

Proceedings

# 2008 Real-Time Systems Symposium

RTSS 2008

30 November-3 December 2008  
Barcelona, Spain

Sponsored by

The IEEE Computer Society  
Technical Committee on Real-Time Systems



Los Alamitos, California  
Washington • Tokyo



# 2008 Real-Time Systems Symposium

## RTSS 2008

### Table of Contents

**Message from Conference Chairs**

**Organizing Committee**

**Program Committee**

**Reviewers**

---

#### **Keynote Speaker**

The Rationale for Time-Triggered Ethernet ..... 1  
*Hermann Kopetz*

#### **Session 1: Cyber-Physical Systems**

Passivity-Based Design of Wireless Networked Control Systems for Robustness  
to Time-Varying Delays ..... 10  
*Nicholas Kottenstette, Xenofon Koutsoukos, Joseph Hall, Janos Sztipanovits,  
and Panos Antsaklis*

Merge-by-Wire: Algorithms and System Support ..... 20  
*Vipul Shingde, Gurulingesh Raravi, Ashish Gudhe, Prakhar Goyal,  
and Krithi Ramamritham*

A Holistic Approach to Decentralized Structural Damage Localization Using Wireless  
Sensor Networks ..... 30  
*Gregory Hackmann, Fei Sun, Nestor Castaneda, Chenyang Lu, and Shirley Dyke*

Task Scheduling for Control Oriented Requirements for Cyber-Physical Systems ..... 42  
*Fumin Zhang, Klementyna Szwaykowska, Wayne Wolf, and Vincent Mooney*

#### **Session 2: Design & Verification: Schedulability Analysis**

A Multi-mode Real-Time Calculus ..... 52  
*Linh T.X. Phan, Samarjit Chakraborty, and P.S. Thiagarajan*

Schedulability and Compatibility of Real Time Asynchronous Objects ..... 63  
*Mohammad Mahdi Jaghoori, Delphine Longuet, Frank S. de Boer, and Tom Chothia*

Symbolic Computation of Schedulability Regions Using Parametric Timed Automata ..... 73  
*Alessandro Cimatti, Luigi Palopoli, and Yusi Ramadian*

### **Session 3: Wireless Sensor Networks: Middleware & Algorithms**

Perpendicular Intersection: Locating Wireless Sensors with Mobile Beacon .....	83
<i>Zhongwen Guo, Ying Guo, Feng Hong, Xiaohui Yang, Yuan He, Yuan Feng, and Yunhao Liu</i>	
Fast Sensor Placement Algorithms for Fusion-Based Target Detection .....	93
<i>Zhaohui Yuan, Rui Tan, Guoliang Xing, Chenyang Lu, Yixin Chen, and Jianping Wang</i>	
Rate-Harmonized Scheduling for Saving Energy .....	103
<i>Anthony Rowe, Karthik Lakshmanan, Haifeng Zhu, and Ragunathan Rajkumar</i>	
Virtual Battery: An Energy Reserve Abstraction for Embedded Sensor Networks .....	113
<i>Qing Cao, Debessay Fesehaye, Nam Pham, Yusuf Sarwar, and Tarek Abdelzaher</i>	

### **Session 4A: Multicore Scheduling**

New Schedulability Test Conditions for Non-preemptive Scheduling on Multiprocessor Platforms .....	124
<i>Nan Guan, Wang Yi, Zonghua Gu, Qingxu Deng, and Ge Yu</i>	
Optimal Dynamic-Priority Real-Time Scheduling Algorithms for Uniform Multiprocessors .....	134
<i>Shih-Ying Chen and Chih-Wen Hsueh</i>	
On the Scalability of Real-Time Scheduling Algorithms on Multicore Platforms: A Case Study .....	144
<i>Björn B. Brandenburg, John M. Calandrino, and James H. Anderson</i>	

### **Session 4B: Design & Verification: Model Checking**

Approximate Parameter Synthesis for Probabilistic Time-Bounded Reachability .....	157
<i>Tingting Han, Joost-Pieter Katoen, and Alexandru Mereacre</i>	
Synthesizing Certificates in Networks of Timed Automata .....	167
<i>Bernd Finkbeiner, Hans-Jörg Peter, and Sven Schewe</i>	
Efficient Model-Checking of Dense-Time Systems with Time-Convexity Analysis .....	179
<i>Farn Wang</i>	

### **Session 5A: Methodologies and Mechanisms for Resource Management**

Synthesis of Optimal Interfaces for Hierarchical Scheduling with Resources .....	190
<i>Insik Shin, Moris Behnam, Thomas Nolte, and Mikael Nolin</i>	
Coscheduling of CPU and I/O Transactions in COTS-Based Embedded Systems .....	202
<i>Rodolfo Pellizzoni, Bach D. Bui, Marco Caccamo, and Lui Sha</i>	
Predictable Interrupt Management and Scheduling in the Composite Component-Based System .....	213
<i>Gabriel Parmer and Richard West</i>	
Real-Time Program Execution on NAND Flash Memory for Portable Media Players .....	225
<i>Jong-Chan Kim, Duhee Lee, Chang-Gun Lee, Kanghee Kim, and Eun Yong Ha</i>	

