italian Wheat System: Agent-based Simulations for Sustainable Policies Design* by Gianfranco Giulioni, Concetta Cardillo, Alessandro Ceccarelli, Arianna Di Paola and Edmondo Di Giuseppe

# Annual Modeling and Simulation Conference 2025

## Agenda

## Work in Progress

## Thursday, May 29, 2025

**Session Block XI**     **9:00 a.m.—10:30 p.m.**     **Room:  Classroom 14**

*Building Analysis Tool: Designing for the Visually Impaired by* Eleftheria Papadosifou, Eleni Papakosta, Kacper Wasilewski, Nouhaila Elmalouli, Sahil Yousaf, Gonzalo Garcia-Perate, Lora Fahmy and Angelos Chronis

*Agent-based Simulation of a Support System to Improve Accessibility for Disabled Individuals in Hospitals* by Duygu Kaya, Ali Firat Inal, Kursat Turker, Gulesin Sena Das and Deniz Cetinkaya

*Emotion-aware Autonomous Vehicle Control: A Novel Framework for Driver State Management through Adaptive AI-driven Interventions* by Ancuta Margondai, Sara Willox, T'Kara Mullins and Mustapha Mouloua  (Virtual Presentation)

**Session Block XII**     **11:00 a.m.—12:30 p.m.**     **Room:  Classroom 14**

*Analyzing Economic Recessions Probabilities through Interest Rates and Labor Market Indicators by Jeremis N. Morales*

*Multimodel Validation of Simulation Scenarios for Optimization of the New Dynamic Electricity Prices* by Thomas Wiedemann

*Improving Automatic Parallelization for Equation Based Mathematical Modeling and Simulation Using Metaheuristic Optimization* by Abdelazim G. Hussien and Adrian Pop

*Contribution to Model-based Interoperable Simulations: The MBS Approach* by Rolf Miemba Makita, Martin Kubic, François Trousset and Greg Zacharewicz

# School of Modeling Simulation and Training

**University of Central Florida**

https://www.cecs.ucf.edu/smst/

The School of Modeling, Simulation, and Training (SMST) at UCF is a leading interdisciplinary academic unit under the College of Engineering and Computer Science that offers cutting edge research and graduate educational programs in modeling and simulation (M&S). Our programs are among the most established in the U.S. and globally with 25 years of history in graduate education.

SMST is home to faculty with diverse background including Engineering, Computer Science, Psychology, Human Systems, Urban Planning, Information Sciences, Artificial Intelligence, Cognition and Learning Science. The faculty conduct interdisciplinary research in various areas of applications including defense, healthcare, transportation systems, logistics, semiconductor processes, Digital Twin among several others.

SMST offers the following graduate programs (in-person and online):

1. Ph.D. in Modeling and Simulation
2. M.S. in Modeling and Simulation
3. Graduate Certificate in Behavioral Cyber Security
4. Graduate Certificate in Digital Twin

Research labs at SMST include:

- Advanced Modeling, Simulation, and Optimization Lab (AMSOL)
- eXtend Reality, Biosensing and Simulation Lab
- Health Energy Nexus Advancement Technology (HENAT)
- High-performance A.I. Lab (HAIL)
- Human-centered AI for Sustainable Technology Innovation (HASTI) Lab
- Privacy Lab
- SMART Lab
- Urban Digital Twin Lab

SMST is part of a vibrant campus located in Orlando, Florida – a hub for modeling and simulation. SMST is also co-located and partners with the Institute for Simulation and Training (IST). SMST receives federal, state and private research funding including but not limited to NSF, DoD, NATO, DoE, Dept of Education among many others.

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