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Guest Editorial: Special issue on outstanding papers from RTNS 2019

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The 27th edition of the International Conference on Real-Time Networks and Systems (RTNS) was held November 6–8, 2019, in Toulouse, France. RTNS is a friendly conference with a great sense of community that offers excellent opportunities for collaboration as well as a high-quality technical program. RTNS publishes papers addressing real-time issues in any area of computation and communication, at any level of abstraction, and in any application domain. The reviewing process involved 44 program committee members, who were assisted by 22 additional reviewers, and each submission received at least three reviews. Of 37 submissions that were received, 20 papers were accepted for publication at RTNS 2019.

From the 20 accepted papers, 4 were chosen as outstanding papers, and the authors of those papers were invited to submit extended articles for this special issue, containing significant additional technical content beyond the contributions that were published at RTNS 2019. Each of those articles underwent a rigorous additional review process, involving new reviewers who had not originally reviewed the papers, as well as reviewers who had evaluated them for RTNS 2019, and with each article receiving three reviews in this stage as well. Following multiple rounds of reviewing and revision, leading ultimately to approval, each of the four articles that appears in this special issue provides new technical advances in the state of the art for real-time networks and systems.

The article by Clara Hobbs, Zelin Tong, Joshua Bakita, and James H. Anderson, titled "Statically Optimal Dynamic Soft Real-Time Semi-Partitioned Scheduling," presents EDF-sc, the first semi-partitioned scheduling algorithm that is optimal for scheduling static soft real-time sporadic task systems and allows tasks to dynamically join and leave. For its soft real-time notion of optimality, EDF-sc requires deadline tardiness to be bounded for any task system that does not over-utilize its allocated resources. For fixed task systems, EDF-sc behaves exactly as partitioned

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EDF, and through heuristics presented in the article, EDF-sc can stabilize the workload to approach the partitioned case even as tasks dynamically join and leave.

The article by Ishfaq Hussain, Muhammad Ali Awan, Pedro F. Souto, Konstantinos Bletsas, Benny Akesson, and Eduardo Tovar, titled "Response Time Analysis of Multiframe Mixed-Criticality Systems with arbitrary deadlines," deals with the schedulability analysis of the combined multiframe and mixed-criticality model. The analysis techniques for Static Mixed-Criticality scheduling and Adaptive Mixed-Criticality scheduling, as well as the schedulability analysis for multiframe task systems are extended to cope with this new combined model in both constrained-deadline and arbitrary-deadline scenarios. The proposed worst-case response time analysis for multiframe mixed-criticality systems is considerably less pessimistic than applying the static and adaptive mixed-criticality scheduling tests oblivious to the WCET variation patterns.

The article by Catherine E. Nemitz, Tanya Amert, Manish Goyal, and James H. Anderson, titled "Concurrency Groups: A New Way to Look at Real-Time Multiprocessor Lock Nesting," proposes to group lock requests whose safe concurrent execution can be determined off-line, and provides a new real-time multiprocessor locking protocol called the CGLP, based on those concurrency groups. The CGLP offers improved run-time parallelism compared to prior work on nested locking protocols, and the article provides a schedulability study to quantify those benefits. The article also presents an approach for determining concurrency groups using an ILP solver, and shows that approach to be efficient in practice.

The article by James Orr and Sanjoy Baruah, titled "Algorithms for Implementing Elastic Tasks on Multiprocessor Platforms: A Comparative Evaluation," compares the relative performance of different multiprocessor scheduling algorithms in scheduling elastic tasks under the global and partitioned paradigms. By extensive simulations, the authors evaluated a set of representative algorithms: fluid, global EDF, PriD, global RM, partitioned fixed-job priority with uniprocessor EDF, and partitioned fixed-task priority with uniprocessor RM. Readers can find in-depth analyses of those algorithms as well as recommendations regarding the best choice for scheduling sequential period-elastic tasks on uniform multiprocessor systems.

We wish to thank the authors of these articles for their diligent efforts to revise and refine these articles, and for the research contributions that the articles present. We also wish to thank our anonymous reviewers for their careful reading, constructive suggestions for improvement, and tireless efforts during the reviewing process. Finally, we wish to thank Prof. Giorgio Buttazzo, Real-Time Systems Journal Editor in Chief, and Ms. Jebamalar Jayapal, Springer Nature Journals Editorial Office Assistant, for guiding us in these efforts and for the opportunity to produce this special issue.