Preface

Hakan Aydin*

Department of Computer Science,
George Mason University,
Fairfax, VA 22030, USA
E-mail: aydin@cs.gmu.edu
*Corresponding author

Dakai Zhu

Department of Computer Science,
University of Texas at San Antonio,
TX 78249, USA
E-mail: dzhu@cs.utsa.edu

Biographical notes: Hakan Aydin is an Associate Professor of Computer Science at George Mason University. He received his PhD in Computer Science from the University of Pittsburgh in 2001. He has published more than 30 peer-reviewed papers and served on the program committees of several international conferences and workshops, including IEEE RTSS and RTAS. He received the NSF CAREER Award in 2006. His current research focuses on low-power computing, real-time systems and fault tolerance.

Dakai Zhu received his PhD in Computer Science from the University of Pittsburgh in 2004. He joined the Department of Computer Science at the University of Texas at San Antonio as an Assistant Professor in 2005. He served as a program committee member of IEEE RTSS (2005, 2006, 2008 and 2009) and RTAS (2006, 2007 and 2008) conferences, as well as a number of other national and international conferences and workshops. He also served as the program committee co-chair of the ICESS conference in 2009. His current research interests include real-time embedded systems, low-power computing and fault tolerance.

The phenomenal improvements in the performance of modern computing systems have been accompanied by a drastic increase in power dissipation. For embedded systems, which are normally battery-powered, power-awareness has become one of the key performance requirements, especially for those involving time constraints. Although significant progress has been reported in this area during the last decade, the problem retains its significance. For instance, International Technology Roadmap for Semiconductors (ITRS) lists 'power management' as one of the near-term grand challenges.

To reflect the ever-increasing concern on power management in real-time embedded systems, we have prepared a special issue on 'low-power real-time embedded computing'. With most submissions being extended editions of the noteworthy papers that have been first presented at the *2nd International Workshop on Power-Aware Real-Time Computing (PARC)* as part of the annual *ACM Conference on Embedded Systems Software (EMSoft)* in 2005, only five papers are accepted after a stringent review process. Each submission was evaluated by at least three members of Guest Editorial Board.

This issue starts with a paper on 'Optimal two-level speed assignment for real-time systems' by Enrico Bini and Claudio Scordino. The paper addresses the problem of exploiting probabilistic execution time information of real-time tasks for reducing processor energy consumption. Considering the processor idle power and speed adjustment overhead, the authors present a solution to obtain the optimal speed assignments and the transition points.

The second paper is titled 'LD-DVS: load-aware dual speed dynamic voltage scaling', and authored by Christian Poellabauer, Dinesh Rajan and Russell Zuck. With the experimental data from an XScale PXA255 processor based platform, the authors show the necessity of workload-awareness to obtain better energy savings. Then, an online approach with dual-speed settings is presented to compute the best frequency pair that yields the best possible energy savings using the workload information for a given task set.

The ever-increasing leakage power due to scaled technology size is a growing concern. The third paper, titled 'Fixed-priority scheduling to reduce both the dynamic and leakage energy on variable voltage processors', addresses this issue. It is authored by Gang Quan, Linwei Niu, Bren Mochocki and Xiaobo Sharon Xu. For fixed-priority real-time task systems, the authors present a scheduling algorithm that can judiciously merge the short, scattered idle

intervals into larger idle intervals, which can be explored to reduce the shut-down overhead and obtain global energy efficiency.

The fourth paper is on 'SYS-EDF: a system-wide energy-efficient scheduling algorithm for hard real-time systems', by Hui Cheng and Steve Goddard. Taking the energy consumption of I/O devices into consideration, the paper addresses the system-wide energy-efficient scheduling problem for preemptive periodic tasks with non-preemptive shared I/O resources and presents an online algorithm that integrates the CPU- and I/O-centric power management.

The last paper of the issue, 'GRACE-2: integrating fine-grained application adaptation with global adaptation for saving energy', is authored by Vibhore Vardhan, Daniel G. Sachs, Wanghong Yuan, Albert F. Harris, Sarita V. Adve, Douglas L. Jones, Robin H. Kravets and Klara Nahrstedt. Extended from their previous work in the GRACE project, this paper presents a hierarchical adaptation solution to optimise energy consumption in a system, and concludes that, for network bandwidth-constrained environments, per-application adaptation yields more significant energy savings when compared to the global adaptation mechanisms that target all applications simultaneously.

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