International Symposium on Design and Diagnostics of Electronic Circuits and Systems

Zoran Stamenkovic
IHP - Leibniz-Institut für innovative Mikroelektronik
Frankfurt (Oder), Germany
stamenko@ihp-microelectronics.com

Alberto Bosio
Institute of Nanotechnology of Lyon
École Centrale de Lyon
Ecully, France
alberto.bosio@ec-lyon.fr

Gyorgy Cserey
Faculty of Information Technology and Bionics
Pazmany Peter Catholic University
Budapest, Hungary
cserey.gyorgy@itk.ppke.hu

Ondrej Novak
Faculty of Mechatronics and Interdis. Studies
Technical University of Liberec
Liberec, Czechia
ondrej.novak@tul.cz

Witold Pleskacz
Institute of Microelectr. and Optoelectronics
Warsaw University of Technology
Warsaw, Poland
w.pleskacz@imio.pw.edu.pl

Lukas Sekanina
Faculty of Information Technology
Brno University of Technology
Brno, Czechia
sekanina@fit.vut.cz

Andreas Steininger
Institute of Computer Engineering
Vienna University of Technology
Vienna, Austria
steininger@ecs.tuwien.ac.at

Goran Stojanovic
Faculty of Technical Sciences
University of Novi Sad
Novi Sad, Serbia
sgoran@uns.ac.rs

Viera Stopjakova
Faculty of Elect. Eng. and Information Techn.
Slovak University of Technology
Bratislava, Slovakia
viera.stopjakova@stuba.sk

***Abstract*—The paper is a contribution to the 50th anniversary celebration of the International Test Conference (ITC) and its Global Test Forum (GTF), which honors the geographic breadth of the test community and highlights the global reach of ITC during the past 50 years. It covers the past, present, and future of the International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS), a symposium which belongs to prominent test technology related events initiated and supported by the ITC.**

Keywords—symposium, DDECS, electronics, circuits, systems

I. Introduction

The International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS) is a regional East-Central European symposium which provides the forum for exchanging ideas, discussing research results, and presenting practical applications in the areas of design, test, and diagnosis of electronic circuits and systems. DDECS had been organized as a workshop till 2008 and became a symposium in 2009. It was held in Czechia (1997, 2002, 2006, 2009, 2013), Poland (1998, 2003, 2007, 2014), Slovakia (2000, 2004, 2008, 2016), Hungary (2001, 2005, 2018), Austria (2010), Germany (2011, 2017), Estonia (2012), Serbia (2015), and Romania (2019).

The symposium invites and accepts (after a rigorous peer-review process) original scientific and student papers, reviews, tutorials, and industrial presentations from the academia and industry. A program committee of more than forty members organizes the peer-review of submitted papers and selects the presentation form of accepted papers. Traditionally, DDECS [1] is steered by a committee of the most active program committee members coming from the Eastern and Central European countries. The list of the steering committee chairs is as follows: Jan Hlavicka (1997 - 2003), Andras Pataricza (2004 - 2008), Ondrej Novak (2009 - 2010), Zdenek Kotasek (2011 - 2014), and Viera Stopjakova (since 2015).

The steering committee decides on the symposium location, dates, general chair, and program chair. It also invites the renowned experts of the relevant research fields as keynote speakers (after proposals of the general and program chairs are collected). Since 2004, this committee awards the two best symposium papers (one from the design field and the other from the test field) by Jan Hlavicka (a co-founder of DDECS) prize. An ad-hoc evaluation committee consisting of four members (the program chair and three program committee members) is responsible for selection of the two best papers. The decision is made after assessment of the paper scientific quality and author's presentation.

In the subsequent sections, we summarize the DDECS' history of challenges and achievements, current activities, and plans for the near and far future.

II. Past

As usual for such events, the **first DDECS editions** were organized by a few enthusiastic people: Jan Hlavicka, Andrzej Hlawiczka, Karel Vlcek, Edward Hrynkiewicz, Vladimir Drabek, Dariusz Badura, and Elena Gramatova. They paved the way to the success of next editions up to date. Information on the location, dates, number of participants, and chairs of these first editions are given in Table I.

