

Proceedings

**12th IEEE International Conference on
Embedded and Real-Time Computing
Systems and Applications
(RTCSA 2006)**

**16–18 August 2006
Sydney, Australia**

Supported by

National ICT Australia



Los Alamitos, California
Washington • Tokyo

Copyright © 2006 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved.

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries may photocopy beyond the limits of US copyright law, for private use of patrons, those articles in this volume that carry a code at the bottom of the first page, provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

Other copying, reprint, or republication requests should be addressed to: IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, P.O. Box 133, Piscataway, NJ 08855-1331.

The papers in this book comprise the proceedings of the meeting mentioned on the cover and title page. They reflect the authors' opinions and, in the interests of timely dissemination, are published as presented and without change. Their inclusion in this publication does not necessarily constitute endorsement by the editors, the IEEE Computer Society, or the Institute of Electrical and Electronics Engineers, Inc.

IEEE Computer Society Order Number P2676
ISBN-13: 978-0-7695-2676-8
ISBN-10: 0-7695-2676-4
ISSN 1533-2306

Additional copies may be ordered from:

IEEE Computer Society
Customer Service Center
10662 Los Vaqueros Circle
P.O. Box 3014
Los Alamitos, CA 90720-1314
Tel: + 1 800 272 6657
Fax: + 1 714 821 4641
<http://computer.org/cspress>
csbooks@computer.org

IEEE Service Center
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
Tel: + 1 732 981 0060
Fax: + 1 732 981 9667
[http://shop.ieee.org/store/
customer-service@ieee.org](http://shop.ieee.org/store/customer-service@ieee.org)


IEEE Computer Society
Asia/Pacific Office
Watanabe Bldg., 1-4-2
Minami-Aoyama
Minato-ku, Tokyo 107-0062
JAPAN
Tel: + 81 3 3408 3118
Fax: + 81 3 3408 3553
tokyo.ofc@computer.org

Individual paper REPRINTS may be ordered at: reprints@computer.org

Editorial production by Randall S. Bilof

Cover art by Alex Torres

Printed in the United States of America by The Printing House


IEEE
COMPUTER
SOCIETY

 **IEEE**

IEEE Computer Society
Conference Publishing Services
<http://www.computer.org/proceedings/>

Contents

Proceedings of the 12th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications

RTCSA 2006

Foreword	x
Conference Organization	xi
Reviewers	xiv

Schedulability and Timing Analysis

Rate Monotonic Schedulability Conditions Using Relative Period Ratios	3
<i>Wan-Chen Lu, Hsin-Wen Wei, and Kwei-Jay Lin</i>	
Characterization and Analysis of Tasks with Offsets: Monotonic Transactions	10
<i>Karim Traore, Emmanuel Grolleau, and Francis Cottet</i>	
Probabilistic Timing Join over Uncertain Event Streams	17
<i>Aloysius K. Mok, Honguk Woo, and Chan-Gun Lee</i>	

Ubiquitous Computing

A Software Infrastructure for Wearable Sensor Networks	27
<i>Kensuke Hanaoka, Ayako Takagi, and Tatsuo Nakajima</i>	
objSampler: A Ubiquitous Logging Tool for Recording Encounters with Real World Objects	36
<i>Jun'ichi Yura, Hideaki Ogawa, Taizo Zushi, Jin Nakazawa, and Hideyuki Tokuda</i>	
Algorithm Selectors for Providing Location Estimation Services within a Cellular Radio Network	42
<i>Junyang Zhou and Joseph Kee-Yin Ng</i>	

Timing Analysis 1

Instruction Scheduling with Release Times and Deadlines on ILP Processors	51
<i>Hui Wu, Joxan Jaffar, and Jingling Xue</i>	
Modeling Instruction-Level Parallelism for WCET Evaluation	61
<i>Jonathan Barre, Cédric Landet, Christine Rochange, and Pascal Sainrat</i>	
Optimization of Real-Time Systems Timing Specifications	68
<i>Ștefan Andrei and Albert Mo Kim Cheng</i>	

Resource Management 1

Dynamic Adaptation of Stability Periods for Service Level Agreements.....	77
<i>Luís Nogueira and Luís Miguel Pinho</i>	
Relaxed Correctness for Firm Real-Time Databases.....	82
<i>Jan Lindström</i>	
Mapping Task-Graphs on Distributed ECU Networks: Efficient Algorithms for Feasibility and Optimality.....	87
<i>Werner Damm, Alexander Metzner, Friedrich Eisenbrand, Gennady Shmonin, Reinhard Wilhelm, and Sebastian Winkel</i>	
A Framework for Compositional and Hierarchical Real-Time Scheduling.....	91
<i>Shanmuga Priya Marimuthu and Samarjit Chakraborty</i>	