## **Session 5B: Distributed and Control Systems**

Delay Composition Algebra: A Reduction-Based Schedulability Algebra for Distributed Real-Time Systems .....	237
<i>Praveen Jayachandran and Tarek Abdelzaher</i>	
Extending a Task Allocation Algorithm for Graceful Degradation of Real-Time Distributed Embedded Systems .....	248
<i>Paul Emberson and Iain Bate</i>	
Control-Driven Tasks: Modeling and Analysis .....	258
<i>Manel Velasco, Pau Martí, and Enrico Bini</i>	
Delay-Aware Period Assignment in Control Systems .....	269
<i>Enrico Bini and Anton Cervin</i>	

## **Session 6A: Power Management**

Power-Efficient Response Time Guarantees for Virtualized Enterprise Servers .....	279
<i>Yefu Wang, Xiaorui Wang, Ming Chen, and Xiaoyun Zhu</i>	
Optimistic Reliability Aware Energy Management for Real-Time Tasks with Probabilistic Execution Times .....	289
<i>Dakai Zhu, Hakan Aydin, and Jian-Jia Chen</i>	
Efficient Power Management of Heterogeneous Soft Real-Time Clusters .....	299
<i>Leping Wang and Ying Lu</i>	

## **Session 6B: Wireless Sensor Networks: Data Management & Aggregation**

Real-Time Querying of Historical Data in Flash-Equipped Sensor Devices .....	309
<i>Adam Ji Dou, Song Lin, and Vana Kalogeraki</i>	
OPAG: Opportunistic Data Aggregation in Wireless Sensor Networks .....	319
<i>Zhigang Chen and Kang G. shin</i>	
MDS: Efficient Multi-dimensional Query Processing in Data-Centric WSNs .....	329
<i>Hanhua Chen, Mo Li, Hai Jin, Yunhao Liu, and Lionel M. Ni</i>	

## **Session 7: Multiprocessor Scheduling**

The EDF Scheduling of Sporadic Task Systems on Uniform Multiprocessors .....	339
<i>Sanjoy Baruah and Joel Goossens</i>	
A Unified Hard/Soft Real-Time Schedulability Test for Global EDF Multiprocessor Scheduling .....	347
<i>Hennadiy Leontyev and James H. Anderson</i>	
Scheduling Arbitrary-Deadline Sporadic Task Systems on Multiprocessors .....	357
<i>Björn Andersson, Konstantinos Bletsas, and Sanjoy Baruah</i>	

## **Session 8: Fixed Priority Scheduling Theory**

Static-Priority Real-Time Scheduling: Response Time Computation Is NP-Hard .....	367
<i>Friedrich Eisenbrand and Thomas Rothvoß</i>	
Response Time Upper Bounds for Fixed Priority Real-Time Systems .....	377
<i>R.I. Davis and A. Burns</i>	

## **Session 9: Communications**

Priority Assignment for Real-Time Wormhole Communication in On-Chip Networks .....	389
<i>Zheng Shi and Alan Burns</i>	
Optimal Sampling Rate Assignment with Dynamic Route Selection for Real-Time Wireless Sensor Networks .....	399
<i>Weihuan Shu, Xue Liu, Zonghua Gu, and Sathish Gopalakrishnan</i>	

## **Session 10: Execution Time Analysis and Management**

Predictable Out-of-Order Execution Using Virtual Traces .....	410
<i>Jack Whitham and Neil Audsley</i>	
WCET Analysis of Multi-level Non-inclusive Set-Associative Instruction Caches .....	421
<i>Damien Hardy and Isabelle Puaut</i>	
Merging State and Preserving Timing Anomalies in Pipelines of High-End Processors .....	432
<i>Sibin Mohan and Frank Mueller</i>	

## **Session 11: Design & Verification: Design & Analysis Techniques**

Hardware Runtime Monitoring for Dependable COTS-Based Real-Time Embedded Systems .....	443
<i>Rodolfo Pellizzoni, Patrick Meredith, Marco Caccamo, and Grigore Roşu</i>	
Efficient SAT-Based Mapping and Scheduling of Homogeneous Synchronous Dataflow Graphs for Throughput Optimization .....	454
<i>Weichen Liu, Mingxuan Yuan, Xiuqiang He, Zonghua Gu, and Xue Liu</i>	
Scheduling Design and Verification for Open Soft Real-Time Systems .....	467
<i>Robert Glaubius, Terry Tidwell, William D. Smart, and Christopher Gill</i>	

## **Author Index**