DDECS2006 [2] was held in Prague, Czechia on April 18-21. It was financially and technically sponsored by the Czech Technical University in Prague and the IEEE Computer Society. The general chair, Bernd Straube from the Fraunhofer IIS/EAS Dresden, and the program chair, Matteo Sonza Reorda from the Politecnico di Torino, received 128 submissions from 18 countries and more than 400 paper reviews to set up an

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attractive technical program. It included 34 regular, 32 poster, and 10 student papers. In addition, two invited presentations were given by Ketan Paranjape (Multi-site collaboration in system on chip design and validation: The Intel experience) and Jaume Segura (CMOS testing at the end of the roadmap: Challenges and opportunities). The event was attended by 161 participants.

TABLE I. DDECS FROM 1997 TO 2005

DDECS	Location	Dates	Attends	G/P Chairs
1997	Solan CZ	May 12-16	45	J. Hlavicka K. Vlcek
1998	Szczyrk PL	Sept 2-4	51	A. Hlawiczka A. Krasniewski
2000	Smolenice SK	April 5-7	56	A. Pawlak H. Manhaeve
2001	Gyor HU	April 18-20	47	J. Hlavicka M. Renovell
2002	Brno CZ	April 17-19	65	B. Straube E. J. Marinissen
2003	Poznan PL	April 14-16	88	J. Tyszer S. J. Piestrak
2004	Tatranska Lomnica SK	April 18-21	80	S. Hellebrand Z. Peng
2005	Sopron HU	April 13-16	56	A. Hlawiczka C. Landrault

DDECS2007 [3] took place in Krakow, Poland on April 11-13. It was organized under the honorary patronage of the Major of the City of Krakow by the Institute of Electronics of the Silesian University of Technology, and sponsored by the IEEE Computer Society and the Test Technology Technical Council (TTTC). The general chair, Elena Gramatova from the Slovak Academy of Sciences, and the program chair, Patrick Girard from the LIRMM, received 131 submissions from 31 countries. The steering and program committees selected 3 keynote speeches (New strategies for system-level design by Daniel Gajski, Design and test of microfluidic biochips by Krishnendu Chakrabarty, and Logic diagnosis and yield learning by Janusz Rajski), 40 regular, and 36 poster papers to build a high-quality technical program. Two special notes about the IEEE Computer Society activities and the European Commission FP7 initiatives were presented as well. The workshop attracted 110 participants.

DDECS2008 [4] was organized in Bratislava, Slovakia on April 16-18 by the Institute of Informatics of Slovak Academy of Sciences. The event was co-sponsored by the IEEE Computer Society, the TTTC, the Visegrad Fund, and a few industrial companies. The general chair, Michel Renovell from the LIRMM, and the program chair, Bernd Straube from the Fraunhofer IIS/EAS Dresden, received 116 submissions from 32 countries. The steering and program committees prepared a three-day technical program based on more than 450 reviews. Three keynote speeches were given by Sandip Kundu (The guiding light for chip testing), Krisztian Flautner (The wall ahead is made of rubber), and Hans Manhaeve (The quest for test: Will redundancy cover all?). Ten regular, two industrial, and one student sessions summarizing 43 oral and 30 poster presentations were attended by 104 participants.

DDECS2009 [5] was held in Liberec, Czechia on April 15-17. The first DDECS symposium was co-sponsored by the Technical University of Liberec, the IEEE Computer Society, the TTTC, and a few industrial partners. The general chair, Hans Manhaeve from the Q-Star Test, and the program chair, Michel Renovell from the LIRMM, received 91 submissions from 26 countries. The steering and program committees received more than 250 reviews and prepared an attractive three-day technical program. It consisted of three keynote speeches given by Georges Gielen (Design tools and circuit solutions for degradation-resilient analog circuits in nanometer CMOS), Abhijit Chatterjee (Cognitive self-adaptive computing and communication systems: Test, control and adaptation), and Anton Chichkov (Challenges for test and design for test). Eight regular, one industrial, two student, and three poster sessions gathering 33 oral and 25 poster presentations were attended by 75 participants.

