

Editor-in-Chief

*A. Joe Turner, Seneca, SC, USA*

Editorial Board

Foundations of Computer Science

*Mike Hinchey, Lero, Limerick, Ireland*

Software: Theory and Practice

*Michael Goedicke, University of Duisburg-Essen, Germany*

Education

*Arthur Tatnall, Victoria University, Melbourne, Australia*

Information Technology Applications

*Ronald Waxman, EDA Standards Consulting, Beachwood, OH, USA*

Communication Systems

*Guy Leduc, Université de Liège, Belgium*

System Modeling and Optimization

*Jacques Henry, Université de Bordeaux, France*

Information Systems

*Jan Pries-Heje, Roskilde University, Denmark*

ICT and Society

*Jackie Phahlamohlaka, CSIR, Pretoria, South Africa*

Computer Systems Technology

*Paolo Prinetto, Politecnico di Torino, Italy*

Security and Privacy Protection in Information Processing Systems

*Kai Rannenber, Goethe University Frankfurt, Germany*

Artificial Intelligence

*Tharam Dillon, Curtin University, Bentley, Australia*

Human-Computer Interaction

*Annelise Mark Pejtersen, Center of Cognitive Systems Engineering, Denmark*

Entertainment Computing

*Ryohei Nakatsu, National University of Singapore*

## **IFIP – The International Federation for Information Processing**

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

*IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.*

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is about information processing may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

Luis M. Camarinha-Matos Slavisa Tomic  
Paula Graça (Eds.)

# Technological Innovation for the Internet of Things

4th IFIP WG 5.5/SOCOLNET Doctoral Conference on  
Computing, Electrical and Industrial Systems, DoCEIS 2013  
Costa de Caparica, Portugal, April 15-17, 2013  
Proceedings



Springer

## Volume Editors

Luis M. Camarinha-Matos  
Slavisa Tomic  
Paula Graça  
Universidade Nova de Lisboa, FCT-DEE  
2829-516, Monte Caparica, Portugal  
E-mail: cam@uninova.pt  
s.tomic@campus.fct.unl.pt  
mpaulagraca@gmail.com

ISSN 1868-4238

ISBN 978-3-642-37290-2

DOI 10.1007/978-3-642-37291-9

Springer Heidelberg Dordrecht London New York

e-ISSN 1868-422X

e-ISBN 978-3-642-37291-9

Library of Congress Control Number: 2013934266

CR Subject Classification (1998): J.2, C.2, I.2.9, I.2.4, I.2.6, C.3, C.4, G.1.6

© IFIP International Federation for Information Processing 2013

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

*Typesetting:* Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# Preface

This proceedings book, which is based on research results produced in engineering doctoral programs, brings the importance of the Internet of Things (IoT) under the spotlight. The Internet and mobile connectivity together with the vision of the IoT promise exciting challenges for researchers and industry and benefits for society. The IoT is an integrated part of the Future Internet and could be defined as a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols, enabling the interlinking of the physical world with cyberspace.

A key challenge for successful usage of IoT in the future is to identify the various areas which will be influenced by or contribute to the future development of the IoT — energy-efficient communication, scalable architectures of networks, bio-inspired algorithms, energy-aware systems, energy harvesting, smart and micro devices, biomedical devices, service-triggered security, self-organizing systems, distributed decision making, collaborative networks and ecosystems, connected machines and robotics, remote operation and supervision, collective adaptive systems, nano-electronics, etc.

Although typical PhD students are not experienced researchers, but rather in the process of learning how to do research, observation of worldwide publications shows that a high number of technologically innovative ideas are produced in the early careers of researchers. The DoCEIS series of Doctoral Conferences on Computing, Electrical and Industrial Systems aim at creating a space for sharing and discussing ideas and results from doctoral research in these inter-related areas of engineering. Innovative ideas and hypotheses can be better enhanced when presented and discussed in an encouraging and open environment. DoCEIS aims to provide such an environment, releasing PhD students from the pressure of presenting their propositions in more formal contexts.

