NCKU Smart Semiconductor Workshop 2023

November 03, 2023 (Taiwan Time GMT+8)

Theme: Intelligent Computing: Algorithms to Devices and Below..

Motivation:
Niklaus Emil Wirth introduced the innovative concept of Programming = Algorithm + Data Structure. Inspired by this, we advance the concept to the next level by stating that Design = Algorithm + Architecture. As algorithms with high accuracy become exceedingly more complex and edge or Internet-of-Things generated data become increasingly larger, flexible parallel and reconfigurable processing are crucial in the design of lightweight systems with low complexity and low power. Furthermore, neuromorphic edge with non-von Neumann architectures witness broad applications such as in computing in memory (CIM), requiring energy-efficient design optimizations of the intelligent algorithm at the device level and possibly lower. Therefore, the smart semiconductor designs crossing levels of algorithm, system architecture, VLSI, circuit, device, etc. poses challenges which are key to the development and success of the global semiconductor community.

CHALLENGES BRING OPPORTUNITIES!

With these CHALLENGES amid current vibrant semiconductor environment, this workshop provides a platform for experience sharing of new disruptive OPPORTUNITIES with yet more emphasis on vertical integration methodologies! UIUC, MIT, Berkley, Princeton, etc. has been working on cross-level design, SONIC since 2013. Taiwan's NSTC has recently introduced the new initiative of Emerging IC (新興晶片) project. From NCKU, we would like to take this occasion to interact with old and new friends with anticipation of reaching out to the semiconductor community worldwide!

Organizers:
Darsen Lu
Associate Professor, National Cheng Kung University, Taiwan

Philex Ming-Yan Fan
Assistant Professor, National Cheng Kung University, Taiwan

Chris Gwo Giun Lee
Professor, National Cheng Kung University, Taiwan

Physical Conference in Taiwan & Virtual Connection with US

Venue: 靄雲廳 Department of Electrical Engineering, NCKU

Zoom Link: https://us02web.zoom.us/j/8781571671
Meeting ID: 878 157 1671

Co-sponsors:
College of Electrical Engineering and Computer Science, NCKU
Academy of Innovative Semiconductor and Sustainable Manufacturing, NCKU

IEEE CASS Society, Tainan Chapter, Taipei Chapter

NCKU Smart Semiconductor Design Workshop 2023

November 03, 2023 (Taiwan Time GMT+8)

Morning Session (8:00AM ~ 12:15PM)

- **8:00 ~ 8:20:** Registration
- **8:20 ~ 8:50:** Opening Ceremony/Remarks
  - **Pao Choo Chung**, Dean, College of EECS, NCKU
  - **Ching Chi Teng**, CTO, Cadence, USA (Virtual from US)
- **8:50 ~ 09:00:** Photo Session
- **Vertical Integration in SoC Design: Challenges and Opportunities**

Host: Prof. Ting-Jung Chang, National Cheng Kung University, Taiwan

Keynote (09:00 ~ 09:45): Prof. Shuvra Bhattacharyya*, University of Maryland, College Park, USA, Topic: Embedded System Design Optimization at the Network Edge*

Invited Talk (09:45 ~ 10:30): Prof. Chris Gwo Giun Lee*, National Cheng Kung University, Taiwan, Topic: Machine Learning for Analytics Architecture: AI to Design AI*

Coffee Break (10:30 ~ 10:45)

Invited Talk (10:45 ~ 11:15)*:* ***Prof. Ting-Jung Chang****, National Cheng Kung University, Taiwan, Topic: Navigating Heterogeneity: Designing, Prototyping, and Evaluating Two Heterogeneous SoCs*

Invited Talk (11:15 ~ 11:45)*:* ***Prof. Darsen Lu****, National Cheng Kung University, Taiwan, Topic: Compact Device Modeling in the Era of Artificial Intelligence*

Invited Talk (11:45 ~ 12:15)*:* ***Prof. Shu-Han Hsu****, National Cheng Kung University, Taiwan, Topic: On-line Failure Monitoring of SRAMs*

Lunch (12:15PM ~ 13:30PM)

Afternoon Session (13:30PM ~ 17:00PM)

- **Cross Level SoC Design: From Algorithm to Architecture, VLSI, Circuit, Device, Material, and *Below*..**

Host: Prof. Shu-Min Hsu, National Cheng Kung University, Taiwan

***Invited Talk (13:30 ~ 14:00)**: **Brian Sung,** Country Manager, Cadence, Taiwan Topic: Computational Software for Intelligent System Design*

***Invited Talk (14:00 ~ 14:30)**: **Prof. Philex Ming-Yan Fan**, National Cheng Kung University, Taiwan, Topic: How Analog Circuits Augments IoT SoC, Design Methodology and Testing.*

***Invited Talk (14:30 ~ 15:00)**: **Prof. Prof. Da-Huei Lee**, National Cheng Kung University, Taiwan, Topic: Data Converter Design: From Architecture to Device*

***IEEE CASS Tainan Chapter, Distinguished Lecture (15:00 ~ 16:00): Prof. Tobi Delbruck**, Inst. Of Neuroinformatics, UZH-ETH Zurich, Topic: Argo: first trials of robot sailboat*

