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ISPD '21

Proceedings of the 2021 International Symposium on Physical Design

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Foreword

On behalf of the organizing committee, we are delighted to welcome you to the 2021 ACM International Symposium on Physical Design (ISPD), held virtually online-only for the first time. We are celebrating the 30th ISPD, a milestone for our research community. Despite the COVID-19 pandemic, we continue the great tradition established by its twenty-nine predecessors, which includes a series of five ACM/SIGDA Physical Design Workshops held intermittently between 1987 and 1996, and twenty-four editions of ISPD in the current form since 1997. ISPD 2021 provides a premier forum to present leading-edge research results, exchange ideas, and promote research on critical areas related to the physical design of VLSI and other systems.

The regular papers in the ISPD 2021 program were selected after a rigorous, double-blind review process and a virtual meeting of the Technical Program Committee members. The papers selected exhibit the latest advancements in a variety of topics in physical design, including: floorplanning and power network optimization; global and detailed placement with legalization; routing, wire parasitic prediction, and voltage drop analysis; flow and design methodology for three-dimensional (3D) integrated circuits (ICs); and mask optimization to improve manufacturability. Some of the algorithmic approaches considered are more traditional; while others apply graph neural networks and machine learning techniques to the physical design of ICs and biological systems.

The ISPD 2021 program is complemented by invited talks on a variety of topics: emerging challenges for current and future process technologies, such as hardware security, wafer-on-wafer 3D integration, and carbon nanotubes; reinforcement and machine learning applied to analog and digital physical design; how placement techniques have improved, the importance of benchmarking, and looking forward to further advances in placement. These speakers are distinguished researchers from both industry and academia.

The conference will feature three keynote addresses. The first is presented by Dr. Frank Lee, Vice President at Taiwan Semiconductor Manufacturing Company (TSMC) North America, who will deliver the Monday opening keynote, “Physical Design for 3D Chiplets and System Integration.” Dr. Lee will discuss the 3D integration of chips and the challenges imposed on physical design to facilitate reliable and economical manufacturing of these systems.

Dr. Ivo Bolsens, Senior Vice President and Chief Technology Officer at Xilinx, will deliver Tuesday’s keynote entitled “Scalable System and Silicon Architectures to Handle the Workloads of the Post-Moore Era.” Dr. Bolsens’ keynote will explore how digital systems need to scale in order to meet the needs of the computations of tomorrow.

Juan C. Rey, Vice President of Engineering, in the Calibre division of Siemens EDA, will present the Wednesday keynote speech “Physical Verification at Advanced Technology Nodes and the Road Ahead.” This keynote focuses on the major challenges for layout verification with extremely dense and complex manufacturing design rules of current and future technology nodes.

Professor Marilyn Wolf will moderate the ISPD Lifetime Achievement Award session in honor of Dr. Louis K. Scheffer. This session highlights Lou’s contributions to Electronic Design Automation and will share insights found working at Valid Logic Systems, then Cadence Design Systems, and his current work in neurobiology at the Janelia Research Campus of Howard Hughes Medical Institute. This session is preceded by a special session on brains, computers and EDA with three distinguished speakers. Dr. Louis K. Scheffer will start the session with a description of the physical design of biological systems, then Professor Jan Rabaey will discuss the relationship between brains and computers. This session is concluded by a talk from Dr. Leon Stok on EDA and Quantum Computing.

Since 2005, the ISPD has organized highly competitive contests to promote and advance research in placement, global routing, clock network synthesis, discrete gate sizing, and detailed routing-driven

placement. This year, we have a retrospective look at the placement contests held since 2005. The session will begin with Professor Patrick Madden giving a talk on the benchmarking for the contests. This is followed by a panel made of previous contest organizers who will discuss lessons learnt from the contest. Professor Andrew Kahng will also give a talk on advancing placement.

This year's ISPD contest is organized by Cerebras Systems and focuses on wafer-scale physics modelling. The 2021 edition of the ISPD benchmark competition opens up a new frontier for partitioning, placement and routing by featuring an innovative twist on traditional physical design. The task is to map a 3D finite element model on a 2D grid of processing elements in a supercomputer. The objectives are to maximize performance and accuracy while minimizing interconnect length. This involves partitioning and placement algorithms. The contest will motivate more research and contributions on the topic of wafer-scale modelling, partitioning and placement.

As in previous years, the symposium will stretch over three days, but this year the schedule is limited to half-days to accommodate attendees in different time zones. Authors of the accepted papers will submit videos of their presentations that can be viewed prior to the session. The sessions will be 45 minutes long with introductions by the session chair then 5 minute videos for each paper. The sessions conclude with a 25 minute panel of questions and answers. Keynote speakers will present their topics live followed by a 10-minute question and answer period. Daily virtual meetings on a social gathering website will allow socializing with participants all over the world. This will give plenty of opportunities for conversations, in addition to the discussions at the end of each session.

Finally, we would like to take this chance to express our gratitude to the people who made this symposium possible. We would like to thank the authors, the presenters, the keynote and invited speakers for contributing to the high-quality program, and the session chairs for moderating the sessions. We would like to thank our Technical Program Committee members and external reviewers, who provided insightful constructive comments and detailed reviews to the authors. We greatly appreciate the exceptional set of invited talks put together by the Steering Committee, which is chaired by William Swartz. We thank the Steering Committee for selecting the best paper. Special thanks go to the Publication Chair David Chinnery, the Publicity Chair Iris Hui-Ru Jiang, and the Finance Chair Patrick Madden for their diligence and tremendous services. We would also like to acknowledge the team of people from Cerebras Systems, led by Patrick Groeneveld, organizing the contest: Michael James, Vladimir Kibardin, Ilya Sharapov, Marvin Tom, and Leo Wang. Special thanks to Sade Rodriguez from the ACM for her logistics behind-the-scenes diligent help and assistance. And last but not least, we thank Lisa Tolles, Adrienne Griscti, Barbara Ryan, and others from Sheridan Communications and ACM, for their expertise and enormous patience during the production of these proceedings.

We are also grateful to our sponsors. The symposium is sponsored by the ACM Special Interest Group on Design Automation (ACM SIGDA) with technical co-sponsorship from the IEEE Council on Electronic Design Automation (IEEE CEDA). Generous financial contributions have also been provided by (in alphabetical order): Cadence Design Systems, HiSilicon, Intel Corporation, Siemens EDA, Synopsys, and TimberWolf Systems.

The organizing committee hopes that you will enjoy the 2021 ISPD in its innovative virtual settings! We look forward to seeing you again in future editions of the ISPD.

Jens Lienig
ISPD 2021 General Chair

Laleh Behjat, Stephen Yang
Technical Program Chairs

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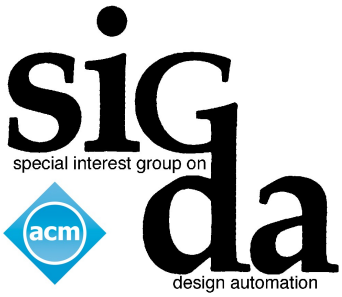

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