

# Lecture Notes in Electrical Engineering

Volume 289

## *Board of Series Editors*

Leopoldo Angrisani, Napoli, Italy  
Marco Arteaga, Coyoacán, México  
Samarjit Chakraborty, München, Germany  
Jiming Chen, Hangzhou, P.R. China  
Tan Kay Chen, Singapore, Singapore  
Rüdiger Dillmann, Karlsruhe, Germany  
Gianluigi Ferrari, Parma, Italy  
Manuel Ferre, Madrid, Spain  
Sandra Hirche, München, Germany  
Faryar Jabbari, Irvine, USA  
Janusz Kacprzyk, Warsaw, Poland  
Alaa Khamis, New Cairo City, Egypt  
Torsten Kroeger, Stanford, USA  
Tan Cher Ming, Singapore, Singapore  
Wolfgang Minker, Ulm, Germany  
Pradeep Misra, Dayton, USA  
Sebastian Möller, Berlin, Germany  
Subhas Mukhopadhyay, Palmerston, New Zealand  
Cun-Zheng Ning, Tempe, USA  
Toyoaki Nishida, Sakyo-ku, Japan  
Federica Pascucci, Roma, Italy  
Tariq Samad, Minneapolis, USA  
Gan Woon Seng, Nanyang Avenue, Singapore  
Germano Veiga, Porto, Portugal  
Junjie James Zhang, Charlotte, USA

For further volumes:

<http://www.springer.com/series/7818>

### *About this Series*

“Lecture Notes in Electrical Engineering (LNEE)” is a book series which reports the latest research and developments in Electrical Engineering, namely:

- Communication, Networks, and Information Theory
- Computer Engineering
- Signal, Image, Speech and Information Processing
- Circuits and Systems
- Bioengineering

LNEE publishes authored monographs and contributed volumes which present cutting edge research information as well as new perspectives on classical fields, while maintaining Springer’s high standards of academic excellence. Also considered for publication are lecture materials, proceedings, and other related materials of exceptionally high quality and interest. The subject matter should be original and timely, reporting the latest research and developments in all areas of electrical engineering.

The audience for the books in LNEE consists of advanced level students, researchers, and industry professionals working at the forefront of their fields. Much like Springer’s other Lecture Notes series, LNEE will be distributed through Springer’s print and electronic publishing channels.

Alessandro De Gloria  
Editor

# Applications in Electronics Pervading Industry, Environment and Society

*Editor*

Alessandro De Gloria  
Electronic Engineering  
University of Genova  
Genova  
Italy

ISSN 1876-1100

ISSN 1876-1119 (electronic)

ISBN 978-3-319-04369-2

ISBN 978-3-319-04370-8 (eBook)

DOI 10.1007/978-3-319-04370-8

Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014943115

© Springer International Publishing Switzerland 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law. The use of general descriptive names, registered names, trademarks, service marks, 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.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

# Preface

Electronics technology has known a very fast development becoming pervasive of everyday life activities. Nowadays, electronics devices are so common that we seldom pay attention to them considering them as usual objects. Electronics devices are often considered a commodity and the attention is toward the application instead of the devices.

Often the prefix “e” is used to technologically qualify a product or a service (E-mail, E-card, E-commerce, E-banking, E-business, E-book, to cite a few) and to communicate that it is new, modern, advanced. Electronics devices have become a part of our life; they are no more a product used in the industrial environment to improve the features of a product. They have changed our life; you only have to think to a smartphone.

The incursion of electronics devices in life has lead to a revision in the electronics engineer’s role. It is not enough to be able to design and implement an efficient device. The design has to consider the context in which the device will be used. Factors like human–machine interaction, usability, scalability, reusability must be included into the specification and drive the design of the device.

These considerations lead to put the attention toward the applications and the development of systems that increasingly simplify human activities.

The APPLEPIES conference aims at bringing together researchers and stakeholders, in order to share the state of the art of research and market in the field of applied electronics. The goal is to discuss the most significant trends, to explore the challenges, issues, and opportunities in the research and to debate on visions about the future of the electronics pervading industry, environment, and society.

The conference also includes an exhibition, where industries can highlight their latest products and technological cornerstones for future applications.

APPLEPIES is an annual conference and it is building a scientific community for shaping the future research in the field. This community represents a significant blend of industrial and academic professionals, mainly at Italian level but with an opening over the international audience, committed to the study, development, and deployment of electronics systems in all the main application fields.