***Host: Prof. Cheng-Ta Chiang,** Chapter IEEE CAS Society, Tainan Chapter, National Chia Yi University,*

Coffee Break (16:00 ~ 16:15)

- **Panel Discussion: Emerging trends in SoC Vertical Integration**

Panel Discussion (16:15 ~ 17:00):

- **16:15 ~ 16:20 *Prof. Philex Ming-Yan Fan***, *National Cheng Kung University, Taiwan (confirmed) Moderator, Panel Chair*
- **16:20 ~ 16:35 *Julian***, *Cadence, Director*
- **16:35 ~ 17:00:** Panel Discussion (*Shuvra Bhattacharyya, Chris Gwo Giun Lee, Da-Huei Lee, Shu-Han Hsu, Ting Jung, Chang)*

Speaker's Information:

Shuvra Bhattacharyya, Professor, Department of Electrical and Computer Engineering, and Institute for Advanced Computer Studies, University of Maryland at College Park, USA. Chair of Excellence in Design Methodologies and Tools, National Institute for Applied Sciences (INSA), Rennes, France.

Short Bio

Shuvra S. Bhattacharyya is a Professor in the Department of Electrical and Computer Engineering at the University of Maryland, College Park. He holds a joint appointment in the University of Maryland Institute for Advanced Computer Studies (UMIACS), and is affiliated with the Maryland Crime Research and Innovation Center (MCRIC). He also holds a part-time visiting position as Chair of Excellence in Design Methodologies and Tools at the National Institute for Applied Sciences (INSA) in Rennes, France. His research interests include signal processing, embedded systems, electronic design automation, machine learning, wireless communication, and wireless sensor networks. He received the Ph.D. degree from the University of California at Berkeley. He has held industrial positions as a Researcher at the Hitachi America Semiconductor Research Laboratory (San Jose, California), and Compiler Developer at Kuck & Associates (Champaign, Illinois). He is a Fellow of the IEEE.

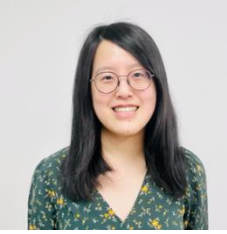
Chris Gwo Giun Lee, Professor, Department of Electrical Engineering, National Cheng Kung University. Director, Bioinfotronics Research Center, National Cheng Kung University.

Short Bio

Chris Gwo Giun Lee is an investigator in signal processing systems for multimedia and bioinformatics. His work on analytics of algorithm concurrently with architecture, Algorithm/Architecture Codesign (AAC), has made possible accurate and efficient computations on SoC, cloud and edge including Digital Health. He is currently using AI to Design AI and is enabling accessible health and wellness via AI Humanity. Chris contributed to 130+ publications with invention of 50+ patents worldwide. His AAC work was used by the industry in deploying more than 60 million LCD panels worldwide. Two of these patents were licensed by US health industry for development of analytics platform-based precision medicine products (Boston, MA, June 1, 2015, GLOBE NEWSWIRE). Chris' AAC work has been pivotal in delivering international standards, including 3D extension of/and HEVC, in MPEG of ISO/IEC. Chris worked in former Philips Semiconductor as a system architect and project leader in the Silicon Valley startups. He was recruited to National Cheng Kung University in 2003. Chris received his B.S. degree in electrical engineering from National Taiwan University, M.S./Ph.D. degrees in electrical engineering from the University of Massachusetts. He is the founder of CogniNU Technologies focusing on digital health.

Ting-Jung Chang, Navigating Heterogeneity: Designing, Prototyping, and Evaluating Two Heterogeneous SoCs

Short Bio



Ting-Jung Chang is an Assistant Professor in the Miin Wu School of Computing at National Cheng Kung University. She holds a Ph.D. in ECE and an M.A. in EE from Princeton University and spent a year at Sambanova working on next-generation AI chips before joining NCKU. She is broadly interested in computer architecture and VLSI design, with a particular focus on heterogeneous architecture and emerging technologies.

Darsen Lu, Associate Professor, Department of Electrical Engineering, National Cheng Kung University

Short Bio

APPOINTMENTS

2020 - present Associate Professor, National Cheng Kung University, Tainan City

2015 - 2020 Assistant Professor, National Cheng Kung University, Tainan City

2011 - 2015 Research Staff Member, IBM Thomas J. Watson Research Center, Yorktown Heights, NY

SYNERGISTIC ACTIVITIES

1. I have developed a new graduate course "Semiconductor Devices Modeling and Simulation" at National Cheng Kung University. This course introduces students to the basics of semiconductor modeling, including fundamental semiconductor device physics and fabrication, TCAD, and compact modeling.
2. I have presented tutorials at multiple IEEE conferences such as IEEE/ACM International Symposium on Microarchitecture (MICRO) in 2016.
3. I served as technical committee member in Modeling and Simulation of the IEEE International Electron Devices Meeting (San Francisco, CA) in 2021 and 2022.
4. While at UC Berkeley, I had been the main developer of BSIM-CMG, which was later on adopted and selected as industry standard compact model for the FinFET in 2012.
5. At NCKU, I led a research team that developed CIMulator, a simulation platform focusing on macro level modeling and benchmarking for computing-in-memory (CIM) for AI computation.