The fourth edition of DoCEIS, which was sponsored by SOCOLNET, IFIP, and the IEEE Industrial Electronics Society, attracted a considerable number of paper submissions from a large number of PhD students (and their supervisors) from 24 countries. This book comprises the works selected by the International Program Committee for inclusion in the main program and covers a wide spectrum of topics, ranging from collaborative enterprise networks to microelectronics. As such, research results and on-going work are presented, illustrated, and discussed in areas such as:

- Collaborative enterprise networks
- Service orientation
- Intelligent computational systems
- Perceptual systems
- Robotics and manufacturing
- Embedded systems and Petri nets

- Control and decision
- Energy systems and smart grid
- Electronics and telecommunications

As a gluing element, all authors were asked to explicitly indicate the (potential) contribution of their work to the IoT.

We expect that this book will provide readers with an inspiring set of promising ideas and new challenges, presented in a multidisciplinary context, and that by their diversity these results can trigger and motivate richer research and development.

We would like to thank all the authors for their contributions. We also appreciate the efforts and dedication of the DoCEIS Program Committee members who both helped with the selection of articles and contributed with valuable comments to improve their quality.

April 2013

Luis M. Camarinha-Matos  
Slavisa Tomic  
Paula Graça

# Organization



4<sup>th</sup> IFIP / SOCOLNET Doctoral Conference  
on COMPUTING, ELECTRICAL AND INDUSTRIAL  
SYSTEMS  
Costa de Caparica, Portugal, April 15–17, 2013

## Conference and Program Chair

Luis M. Camarinha-Matos, Portugal

## Organizing Committee Co-chairs

Luis Gomes, Portugal

João Goes, Portugal

João Martins, Portugal

## International Program Committee

Marian Adamski, Poland

Amir Assadi, USA

José Barata, Portugal

Olga Battaia, France

Marko Beko, Portugal

Luis Bernardo, Portugal

Vedran Bilas, Croatia

Theodor Borangiu, Romania

Xavier Boucher, France

Erik Bruun, Denmark

Giuseppe Buja, Italy

Luis M. Camarinha-Matos,  
Portugal

António Cardoso, Portugal

João Catalão, Portugal

Wojciech Cellary, Poland

Naoufel Cheikhrouhou,  
Switzerland

Alok Choudhary, UK

Fernando J. Coito, Portugal

Luis Correia, Portugal

Ed Curry, Ireland

Ridha Derrouiche, France

Jorge Dias, Portugal

Pedro Encarnação, Portugal

Ip-Shing Fan, UK

Florin G Filip, Romania

Maria Helena Fino, Portugal

José M. Fonseca, Portugal

Leopoldo Garcia Franquelo,  
Spain

Liljana Gavrilovska, Macedonia

Paulo Gil, Portugal

João Goes, Portugal

Luis Gomes, Portugal

Antoni Grau, Spain

Ricardo Jardim-Gonçalves,  
Portugal

Bernhard Katzy, Germany  
Hans-Jörg Kreowski, Germany  
Johann Walter Kolar,  
Switzerland  
Paulo Leitão, Portugal  
Ratko Magjarevic, Croatia  
Veljko Malbasa, Serbia  
João Martins, Portugal  
Maria do Carmo Medeiros,  
Portugal  
Paulo Miyagi, Brazil  
Jörg Müller, Germany  
Milica Naumovic, Serbia  
Rudy Negenborn,  
The Netherlands  
Horacio Neto, Portugal  
Rui Neves-Silva, Portugal  
Henrique O'Neill, Portugal  
Luis Oliveira, Portugal  
Manuel D. Ortigueira, Portugal  
Angel Ortiz, Spain  
Gordana Ostojic, Serbia  
Peter Palensky, Austria  
Luis Palma, Portugal  
Nuno Paulino, Portugal

Carlos Eduardo Pereira, Brazil  
Willy Picard, Poland  
Paulo Pinto, Portugal  
José M. Quintana, Spain  
Ricardo Rabelo, Brazil  
Sven-Volker Rehm, Germany  
Rita Ribeiro, Portugal  
Rolf Drechsler, Germany  
Juan Rodriguez Andina, Spain  
Enrique Romero, Spain  
Jose de la Rosa, Spain  
Gheorghe Scutaru, Romania  
Fernando Silva, Portugal  
Adolfo Steiger-Garção,  
Portugal  
Sasu Tarkoma, Finland  
J. Tenreiro Machado, Portugal  
Klaus-Dieter Thoben, Germany  
Stanimir Valtchev, Portugal  
Manuela Vieira, Portugal  
Vasos Vassiliou, Cyprus  
Dmitri Vinnikov, Estonia  
Ljiljana Zivanov, Serbia