DDECS2010 [6] took place in Vienna, Austria on April 14-16. It was sponsored by the IEEE Computer Society, the TTTC, and the Faculty of Informatics, Vienna University of Technology. The general chair, Zdenek Kotasek from the Brno University of Technology, and the program chair, Elena Gramatova from the Slovak Academy of Sciences, received 149 submissions from 34 countries. The symposium program included 33 regular papers, 6 application papers, 33 posters, 13 student papers, and, for the first time, 4 embedded tutorials. The keynote speeches of Didier Keymeulen (Self-repairing and tuning reconfigurable electronics for space), Davide Appello (Safety features of SOCs: How can they be re-used?), and Alex Yakovlev (Asynchronous design, Quo vadis?) complemented the scientific program. The event was attended by 118 participants.

DDECS2011 [7] was organized in Cottbus, Germany on April 13-15. It was sponsored by the IEEE Computer Society and the TTTC. The Brandenburg University of Technology and the IHP – Leibniz-Institut für innovative Mikroelektronik technically co-sponsored the symposium. The general chair, Heinrich Theodor Vierhaus from the Brandenburg University of Technology, and the program chair, Adam Pawlak from the Silesian University of Technology, received a record-breaking number of 156 submissions from all around the world. As usual, three keynote speakers were invited: Raul Camposano spoke about EDA perspectives in combination with cloud computing, Andrzej Strojwas presented a keynote on cost-effective scaling down to 22 nm, and Jürgen Alt talked on the industrial design and test flows and the role of Electronic Design Automation (EDA) in the semiconductor industry. The symposium program included 56 regular papers, 38 poster papers, and 4 embedded tutorials. The symposium attracted 125 participants.

DDECS2012 [8] was held in Tallinn, the capital of Estonia on April 18-20. It was sponsored by the IEEE Computer Society, the TTTC, and the Tallinn University of Technology. The general chair, Jaan Raik from the Tallinn University of Technology, and the program chair, Viera Stopjakova from the Slovak University of Technology, received 130 submissions from 33 countries. The symposium's steering and program committees accepted 48 regular papers, 30 poster papers, and 4 embedded tutorials after considering more than 400 reviews. A high-quality technical program included three keynote speeches given by Matteo Sonza Reorda (On-line test of embedded systems: Which role for functional test?), Said

Hamdioui (TSV based 3D stacked ICs: Opportunities and challenges), and Andrzej Pfitzner (Vertical slit transistor based integrated circuits (VeSTICs)). The symposium was attended by 106 participants.

DDECS2013 [9] was held in Karlovy Vary, Czechia on April 8-10. It was co-sponsored by the IEEE Computer Society, the TTTC, and the Brno University of Technology. The general chair, Lukas Sekanina from the Brno University of Technology, and the program chair, Goerschwin Fey from the German Aerospace Center, received 85 submissions. The technical program consisted of 26 regular papers, 1 industrial paper, 18 posters, and 14 student papers. The keynote lectures included: Hardware-software co-visualization: Developing systems in the Holodeck of Rolf Drechsler; Approximate computing for energy-efficient error-resilient multimedia systems of Kaushik Roy; and Creating options for 3D-SIC testing of Erik Jan Marinissen. Four invited embedded tutorials were given by Natasha Sharygina, Mehdi Tahoori, Jan Korenek, and Ilia Polian. This event was attended by 78 participants.

DDECS2014 [10] was held in Warsaw, Poland on April 23-25. It was co-sponsored by the IEEE Computer Society, the TTTC, and the Warsaw University of Technology. The general chair, Witold Pleskacz from the Warsaw University of Technology, and the program chair, Michel Renovell from the LIRMM, received 98 submissions from 30 countries. The technical program consisted of 31 regular papers, 23 poster papers, and 10 student papers. The keynote lectures were given by Yervant Zorian (Detection and diagnostics in today's advanced technology nodes), Lech Jozwiak (Architecture exploration and synthesis of heterogeneous massively parallel MPSoCs for highly-demanding applications), and Pawel Grybos (Design and testing of integrated circuit of pixel architecture for fast X-ray imaging applications). Two invited embedded tutorials were given by Alexandre Mehdaoui and Stefano Pettazzi. The symposium attracted 77 participants.