Alessandro De Gloria

# Contents

<b>1</b>	<b>SuperCap-Based Energy Back-up System for Automotive Electronic Control Units . . . . .</b>	<b>1</b>
	Sergio Saponara, Roberto Saletti, Luca Fanucci, Roberto Roncella, Marco Marlia and Corrado Taviani	
<b>2</b>	<b>CH<sub>4</sub> Monitoring with Ultra-Low Power Wireless Sensor Network . . . . .</b>	<b>13</b>
	Davide Brunelli and Maurizio Rossi	
<b>3</b>	<b>Integrated Front-end Electronics for Silicon PhotoMultiplier Readout in Medical Imaging Applications . . . . .</b>	<b>27</b>
	Nahema Marino, Sergio Saponara, Luca Fanucci, Federico Baronti, Roberto Roncella, Francesco Corsi, Cristoforo Marzocca, Gianvito Matarrese, Fabio Ciciriello, Francesco Licciulli, Maria Giuseppina Bisogni and Alberto Del Guerra	
<b>4</b>	<b>Energy Autonomous Low Power Vision System . . . . .</b>	<b>39</b>
	Davide Brunelli, Alberto Tovazzi, Massimo Gottardi, Michele Benetti, Roberto Passerone and Pamela Abshire	
<b>5</b>	<b>A New Space Digital Signal Processor Design . . . . .</b>	<b>51</b>
	Massimiliano Donati, Sergio Saponara, Luca Fanucci, Walter Errico, Annamaria Colonna, Giuseppe Piscopiello, Giovanni Tuccio, Franco Bigongiari, Maximilian Odendahl, Rainer Leupers, Antonio Spada, Vincenzo Pii, Elena Cordiviola, Francesco Nuzzolo and Frederic Reiter	
<b>6</b>	<b>Spatial Sound Rendering for Assisted Living on an Embedded Platform . . . . .</b>	<b>61</b>
	Luca Rizzon and Roberto Passerone	

<b>7</b>	<b>BASIC32: A New ASIC for Silicon Photomultiplier Detectors . . .</b>	<b>75</b>
	Fabio Ciciriello, Francesco Corsi, Francesco Licciulli, Cristoforo Marzocca, Gianvito Matarrese, Alberto Del Guerra and Maria Giuseppina Bisogni	
<b>8</b>	<b>Reconfigurable Implementation of a CNN-UM Platform for Fast Dynamical Systems Simulation. . . . .</b>	<b>85</b>
	Gianluca Borgese, Calogero Pace, Pietro Pantano and Eleonora Bilotta	
<b>9</b>	<b>A Multi Harvester with Hydrogen Fuel Cell for Outdoor Applications . . . . .</b>	<b>103</b>
	Davide Brunelli, Michele Magno, Danilo Porcarelli and Luca Benini	
<b>10</b>	<b>A Dosimetric Device Based on CMOS Image Sensor for Interventional Radiology . . . . .</b>	<b>113</b>
	E. Conti, D. Magalotti, P. Placidi, L. Bissi, M. Paolucci, D. Passeri, A. Scorzoni and L. Servoli	
<b>11</b>	<b>A Novel Wireless Sensor Network for Electric Power Metering . . . . .</b>	<b>121</b>
	Natale Galioto, Francesco Lo Bue, Daniele Rizzo, Leonardo Mistretta and Costantino Giuseppe Giaconia	
<b>12</b>	<b>High Performance Bit-Stream Decompressor for Partial Reconfigurable FPGAs . . . . .</b>	<b>133</b>
	Gian Carlo Cardarilli, Marco Re and Ilir Shuli	
<b>13</b>	<b>A Reconfigurable Functional Unit for Modular Operations . . . . .</b>	<b>141</b>
	Gian Carlo Cardarilli, Luca Di Nunzio, Rocco Fazzolari, Salvatore Pontarelli and Marco Re	
<b>14</b>	<b>Wireless and Ad Hoc Sensor Networks: An Industrial Example Using Delay Tolerant, Low Power Protocols for Security-Critical Applications . . . . .</b>	<b>153</b>
	Claudio S. Malavenda, Francesco Menichelli and Mauro Olivieri	
<b>15</b>	<b>A Social Serious Game Concept for Green, Fluid and Collaborative Driving. . . . .</b>	<b>163</b>
	Francesco Bellotti, Riccardo Berta and Alessandro De Gloria	