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UCLA Samueli School of Engineering Professor Honored as Key Figure in the Microchip Revolution

Jason Cong Recognized With the ACM Breakthrough in Computing Award for Improving the Automation and Customizability of Computing Systems

New York, NY, April 9, 2025 – ACM, the Association for Computing Machinery, today announced that Jingsheng Jason Cong, the holder of the Volgenau Chair for Engineering Excellence at the UCLA Samueli School of Engineering, is the recipient of the 2024 ACM Charles P. "Chuck" Thacker Breakthrough in Computing Award. Cong is recognized for fundamental contributions to the design and automation of field-programmable systems and customizable computing.

The ACM Charles P. "Chuck" Thacker Breakthrough in Computing Award recognizes individuals or groups who have made surprising, disruptive, or leapfrog contributions to computing ideas or technologies. The award is accompanied by a $100,000 prize with financial support provided by Microsoft.

During his career in both academia and industry, Cong developed an extraordinary array of tools to automate integrated circuit design, mostly focused on tools for Field-Programmable Gate Arrays (FPGAs). FPGAs are special integrated circuits that can be programmed after they have been manufactured. The ability of FPGAs to change their functionality after manufacturing has made them part of the standard hardware in many applications including data centers, telecommunications, aerospace, defense, and automotive engineering.

While FPGAs are programmable, creating the configuration files for them is a complex task and difficult for users to complete. Cong has spent much of his career building tools to address this problem. For example, his work has made it possible to use software programming languages such as C or C++ to program an FPGA, significantly broadening their accessibility and usability. In addition to working out the basic algorithms, Cong and his students have created commercial tools that embed these algorithms to power the FPGA design tools in use today.

In the late 1990s, Cong worked on how to map logic onto the look-up tables that are the building blocks of FPGAs. This was a difficult problem which was solved using heuristics. Cong and his

students made a major theoretical breakthrough when they showed this problem could be solved exactly in polynomial time. This insight led to the creation of Aplus Design Automation to commercialize this technology, and now it is used in all FPGA synthesis tools.

While Cong's early work enabled designers to use a hardware description language such as Verilog to design FPGAs, it was still difficult for software application engineers to program these circuits. In the 2000s, Cong's group started working on high-level synthesis techniques to enable FPGAs to be programmed from C/C++ descriptions. This successful effort led to AutoESL, a spin-off from his lab at UCLA, which was acquired by Xilinx Inc. in 2011 (now part of Advanced Micro Devices). AutoPilot, a commercial product based on the AutoESL technology, is the basis of AMD/Xilinx's high-level synthesis tools today.

Having created these tools, Cong applied them to the field of customizable domain-specific computing, where he and his team designed a wide range of domain-specific hardware accelerators with FPGAs, including deep learning, medical image processing, genomic sequencing, data compression, satisfiability solving, and many other computationally intensive tasks. An important benefit of these customized computing solutions is that they have shown drastically improved energy efficiency over conventional CPU-based computing approaches.

"Field Programmable Gate Arrays and Electronic Design Automation Tools have been essential to the development of the computer chips that now power the world," said ACM President Yannis Ioannidis. "Cong's work in enabling integrated circuits to be programmed, or re-programmed, led to a new level of versatility, efficiency, and power for a wide range of applications. Like Chuck Thacker, Cong has also been an important mentor and champion in advancing his discipline. As a serial entrepreneur, he has successfully brought his innovations into the marketplace, and as an academic, he has produced 48 PhD students who have taken up leadership roles at companies and universities—ensuring that this work continues."

"Microsoft is honored to sponsor this award in memory of our late colleague, Chuck Thacker," said Eric Horvitz, Chief Scientific Officer of Microsoft. "Jason Cong's pioneering approach to customizable computing and architectural design tools reflects the kind of 'leapfrog advances' this award is intended to recognize. The exponential gains in semiconductor complexity over the past thirty years would not have been possible without equally impressive innovations in the tools required to design them. Cong's research has played a foundational role in enabling these innovations. His work remains essential today, underpinning highly flexible and energy-efficient FPGA architectures important to cutting-edge applications in AI, cloud computing, and other rapidly evolving domains."

Biographical Background

Jingsheng Jason Cong is the Volgenau Professor of Engineering Excellence at the UCLA Samueli School of Engineering. Cong's research interests include design automation of VLSI circuits and

systems, customizable computing, quantum computing, and highly scalable algorithms. He has published over 500 research papers, led over 100 research projects, and received several patents.

A graduate of Peking University, Cong earned MS and PhD degrees in Computer Science from the University of Illinois at Urbana-Champaign. His honors include the Phil Kaufman Award, the IEEE Robert N. Noyce Medal, and the ACM/IEEE A. Richard Newton Technical Impact Award in Electronic Design Automation, among many others. He is a Fellow of ACM and IEEE and is a member of the American Academy of Arts and Sciences and the US National Academy of Engineering.

Cong will be formally presented with the ACM Breakthrough Award at ACM's annual Awards Banquet, which will be held on Saturday, June 14 at The Palace Hotel in San Francisco.

About the ACM Charles P. "Chuck" Thacker Breakthrough in Computing Award
The ACM Breakthrough Award celebrates Thacker's pioneering contributions in computing and his long-term inspirational mentorship of generations of computer scientists. The award recognizes individuals or groups with the same out-of-the-box thinking and "can-do" approach to solving the unsolved that Thacker exhibited. The award is accompanied by a prize of $100,000 and is presented at the annual ACM Awards Banquet. Recipients are expected to give the ACM Breakthrough Lecture at a major ACM conference of their choosing during the year following the announcement. Financial support of the ACM Breakthrough Award is provided by Microsoft.

About ACM
ACM, the Association for Computing Machinery, is the world's largest educational and scientific computing society, uniting computing educators, researchers, and professionals to inspire dialogue, share resources, and address the field's challenges. ACM strengthens the computing profession's collective voice through strong leadership, promotion of the highest standards, and recognition of technical excellence. ACM supports the professional growth of its members by providing opportunities for life-long learning, career development, and professional networking.

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