### Organizing Committee (PhD Students)

Fábio Silva  
João Borges  
Joaquim Moreira Lima  
Luis Pires  
Manuel Carvalho  
Maria Paula Graça  
Massimiliano Zanin  
Miguel Campilho Gomes

Nuno Amaro  
Rui Medeiros  
Sebastian Scholze  
Slavisa Tomic  
Sudeep Ghimire  
Tahereh Nodehi  
Vasco Gomes



## Technical Sponsors



Society of Collaborative Networks



IFIP WG 5.5 COVE  
Co-Operation infrastructure for Virtual Enterprises  
and electronic business



IEEE-Industrial Electronics Society

## Organizational Sponsors



## Organized by:

PhD Program on Electrical and Computer Engineering FCT-UNL.

# Table of Contents

## Part I: Introduction

Contributing to the Internet of Things . . . . .	3
<i>Luis M. Camarinha-Matos, João Goes, Luís Gomes, and João Martins</i>	

## Part II: Collaborative Enterprise Networks

Negotiation Support and Risk Reduction in Collaborative Networks . . . .	15
<i>Ana Inês Oliveira and Luis M. Camarinha-Matos</i>	
Inter-Enterprise Architecture and Internet of the Future . . . . .	25
<i>Alix Vargas, Andrés Boza, Llanos Cuenca, and Ioan Sacala</i>	
Collective Emotions Supervision in the Product-Servicing Networks . . . .	33
<i>Filipa Ferrada and Luis M. Camarinha-Matos</i>	

## Part III: Service Orientation

Web Service Composition with Uncertain Non-functional Parameters . . .	45
<i>Lukasz Falas and Paweł Stelmach</i>	
Service Composition Scenarios in the Internet of Things Paradigm . . . .	53
<i>Paweł Stelmach</i>	
Automatic Adaptation of SOA Systems Supported by Machine Learning . . . . .	61
<i>Kornel Skalkowski and Krzysztof Zielniński</i>	

## Part IV: Intelligent Computational Systems

Modelling of Things on the Internet for the Search by the Human Brain . . . . .	71
<i>Fernando Luis-Ferreira and Ricardo Jardim-Gonçalves</i>	
A Neural Network Based Security Tool for Analyzing Software . . . . .	80
<i>Adetunji Adebisi, Johnnes Arreyimbi, and Chris Imafidon</i>	
Semantic Adaptation of Knowledge Representation Systems . . . . .	88
<i>Catarina Lucena, João Sarraipa, and Ricardo Jardim-Gonçalves</i>	

## Part V: Computational Systems

BrainMap – A Navigation Support System in a Tourism Case Study . . . . .	99
<i>Luís F.S. Teixeira, Rita A. Ribeiro, António Falcão, Gabriel P. Lopes, and Ricardo Raminhos</i>	
A Scalable Spam Filtering Architecture . . . . .	107
<i>Nuno Ferreira, Gracinda Carvalho, and Paulo Rogério Pereira</i>	
Multi-Agent Systems Meet GPU: Deploying Agent-Based Architectures on Graphics Processors . . . . .	115
<i>Roman Pavlov and Jörg P. Müller</i>	

## Part VI: Computational Systems Applications

The Architecture of Coupon-Based, Semi-off-Line, Anonymous Micropayment System for Internet of Things . . . . .	125
<i>Daniel Wilusz and Jarogniew Rykowski</i>	
Mechanical Characterization of Ink-Jet Printed Ag Samples on Different Substrates . . . . .	133
<i>Dragana Z. Vasiljevic, Aleksandar B. Menicanin, and Ljiljana D. Zivanov</i>	
Toward a Modeling Framework for Organizational Competency . . . . .	142
<i>Reza Vatankhah Barenji, Majid Hashemipour, and David A. Guerra-Zubiaga</i>	