Embedded Software 1

Towards an Analysis of Garbage Collection Techniques for Embedded Real-Time Java Systems	97
<i>M. Teresa Higuera-Toledano</i>	
Garbage Collector Scheduling in Dynamic, Multiprocessor Real-Time Systems	101
<i>Chewoo Na, Hyeonjoong Cho, Binoy Ravindran, and E. Douglas Jensen</i>	
Strengthening Property Preservation in Concurrent Real-Time Systems	106
<i>Oana Florescu, Jinfeng Huang, Jeroen Voeten, and Henk Corporaal</i>	
Security for Ubiquitous Computing: Problems and Proposed Solution.....	110
<i>Le Xuan Hung, Tran Van Phuong, Pho Duc Giang, Yonil Zhung, Sungyoung Lee, and Young-Koo Lee</i>	

Scheduling

Deferrable Scheduling for Temporal Consistency: Schedulability Analysis and Overhead Reduction.....	117
<i>Ming Xiong, Song Han, and Deji Chen</i>	
Computing the Minimum EDF Feasible Deadline in Periodic Systems	125
<i>Hoai Hoang, Giorgio Buttazzo, Magnus Jonsson, and Stefan Karlsson</i>	
Algorithms for Determining the Demand-Based Load of a Sporadic Task System	135
<i>Nathan Fisher, Theodore P. Baker, and Sanjoy Baruah</i>	

RT-Communications

A Broadcast Algorithm for Mobile Transaction Processing.....	147
<i>Chui Ying Hui, Joseph Kee-Yin Ng, and Victor Chung-Sing Lee</i>	
A Fast Elliptic Curve Based Key Agreement Protocol-on-Chip (PoC) for Securing Networked Embedded Systems	154
<i>Roshan Duraisamy, Zoran Salcic, Miguel Morales-Sandoval, and Claudia Feregrino-Uribe</i>	
Implementation of a Dominance Protocol for Wireless Medium Access	162
<i>Nuno Pereira, Björn Andersson, and Eduardo Tovar</i>	

Embedded Software 2

Data Freshness and Overload Handling in Embedded Systems	173
<i>Thomas Gustafsson and Jörgen Hansson</i>	
Systematic Security and Timeliness Tradeoffs in Real-Time Embedded Systems.....	183
<i>Kyoung-Don Kang and Sang H. Son</i>	
Implementation Synthesis of Embedded Software under the Group-Based Scheduling Model.....	190
<i>Zhigang Gao and Zhaohui Wu</i>	

Invited Papers

Application-Driven Low-Power Techniques Using Dynamic Voltage Scaling.....	199
<i>Taewhan Kim</i>	
Hardware-Software Codesign of Multimedia Embedded Systems: The PeaCE Approach.....	207
<i>Soonhoi Ha, Choonseung Lee, Youngmin Yi, Seongnam Kwon, and Young-Pyo Joo</i>	
Integrating Compiler and System Toolkit Flow for Embedded VLIW DSP Processors	215
<i>Chi Wu, Kun-Yuan Hsieh, Yung-Chia Lin, Chung-Ju Wu, Wen-Li Shih, S. C. Chen, Chung-Kai Chen, Chien-Ching Huang, Yi-Ping You, and Jenq Kuen Lee</i>	
A Property-Preserving Reuse-Geared Approach to Model-Driven Development.....	223
<i>Tullio Vardanega</i>	

Hardware Issues

Finite Horizon QoS Prediction of Reconfigurable Firm Real-Time Systems.....	233
<i>Mehdi Amirijoo, Aleksandra Tesanovic, Torgny Andersson, Jörgen Hansson, and Sang H. Son</i>	
COS: A Configurable OS for Embedded SoC Systems.....	242
<i>Hsin-hung Lin and Chih-Wen Hsueh</i>	
Developing Embedded Kernel for System-on-a-Chip Platform of Heterogeneous Multiprocessor Architecture	246
<i>Jing Chen and Jian-Hong Liu</i>	
Workload-Aware Dual-Speed Dynamic Voltage Scaling.....	251
<i>Dinesh Rajan, Russell Zuck, and Christian Poellabauer</i>	

