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*IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.*

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

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 generally smaller and occasionally 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.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

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# System Level Design from HW/SW to Memory for Embedded Systems

5th IFIP TC 10 International  
Embedded Systems Symposium, IESS 2015  
Foz do Iguaçu, Brazil, November 3–6, 2015  
Proceedings

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# Preface

This book presents the technical program of the International Embedded Systems Symposium (IESS) 2015. A broad discussion on the design, analysis, and verification of embedded and cyber-physical systems is presented in a complementary view throughout the chapters of this book, including design methodologies, verification, performance analysis, and real-time systems design. The book includes real-world application case studies discussing challenges and realizations of embedded systems.

The advances in technology over recent years have provided a resourceful infrastructure to embedded systems in terms of an enormous amount of processing power and storage capacity. Formerly external components can now be integrated into a single System-on-Chip. This tendency has resulted in a dramatic reduction in the size and cost of embedded systems. Such a hardware infrastructure has led to an increasing number of services provided, allowing embedded systems to enter numerous application areas (including cyber-physical applications). As a unique technology, the design of embedded systems is an essential element of many innovations.

Embedded systems meet their performance goals, including real-time constraints, through a combination of special-purpose hardware and software components tailored to the system requirements. Both the development of new features and the reuse of existing intellectual property components are essential to keeping up with ever-demanding customer requirements. Furthermore, design complexities are steadily growing with an increasing number of components that have to cooperate properly. Embedded system designers have to cope with multiple goals and constraints simultaneously, including timing, power, reliability, dependability, maintenance, packaging and, last but not least, price.

The significance and importance of these constraints vary depending on the application area a system is targeted for. Typical embedded applications include consumer electronics, automotive, avionics, medical, industrial automation, robotics, communication devices, and others.

The International Embedded Systems Symposium (IESS) is a unique forum to present novel ideas, exchange timely research results, and discuss the state of the art and future trends in the field of embedded systems. Contributors and participants from both industry and academia take active part in this symposium. The IESS conference is organized by the Computer Systems Technology committee (TC10) of the International Federation for Information Processing (IFIP), especially the Working Group 10.2 “Embedded Systems.”

IESS is a true interdisciplinary conference on the design of embedded systems. Computer Science and Electrical Engineering are the predominant academic disciplines concerned with the topics covered in IESS, but many applications also involve civil, mechanical, aerospace, and automotive engineering, as well as various medical disciplines.

In 2005, IESS was held for the first time in Manaus, Brazil. In this initial instalment, IESS 2005 was very successful with 30 accepted papers ranging from specification to embedded systems application. IESS 2007 was the second edition of the symposium held in Irvine (CA), USA, with 35 accepted papers and two tutorials ranging from analysis and design methodologies to case studies from automotive and medical applications. IESS 2009 took place in the wonderful Schoß Montfort in Langenargen, Germany, with 28 accepted papers and two tutorials ranging from efficient modelling to challenges for designers of fault-tolerant embedded systems. IESS 2013 was held in Paderborn, Germany, at the Heinz Nixdorf Museums-Forum (HNF) with 22 full papers and eight short papers.

IESS 2015 was held in Foz do Iguauçu, Brazil, close to the beautiful Iguauçu Falls. The articles presented in this book are the result of a thorough review process implemented by the Technical Program Committee. Out of 25 valid submissions, 12 full papers were accepted yielding an acceptance rate of 48%. In addition, six short papers are included, yielding an overall acceptance rate of 72%.

The technical program of IESS 2015 included sessions with complementary and interdisciplinary themes, e.g., cyber-physical systems, system level design, multi/many-core systems design, memory systems design, and embedded hardware and software design and applications. Very interesting keynotes on diverse topics, such as the Internet of Things, real-time operating systems, ubiquitous computing infrastructure, and adaptive systems design based on COTS, were also included in the technical program.

With our strong technical program, we had a successful IESS 2015 conference with fruitful discussions.

First and foremost, we thank our sponsors Hella KGaA Hueck & Co. and the Carl von Ossietzky University Oldenburg for their generous financial support of this conference. Without these contributions, IESS 2015 would not have been possible in its current form. Very special thanks to the co-located conference team from SBESC 2015, who supported mainly the local arrangements with the Golden Tulip Conference Hotel where the event was hosted.

We would also like to thank IFIP for the promotion and support of the IESS conference.

Last but not least, we thank the authors for their interesting research contributions and the members of the Technical Program Committee for their valuable time and effort in reviewing the articles.

November 2015

Marcelo Götz  
Gunar Schirner  
Marco Wehrmeister  
Mohammad Abdullah Al Faruque  
Achim Rettberg

**IFIP TC10 Working Conference:  
International Embedded Systems Symposium  
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Golden Tulip Conference Hotel, Foz do Iguacu,  
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