## Part VII: Perceptual Systems

Food Product Traceability by Using Automated Identification Technologies . . . . .	155
<i>Ivana Šenk, Gordana Ostojić, Laslo Tarjan, Stevan Stankovski, and Milovan Lazarević</i>	
Implantable Sensor System for Remote Detection of a Restenosis Condition . . . . .	164
<i>J.A. Miguel, Y. Lechuga, R. Mozuelos, and M. Martínez</i>	
Internet of Things in Psoriasis Assessment and Treatment . . . . .	172
<i>Simona Maria Banu, Laura Mădălina Dascălu, and Gheorghe Toacșe</i>	

## Part VIII: Robotics and Manufacturing

On Collaborative Aerial and Surface Robots for Environmental Monitoring of Water Bodies . . . . .	183
<i>Eduardo Pinto, Pedro Santana, and José Barata</i>	

An Omnidirectional System for Navigation in Virtual Environments . . . .	192
<i>Răzvan Gabriel Boboc, Mădălina-Ioana Toma, Horațiu Moga, Alina Ninett Panfir, and Doru Talabă</i>	
Indoor Exploration Using a $\mu$ UAV and a Spherical Geometry Based Visual System . . . . .	200
<i>Tiago Caldeira, Lakmal Seneviratne, and Jorge Dias</i>	
Context Awareness for Self-adaptive and Highly Available Production Systems . . . . .	210
<i>Sebastian Scholze, José Barata, and Oliver Kotte</i>	

## Part IX: Embedded Systems and Petri Nets

Augmenting High-Level Petri Nets to Support GALS Distributed Embedded Systems Specification . . . . .	221
<i>Filipe Moutinho and Luís Gomes</i>	
On Structuring Events for IOPT Net Models . . . . .	229
<i>Rogério Campos-Rebelo, Anikó Costa, and Luís Gomes</i>	
Minimalist Architecture to Generate Embedded System Web User Interfaces . . . . .	239
<i>Fernando Pereira and Luís Gomes</i>	
Application of an Exact Transversal Hypergraph in Selection of SM-Components . . . . .	250
<i>Lukasz Stefanowicz, Marian Adamski, and Remigiusz Wisniewski</i>	

## Part X: Control and Decision

Safety in Supervisory Control for Critical Systems . . . . .	261
<i>Reinaldo Squillante Jr., Diolino J. Santos Fo, Jeferson A.L. de Souza, Fabrício Junqueira, and Paulo E. Miyagi</i>	
ARMA Modelling for Sleep Disorders Diagnose . . . . .	271
<i>João Caldas da Costa, Manuel Duarte Ortigueira, Arnaldo Batista, and Teresa Paiva</i>	
Fault Detection and Diagnosis in Induction Machines: A Case Study . . .	279
<i>Miguel Marques, João Martins, V. Fernão Pires, Rui Dias Jorge, and Luís Filipe Mendes</i>	

**Part XI: Integration of Power Electronics Systems with ICT -I**

Multilevel Inverter for Grid-Connected Photovoltaic Systems with Active Filtering Function ..... 289  
*Kleber C. Oliveira, João L. Afonso, and Marcelo C. Cavalcanti*

Analysis of the Features of a UPQC to Improve Power Quality in Smart Grids ..... 299  
*J.G. Pinto, Carlos Couto, and João L. Afonso*

Intelligent Energy Management System for Residential and Community Applications ..... 307  
*Vicente Botón-Fernández, Máximo Pérez Romero, Adolfo Lozano-Tello, and Enrique Romero-Cadaval*

Community and Residential Energy Storage in Smart Grids ..... 315  
*Máximo Pérez-Romero, Adolfo Lozano-Tello, Enrique Romero-Cadaval, and João Martins*

**Part XII: Integration of Power Electronics Systems with ICT - II**

Development of a Photovoltaic Array Emulator in a Real Time Control Environment Using xPC Target ..... 325  
*S. Polo-Gallego, Carlos Roncero-Clemente, Enrique Romero-Cadaval, V. Miñambres-Marcos, and M.A. Guerrero-Martínez*