Timing Analysis 2

Jitter Evaluation of Real-Time Control Systems	257
<i>Manuel Lluesma, Anton Cervin, Patricia Balbastre, Ismael Ripoll, and Alfons Crespo</i>	
An EDF Hierarchical Scheduling Model for Bandwidth Servers.....	261
<i>José L. Lorente and J. Carlos Palencia</i>	
Portable Execution Time Analysis Method	267
<i>Keiji Yamamoto, Yutaka Ishikawa, and Toshihiro Matsui</i>	
Worst Case Response Time Analysis of Sporadic Graph Tasks with EDF Scheduling on a Uniprocessor.....	271
<i>Hui Xue Zhao, Laurent George, and Serge Midonnet</i>	

Power Aware Computing

A Quasi-Static Approach to Minimizing Energy Consumption in Real-Time Systems under Reward Constraints.....	279
<i>Luis Alejandro Cortés, Petru Eles, and Zebo Peng</i>	
Power-Aware Resource Allocation with Fair QoS Guarantee.....	287
<i>Fumiko Harada, Toshimitsu Ushio, and Yukikazu Nakamoto</i>	
Balancing Energy vs. Performance in Processors with Discrete Voltage/Frequency Modes	294
<i>Mauro Marinoni and Giorgio Buttazzo</i>	

Multiprocessor Scheduling

Generalized Rate Analysis for Media-Processing Platforms	305
<i>Yanhong Liu, Samarjit Chakraborty, and Radu Marculescu</i>	
Utilization Bounds for RM Scheduling on Uniform Multiprocessors	315
<i>Vivek N. Darera and Lawrence Jenkins</i>	
Multiprocessor Scheduling with Few Preemptions.....	322
<i>Björn Andersson and Eduardo Tovar</i>	

Case Studies and Industrial Papers

Efficient Real-Time Support for Automotive Applications: A Case Study.....	335
<i>Gurulingesh R. Goud, Neera Sharma, Krithi Ramamritham, and Sachitanand Malewar</i>	
Automatic Generation and Validation of Models of Legacy Software.....	342
<i>Joel Huselius, Johan Andersson, Hans Hansson, and Sasikumar Punnekkat</i>	
Applying System Execution Modeling Tools to Evaluate Enterprise Distributed Real-Time and Embedded System QoS	350
<i>John M. Slaby, Steve Baker, James Hill, and Douglas C. Schmidt</i>	

Real-Time Operating Systems

An RTOS API Translator for Model-Driven Embedded Software Development	363
<i>Ji Chan Maeng, Jong-Hyuk Kim, and Minsoo Ryu</i>	
A Scheduler Support Unit for Reactive Microprocessors.....	368
<i>Zoran Salcic, Flavius Gruian, Partha Roop, and Alif Wahid</i>	
Extended U-Link Scheduling to Increase the Execution Efficiency for SMT Real-Time Systems.....	373
<i>Shinpei Kato and Nobuyuki Yamasaki</i>	
Operating System Support for Procedural Abstraction in Embedded Systems	378
<i>Keun Soo Yim, Jeong-Joon Yoo, Jae Don Lee, and Jihong Kim</i>	

Resource Management 2

Predictable Interrupt Scheduling with Low Overhead for Real-Time Kernels.....	385
<i>Luis E. Leyva-del-Foyo, Pedro Mejia-Alvarez, and Dionisio de Niz</i>	
Dynamic Load Balancing for Multiple Processors	395
<i>Chin-Fu Kuo, Tung-Wei Yang, and Tei-Wei Kuo</i>	

Maximizing Guaranteed QoS in (m, k)-Firm Real-Time Systems	402
<i>Jian Lin and Albert M. K. Cheng</i>	

Wireless Sensor Networks

Trust Management Problem in Distributed Wireless Sensor Networks.....	411
<i>Riaz Ahmed Shaikh, Hassan Jameel, Sungyoung Lee, Saeed Rajput, and Young Jae Song</i>	

An Energy-Efficient FEC Scheme for Weakly Hard Real-Time Communications in Wireless Networks.....	415
<i>Kyong Hoon Kim and Jong Kim</i>	

Using Real-Time Logic Synthesis Tool to Achieve Process Control over Wireless Sensor Networks.....	420
<i>Jianping Song, Aloysius K. Mok, Deji Chen, and Mark Nixon</i>	

Author Index	427
---------------------------	-----