DDECS2015 [11] was held in Belgrade, the capital of Serbia on April 22-24. It was financially and technically sponsored by the IEEE Computer Society. The other technical sponsors were the IEEE Council on Electronic Design Automation (CEDA), the IHP – Leibniz-Institut für innovative Mikroelektronik, the University of Belgrade, and the University of Nis. The general chair, Zoran Stamenkovic from the IHP – Leibniz-Institut für innovative Mikroelektronik, and the program chair, Jaan Raik from the Tallinn University of Technology, received 90 submissions from 27 countries and accepted 59 papers for publication. The challenging technical program comprised 24 regular, 27 poster, 8 student papers, and 2 invited embedded tutorials (Anton Klotz and Robert Wille). The keynote lectures were presented by Thanos Stouraitis (Matching data representation to application needs: Cryptographic systems), Sybille Hellebrand (Diagnosis meets machine learning), and Dejan Milojicic (Systems software disruption). The symposium sessions attracted 91 participants.

DDECS2016 [12] was held in Kosice, Slovakia on April 20-22. It was co-sponsored by the IEEE CEDA, the Slovak University of Technology, the Slovak Academy of Sciences, and the ON Semiconductor Slovakia. The general chair, Viera Stopjakova from the Slovak University of Technology, and the program chair, Andreas Steininger from the Vienna University of Technology, received 93 submissions from 24 countries. After each submission was reviewed by at least three reviewers, 31 papers were accepted for oral presentation. In addition, the technical program included 14 poster and 7 work-in-progress papers. The symposium had three excellent keynote lectures: Cecilia Metra addressed test and reliability challenges for high-performance nanotechnology circuits and systems, Dominique Borrione talked on automatic synthesis of verification IP's from assertions, and Domenik Helms presented innovative ways of supporting design for reliability. An embedded tutorial on approximate computing was given by Lukas Sekanina. The event was attended by 74 participants.

DDECS2017 [13] was organized in Dresden, Germany on April 19-21. It was sponsored by the IEEE CEDA and the Fraunhofer IIS. The general chair, Manfred Dietrich from the Fraunhofer IIS, and the program chair, Ondrej Novak, from the Technical University of Liberec, received more than 60 submissions from 17 countries. The technical program included 30 regular papers, 8 posters, and 2 embedded tutorials. Gerd Teepe presented a keynote on FDSOI and new circuit architectures for low power embedded designs. Hans-Joachim Wunderlich reviewed the historical development of self-test from the random test patterns to the in-field automotive testing and health monitoring. Dirk Droste addressed MEMS sensors and new methods for the IC design in sensor systems. The symposium was attended by 72 participants.

DDECS2018 [14] was held in Budapest, Hungary on April 25-27. It was sponsored by the IEEE Computer Society, the IEEE CEDA, the Infobionikai Egyesulet, and the Pazmany Peter Catholic University (PPCU). The general chair, Gyorgy Cserey from the PPCU, and the program chair, Zoran Stamenkovic from the IHP – Leibniz-Institut für innovative Mikroelektronik, received 56 submissions from 22 countries. The steering and program committees, based on more than 230 reviews, accepted 13 regular, 14 poster, 3 student, and 6 work-in-progress papers. Three excellent keynotes were given by Rolf Kraemer (Ultra-fast wireless communication with 100 Gbps and beyond), Friedrich Hapke (Complete defect oriented test and diagnosis of logic designs), and Gyorgy Csaba (Design of computing architectures for emerging nano-electronic devices). The symposium attracted 51 participants.