Three-Level Neutral-Point-Clamped Quasi-Z-Source Inverter with Maximum Power Point Tracking for Photovoltaic Systems ..... 334  
*Carlos Roncero-Clemente, Serhii Stepenko, Oleksandr Husev, Víctor Miñambres-Marcos, Enrique Romero-Cadaval, and Dmitri Vinnikov*

Instantaneous, Short-Term and Predictive Long-Term Power Balancing Techniques in Intelligent Distribution Grids ..... 343  
*Alexander Suzdalenko and Ilya Galkin*

Electric Vehicles On-Board Battery Charger for the Future Smart Grids ..... 351  
*Vítor Monteiro, João C. Ferreira, Andrés A. Nogueiras Meléndez, and João L. Afonso*

## Part XIII: Energy Generation

Schedule of Thermal Units with Emissions in a Spot Electricity Market .....	361
<i>R. Laia, H.M.I. Pousinho, R. Melício, V.M.F. Mendes, and A.H. Reis</i>	
An Advanced LMI-Based-LQR Design for Load Frequency Control of an Autonomous Hybrid Generation System .....	371
<i>S.K. Pandey, S.R. Mohanty, N. Kishor, and J.P.S. Catalão</i>	
Darrieus Wind Turbine Performance Prediction: Computational Modeling .....	382
<i>N.C. Batista, R. Melício, V.M.F. Mendes, J. Figueiredo, and A.H. Reis</i>	

## Part XIV: Energy Distribution

The Electric Vehicle Integration into the Power System: An Application to the Portuguese Case .....	395
<i>Ezequiel Carvalho, Jorge Sousa, and M. Ventim Neves</i>	
Demand Response Analysis in Smart Grids Using Fuzzy Clustering Model .....	403
<i>R. Pereira, A. Fagundes, R. Melício, V.M.F. Mendes, J. Figueiredo, J. Martins, and J.C. Quadrado</i>	
Modeling the Input Variables and Setting on the Static System Model at Using the Genetic Algorithm for Fault Location in the Power Transmission Grid .....	413
<i>Tonka Sharenkova and Rosen Rusev</i>	

## Part XV: Energy Transformation

Modeling and Characterization of Leakage Inductances for Transformer Winding Fault Studies .....	423
<i>Luís M.R. Oliveira and A.J. Marques Cardoso</i>	
Preliminary Studies and Test Results of a Superconducting Hysteresis Motor with Multiphase Windings and Variable Number of Magnetic Poles .....	431
<i>Raul Dionísio, João Murta Pina, David Inácio, and Amadeu Leão Rodrigues</i>	
A Voltage Limiter Circuit for Indoor Light Energy Harvesting Applications .....	441
<i>Carlos Carvalho and Nuno Paulino</i>	

A Study on Superconducting Coils for Superconducting Magnetic Energy Storage (SMES) Applications ..... 449  
*Nuno Amaro, João Murta Pina, João Martins, and José Maria Ceballos*

**Part XVI: Optimization Techniques in Energy**

A Multi-objective Simulation Based Tool: Application to the Design of High Performance LC-VCOs ..... 459  
*Amin Sallem, Pedro Pereira, Mourad Fakhfakh, and Helena Fino*

Distributed Model Predictive Control for Housing with Hourly Auction of Available Energy ..... 469  
*F.A. Barata and R.N. Silva*

Sensing Cloud Optimization to Solve ED of Units with Valve-Point Effects and Multi-fuels ..... 477  
*Pedro Fonte, Claudio Monteiro, and Fernando Maciel Barbosa*

Impact of Component Losses on the Efficiency of a New Quasi-Z-Source-Based Dual Active Bridge ..... 485  
*Viktor Beldjajev, Indrek Roasto, and Janis Zakis*

**Part XVII: Telecommunications**

Channel Availability Assessment for Cognitive Radios ..... 495  
*António Furtado, Miguel Luís, Rodolfo Oliveira, Rui Dinis, and Luis Bernardo*

