# Introduction to the Special Issue on Real-Time, Embedded and Cyber-Physical Systems

Embedded software has become a necessity in almost every aspect of our daily life. The types of embedded software range from self-contained applications to those embedded in various devices and services, such as mobile phones, vital sign sensors, medication dispensers, home appliances, engine ignition systems, etc. Many such systems are mission/life-critical and performance-sensitive. This special issue presents recent advances in embedded computing, real-time computing, and ubiquitous computing, and especially advances jointly among these areas.

This special issue received over forty submissions, including articles extended from their conference versions in the *19th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (IEEE RTCSA)* and other high-quality submissions worldwide. All of the submissions were reviewed by at least 3 reviewers with particular expertise in the subject area of the article. Among the submissions, eight articles were selected to appear in this special issue. The selected articles cover three topics: embedded system architectures, real-time scheduling algorithms, and cyber-physical system designs.

The first three articles address embedded architecture design and energy efficiency. The article *Branch Prediction-Directed Dynamic Instruction Cache Locking for Embedded Systems* by K. Qiu et al. presents a cache-locking technique for improving the average-case execution time performance of embedded applications. The article *A Hybrid Storage Access Framework for High-Performance Virtual Machines* by C.-K. Kang et al. introduces a hybrid storage access framework for a virtualization environment to improve I/O performance using solid-state drives. The article *Energy Efficiency Analysis for the Single Frequency Approximation (SFA) Scheme* by Pagani and Chen presents a comprehensive analysis for SFA and shows the usefulness of SFA under practical settings.

The next three articles focus on real-time scheduling. The article *Task Assignment Algorithms for Heterogeneous Multiprocessors* by Raravi and Nélis presents two algorithms for assigning real-time tasks on a t-type heterogeneous multiprocessor with performance guarantees. The article *Provably Good Task Assignment for Two-Type Heterogeneous Multiprocessors Using Cutting Planes* by Andersson and Raravi considers the problem of determining a task-to-processor assignment for an implicit deadline sporadic task set on a two-type heterogeneous multiprocessor. The article *Optimal Priority Assignment to Control Tasks* by Mancuso et al. addresses the problem of determining the optimal priority assignments and the periods of sample-data control tasks.

The last two articles are on cyber-physical system design. The article *Utility-Based Resource Overbooking for Cyber-Physical Systems* by de Niz et al. proposes ZS-QRAM, a scheduling approach that enables the use of flexible execution times and application-derived utility to tasks in order to maximize total system utility. The article *Scheduling Temporal Data with Dynamic Snapshot Consistency Requirement in Vehicular Cyber-Physical Systems* by Liu et al. investigates both static and dynamic snapshot consistency requirements for temporal data dissemination in vehicular cyber-physical systems.

We would like to thank all of the authors who submitted their excellent work to this special issue and the reviewers for their great efforts in reviewing the submissions

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