DDECS2019 [15] was held in Cluj-Napoca, Romania on April 24-26. It was co-sponsored by the IEEE CEDA, the Technical University of Cluj-Napoca and a few industrial companies. The general chair, Liviu Miclea from the Technical University of Cluj-Napoca, and the program chair, Alberto Bosio from the Ecole Centrale de Lyon, received 60 submissions from 20 countries. The technical program comprised 16 regular, 18 poster, and 4 student papers. A special session of 4 presentations on the analog and mixed-signal circuit design flow was also organized. The keynotes were given by Said Hamdioui (The power of computation-in-memory: Beyond von Neumann and beyond CMOS), Anca Molnos (Towards embedding attack detection on systems-on-chip), and Adit Singh (Can new defect models help eliminate system level tests?). The symposium was attended by 62 participants.

III. Present

DDECS2020 [16] will be organized on April 22-24 in Novi Sad, Serbia. It will be financially and technically sponsored by the University of Novi Sad. The IEEE CEDA will be a technical co-sponsor of the symposium. The core topics of this symposium's edition will be addressed by the three keynote speakers: Milos Ercegovac from USA (innovative computer architectures), Cristiano Calligaro from Italy (radiation-hard non-volatile memories), and Paolo Bernardi from Italy (reliability and safety of automotive electronics). The general chair, Goran Stojanovic from the University of Novi Sad, and the program chair, Zoran Stamenkovic from the IHP – Leibniz-Institut für innovative Mikroelektronik, seek submissions on the topics that include but are not limited to the following:

- Emerging Technologies
- Wireless Communication Systems
- Embedded Systems
- Dependable Systems
- Embedded Machine Learning
- Approximate Computing
- Formal Methods in System Design
- Hardware/Software Co-Design
- IP-Based Design
- ASIC/FPGA Design
- Internet-of-Things Design and Test
- SoC and NoC Design and Test
- Digital Circuits Design and Test
- RF, Analog, and Mixed-Signal Circuits Design and Test
- Memory Design and Test
- MEMS Design and Test
- Verification and Validation
- On-Line Testing
- Built-in Self-Test and Self-Repair
- Design for Testability and Diagnosis
- Defect/Fault Tolerance and Reliability
- Design and Test in Nano-Technologies
- ATE Hardware and Software
- Physical Failure Analysis
- Debug and Diagnosis
- Hardware Security and Trust
- Flexible and Printed Electronics
- Automotive Electronics
- Medical Electronics
- Bio-Inspired Electronics
- Stretchable and Textile Electronics
- Mechatronics
- Sensors and Transducers
- Integrated Passive Components
- Microfluidic Electronic Devices

Potential authors are invited to submit original, unpublished research work in the form of a complete manuscript. The manuscript should follow the instructions included in the author's kit at the conference web site [16].

IV. Future

Based on the experience and analysis of the previous symposium's editions, the steering and program committees have decided to offer some additional opportunities for prospective authors. In the near future, DDECS is going to attract more master and PhD students (introducing student contests and tutorials), more researchers (introducing national and European project sessions), and more engineers (introducing practical demonstrations). Long-term plans include attracting more local ICT companies and starting the collaboration between DDECS and MIXDES [17] (two symposia covering the same field of electronic circuit design and test) to rise the number of high-quality submissions and attendees.

Acknowledgment

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References

[1] IEEE Symposium on Design and Diagnostics of Electronic Circuits and Systems
[2] IEEE 9th Workshop on Design and Diagnostics of Electronic Circuits and Systems (DDECS2006)
[3] IEEE 10th Workshop on Design and Diagnostics of Electronic Circuits and Systems (DDECS2007)
[4] IEEE 11th Workshop on Design and Diagnostics of Electronic Circuits and Systems (DDECS2008)
[5] IEEE 12th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2009)
[6] IEEE 13th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2010)
[7] IEEE 14th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2011)
[8] IEEE 15th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2012)
[9] IEEE 16th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2013)
[10] IEEE 17th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2014)
[11] IEEE 18th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2015)
[12] IEEE 19th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2016)
[13] IEEE 20th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2017)
[14] IEEE 21st International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2018)
[15] IEEE 22nd International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2019)
[16] IEEE 23rd International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS2020)
[17] International Conference on Mixed Design of Integrated Circuits and Systems (MIXDES)