Optical Strategies for Generating and Transmitting Signals in OFDM-RoF Systems ..... 505  
*Vitor Lopes, Diogo Bento, Maria C.R. Medeiros, and Paula Laurêncio*

Local Oscillator Phase Noise Influence on Single Carrier and OFDM Modulations ..... 513  
*Vitor Fialho, Fernando Fortes, and Manuela Vieira*

Indoor Sound Based Localization: Research Questions and First Results ..... 521  
*João Moutinho, Diamantino Freitas, and Rui Esteves Araújo*

**Part XVIII: Electronics: Devices Design**

Enhancing a Layout-Aware Synthesis Methodology for Analog ICs by Embedding Statistical Knowledge into the Evolutionary Optimization Kernel ..... 531  
*Frederico Rocha, Ricardo Martins, Nuno Lourenço, and Nuno Horta*

Optoelectronic Logic Functions Based on Reconfigurable SiC Multilayer Devices . . . . .	539
<i>Manuel A. Vieira, Vitor Silva, Paula Louro, Manuela Vieira, and Manuel Barata</i>	
Measurement of Photo Capacitance in Amorphous Silicon Photodiodes . . . . .	547
<i>Dora Gonçalves, L. Miguel Fernandes, Paula Louro, Manuela Vieira, and Alessandro Fantoni</i>	
Optoelectronic Digital Capture Device Based on Si/C Multilayer Heterostructures . . . . .	555
<i>Vitor Silva, Manuel A. Vieira, Paula Louro, Manuela Vieira, and Manuel Barata</i>	

## Part XIX: Electronics: Amplifiers

Design of a Fully Differential Power Output Stage for a Class D Audio Amplifier Using a Single-Ended Power Supply . . . . .	565
<i>Pedro V. Leitão, João L.A. de Melo, and Nuno Paulino</i>	
A 1.2 V Low-Noise-Amplifier with Double Feedback for High Gain and Low Noise Figure . . . . .	573
<i>Ivan Bastos, F. Querido, D. Amoêdo, Luis B. Oliveira, J.P. Oliveira, João Goes, and Manuel M. Silva</i>	
A Switched-Capacitor Band-Pass Biquad Filter Using a Simple Quasi-unity Gain Amplifier . . . . .	582
<i>Hugo Serra, Nuno Paulino, and João Goes</i>	
Design of Cascode-Based Transconductance Amplifiers with Low-Gain PVT Variability and Gain Enhancement Using a Body-Biasing Technique . . . . .	590
<i>Nuno Pereira, Luis B. Oliveira, and João Goes</i>	

## Part XX: Electronics: RF Applications

Comparison of Feedback Influence on Ring Oscillator Performance for IR-UWB Pulse Generator in 0.13 $\mu\text{m}$ and 0.18 $\mu\text{m}$ CMOS Technologies . . . . .	603
<i>Jelena Radic, Alena Djugova, Laszlo Nagy, Mirjana Videnovic-Misic, and Ljiljana D. Zivanov</i>	
A Low-Voltage CMOS Buffer for RF Applications Based on a Fully-Differential Voltage-Combiner . . . . .	611
<i>S. Abdollahvand, R. Santos-Tavares, and João Goes</i>	



Using Variable Width RF Integrated Inductors for Quality Factor  
Optimization ..... 619  
*Pedro Almeida, Pedro Pereira, and Helena Fino*

**Part XXI: Electronics: Applications**

Use of a-SiC:H Semiconductor-Based Transducer for Glucose Sensing  
through FRET Analysis ..... 631  
*Paula Louro, Vitor Silva, Manuel A. Vieira, A. Karmali, and  
Manuela Vieira*

Design of a 3<sup>rd</sup> Order 1.5-Bit Continuous-Time Fully Differential  
Sigma-Delta ( $\Sigma\Delta$ ) Modulator Optimized for a Class D Audio Amplifier  
Using Differential Pairs ..... 639  
*Nuno Pereira, João L.A. de Melo, and Nuno Paulino*

System-Level Optimization of a DAC for Hearing-Aid Audio Class D  
Output Stage ..... 647  
*Peter Pracný, Ivan H.H. Jørgensen, and Erik Bruun*

**Author Index** ..... 655