

**ACM Distinguished Speaker:** Gabriel Wainer (Ottawa, ON, Canada), [https://speakers.acm.org/speakers/wainer\\_14789](https://speakers.acm.org/speakers/wainer_14789)

**Conference name:** Discrete-Event Modeling and Simulation for Development of Embedded and Real-Time Systems

**Seminar for postgraduate students and researchers:** Smart Data: Systems and Applications, Master's Degree in Systems and Computer Engineering Research, <https://esingenieria.uca.es/docencia/masteres/muiisc/>

**Venue:** February, 21st 2023 at 16.00 h. in B05 seminar, School of Engineering, Avda. Universidad de Cádiz 10, Puerto Real, Cádiz 11519, Spain (<https://esingenieria.uca.es/conocenos/localizacion-y-contacto/>)

**Name of hosting organization:** University of Cadiz (UCA), Spain, <https://www.uca.es/>

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**Abstract:**

Embedded real-time software construction has usually posed interesting challenges due to the complexity of the tasks these systems have to execute. Most methods for developing these systems are either hard to scale up for large systems, or require a difficult testing effort with no guarantee for bug-free software products. Although formal methods have showed promising results, they are difficult to apply when the complexity of the system under development scales up. Instead, systems engineers have often relied on the use of modeling and simulation (M&S) techniques in order to make system development tasks manageable. Construction of system models and their analysis through simulation reduces both end costs and risks, while enhancing system capabilities and improving the quality of the final products. M&S let users experiment with “virtual” systems, allowing them to explore changes, and test dynamic conditions in a risk-free environment. This is a useful approach, moreover considering that testing under actual operating conditions may be impractical and in some cases impossible.

In this talk, we will present a Modeling and Simulation-based framework to develop embedded systems based on the DEVS (Discrete Event systems Specification) formalism. DEVS provides a formal foundation to M&S that proved to be successful in different complex systems. This approach combines the advantages of a simulation-based approach with the rigor of a formal methodology. We will discuss how to use this framework to incrementally develop embedded applications, and to integrate simulation models with hardware components seamlessly. One of the main aspects of the methodology is that it can be integrated with models of the environment in which the embedded controller will act. We will show how the Cell-DEVS and the QSS methods can be used for this task. We will introduce the main characteristics of the Cell-DEVS and QSS methods, and will show how to model physical systems. We will introduce an integrated environment that deals with these issues, orchestrating a cellular-based simulator, a GIS and data visualization, to simulate behavior and analyze results supporting the decision making for varied environmental scenarios.

Our approach does not impose any order in the deployment of the actual hardware components, providing flexibility to the overall process. The use of DEVS improves reliability (in terms of logical correctness and timing), enables model reuse, and permits reducing development and testing times for the overall process. Consequently, the development cycle is shortened, its cost reduced, and quality and reliability of the final product is improved.

**Bio:**

GABRIEL A. WAINER, FSCS, received the M.Sc. (1993) at the University of Buenos Aires, Argentina, and the Ph.D. (1998, with highest honors) at UBA/Université d’Aix-Marseille III, France. In July 2000, he joined the Department of Systems and Computer Engineering at Carleton University (Ottawa, ON, Canada), where he is now Full Professor. He has held visiting positions at the University of Arizona; LSIS (CNRS), Université Paul Cézanne, University of Nice, INRIA Sophia-Antipolis, Université de Bordeaux (France); UCM, UPM, UPC (Spain), University of Buenos Aires, National University of Rosario (Argentina) and others. He is one of

the founders of the SCS/ACM/IEEE Symposium on Theory of Modeling and Simulation, SIMUTools and SCS/ACM/IEEE SimAUD. Prof. Wainer was Vice-President Conferences and Vice-President Publications and is a member of the Board of Directors of the SCS, Society for Modeling and Simulation International. He has published over 400 research articles and five books in the field of Modeling and Simulation. Prof. Wainer is Editor in Chief of SIMULATION, member of the Editorial Board of Journal of Simulation (Taylor and Francis) IEEE Computing in Science and Engineering, Wireless Networks (Elsevier), Journal of Defense Modeling and Simulation (SCS). He is the head of the Advanced Real-Time Simulation lab, located at Carleton University's Centre for advanced Simulation and Visualization (V-Sim). He helped organizing over 150 conferences including ACM SIGSIM PADS and Winter Simulation Conference (co-sponsored by ACM). He has been the recipient of various awards, including the IBM Eclipse Innovation, SCS Leadership, and various Best Papers. He has been awarded Carleton University's Research Achievement Award (2005, 2014), the SCS Outstanding Professional Award (2011), Carleton University's Mentorship Award (2013), the SCS Distinguished Professional Award (2013), the SCS Distinguished Service Award (2015), Nepean's Canada 150th Anniversary Medal (2017), ACM Recognition of Service Award (2018), IEEE Outstanding Engineering Award (Ottawa Section - 2019). He is a Fellow of SCS.