Introduction to the Special Issue on PADS 2024

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It is a privilege to announce the 2024 ACM TOMACS Special Issue on the Principles of Advanced Discrete Simulation (PADS), which builds on selected contributions originally presented at the 38th ACM SIGSIM-PADS Conference in Atlanta, GA, USA, from June 24 to 26. The conference, serving as the flagship event of the Special Interest Group on Simulation and Modeling (SIGSIM), provided a platform to discuss recent advances in modeling and simulation. Since serving as Program Chair for the conference, it has been an honor to take on the role as Guest Editor of this special issue. Margaret Loper served as the General Chair of the conference.

For the first time in the long history of PADS, the Steering Committee, guided by Adelinde Uhrmacher, introduced a "journal-first" approach that was immediately endorsed by Wentong Cai, the Editor-in-Chief of ACM TOMACS. This innovative submission procedure, schematized in Figure 1, allowed authors to submit their manuscripts through two distinct calls, each subjected to a double-blind peer review by the Technical Program Committee of PADS. Papers that demonstrated the exceptional quality expected of TOMACS were then rerouted directly to the journal for an additional multi-round evaluation phase, thereby guaranteeing that only the highest-quality contributions were accepted for publication.

The result was a set of papers that were available in the "just accepted" section of TOMACS in time for the conference presentations, enabling rapid dissemination of findings while maintaining the highest scholarly standards. Authors benefited from rigorous vetting through multiple review cycles and found an ideal opportunity to showcase their research to the broader simulation community during the conference.

The articles in this issue illustrate the diversity and breadth of contemporary research in discrete-event simulation. They collectively highlight innovative approaches to computational challenges posed by real-world applications.

The first article, "Adaptive Synchronization and Pacing Control for Visual Interactive Simulation," [1] by Meng et al., addresses the challenges of integrating real-time visualization with computationally intensive simulations. The authors propose a buffer-based adaptive synchronization algorithm that dynamically adjusts pacing based on predictive workload analysis. This approach enhances runtime efficiency and minimizes delays in user interaction.

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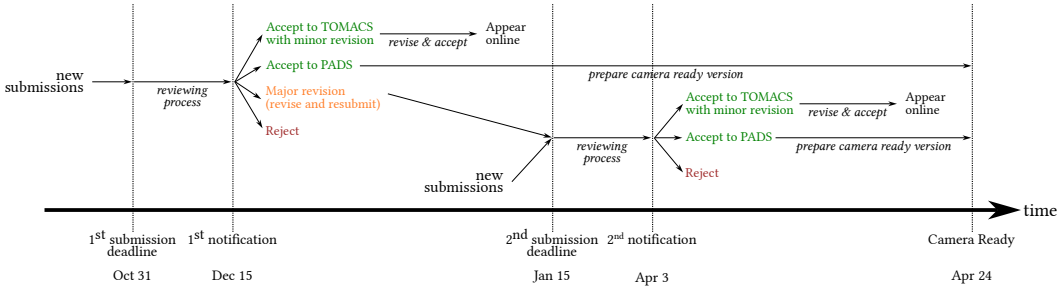

Fig. 1. Submission Timeline for PADS'24.

The second article is "ENHANCE: Multilevel Heterogeneous Performance-Aware Re-Partitioning Algorithm for Microscopic Vehicle Traffic Simulation," [2] by Siguenza-Torres et al., which introduces a novel cost-model-driven partitioning framework designed to optimize large-scale microscopic traffic simulations in heterogeneous computational environments. The proposed ENHANCE algorithm enables fine-grained adaptation to variable load patterns.

The article "A Toolset for Predicting Performance of Legacy Real-Time Software Based on the RAST Approach" [3] by Tomak and Gorlatch, introduces a methodology for simulating and predicting the performance of a distributed software system working with real-time constraints. Using the RAST (Regression Analysis, Simulation, and load Testing) framework, the authors provide an integrated approach that combines static analysis and simulation to predict system performance under varying operational conditions. This toolset is particualarly useful when dealing with legacy systems.

In "SpecSims: A Scalable Speculative Tree-Based Simulation Cloning Framework for Finite Memory Machines," [4] Yoginath et al. present a framework for speculative simulation cloning. By leveraging tree-based cloning strategies and memory-aware execution techniques, the framework enables efficient exploration of large-scale simulation state spaces under stringent memory constraints. This proposal allows to effectively carry out what-if analysis by speculatively exploring and evaluating the impact of various permutations of intervening cascade of events. This paper earned the best paper award at PADS'24.

We hope that this special issue will be interesting for researchers and practitioners alike, fostering further advancements in the field. We extend our deepest gratitude to the authors for their contributions, the reviewers for their meticulous evaluations, and the ACM TOMACS editorial team for their continuous support.

Alessandro Pellegrini
Guest Editor

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