Shu-Han Hsu, Assistant Professor, Department of Computer Science and Information Engineering, National Cheng Kung University. Director, Semiconductor Manufacturing And Reliability Testing (SMART) Lab, National Cheng Kung University.

Short Bio

Shu-han Hsu has an interdisciplinary background in the field of semiconductor fabrication, circuits, machine learning and failure analysis. She was previously a research and development integration engineer at Taiwan Semiconductor Manufacturing Company Limited (TSMC). She received her B.S. degree in materials science and engineering from National Cheng Kung University. She also received a M.S. degree in photonics and optoelectronics from National Taiwan University and a M.S. in materials engineering from Purdue University. She received her Ph.D. in electrical and computer science engineering from Georgia Institute of Technology.

Brian Sung, Country Manager, Cadence, Taiwan

Short Bio

Brian Sung took the position of Country Manager at Cadence Taiwan Office since May 2016, responsible for business and operation in this region.

Born in Taiwan, Mr. Sung has over 19 years of rich experiences in semiconductor industry, including 11 years in research, management and sales roles, and multiple years of working experiences in the US. He also served as executive and director at IC design companies.

Prior to joining Cadence, Mr. Sung had various positions at Wistron NeWeb Corporation, Faraday Technology Corporation, and Sony Research Center, engaging in the field of IC design, technical support, sales, and business development

Philex Ming-Yan Fan, Assistant Professor, Department of Electrical Engineering, National Cheng Kung University, Taiwan

Short Bio

Educations

2014/10~2019/07 Ph.D., Electrical Engineering Division, Department of Engineering, University of Cambridge, Cambridge, UK

2008/09~2011/09 M.S., Institute of Electrical Control Engineering, National Chiao Tung University, Hsinchu, Taiwan

2007/09~2008/06 Exchange Student, Katholieke Universiteit Leuven, Leuven, Belgium

2004/09~2008/06 B.S., Electrical Engineering and Computer Science (EECS) Undergraduate Honors Program, National Chiao Tung University, Hsinchu, Taiwan

Experiences

2021/08~ present Assistant Professor, Department of Electrical Engineering, National Cheng Kung University, Tainan, Taiwan

2020/11~2021/07 Principle Engineer, Taiwan Semiconductor Manufacturing Company, Ltd., Hsinchu, Taiwan

2018/01~2020/05 Senior Research Engineer, Arm Research, Arm Ltd., Cambridge, UK

2016/06~2016/12 Engineering Intern, Qualcomm Technologies International, Cambridge, UK

2014/07~2014/08 Intern Component Engineer, Cisco Systems Inc., Taipei, Taiwan

2012/11~2014/06 Research Assistant, National Chiao Tung University, Hsinchu, Taiwan

Da-Huei Lee, Assistant Professor, Department of Electrical Engineering, National Cheng Kung University.

Short Bio

Da-Huei Lee received the B.S., M.S., and Ph.D. degrees from the Department of Electrical Engineering, National Cheng Kung University, Tainan, Taiwan, in 1999, 2001, and 2008, respectively. From 2009 to 2011, he was an associate researcher with the Taiwan Semiconductor Research Institute (TSRI), Taiwan. In 2012, he joined the Department of Electronic Engineering, Southern Taiwan University of Science and Technology, Tainan, Taiwan, as an Assistant Professor and became an Associate Professor in 2016. In 2023, he joined the Department of Electrical Engineering, National Chung-Kung University, Tainan, Taiwan, where he is currently an Assistant Professor. His current research interests include audio frontend/backend, high-resolution direct sampling RF ADC, high-resolution direct synthesis RF DAC, delta-sigma modulator, class-D analog/digital audio power amplifier, and IoT high-sensitivity sensing interface circuits.

Tobi Delbruck, Sensors Group, Inst. of Neuroinformatics, UZH-ETH Zurich

Short Bio

I received a B.Sc. degree in physics from University of California in 1986 and a Ph.D. degree from Caltech in 1993 in the inaugural class of the Computation and Neural Systems program founded by John Hopfield, as a student of Christof Koch, David van Essen and Carver Mead. Currently I am a Professor of Physics and Electrical Engineering at ETH Zurich in the Institute of Neuroinformatics, University of Zurich and ETH Zurich, Switzerland, where I have been since 1998. I codirect the Sensors group together with Prof. Shih-Chii Liu. We focus on neuromorphic event sensors and processing, theory and hardware accelerators for AI, and real time optimal robot control. I co-organize the Telluride Neuromorphic Engineering workshop and have organized live demonstration sessions at ISCAS, NeuIPS, and AICAS and two Confession Sessions at ISCAS. I am past Chair of the IEEE CAS Sensory Systems Technical Committee. I worked on electronic imaging at Arithmos, Synaptics, National Semiconductor, and Foveon and co-founded 3 companies inilabs, insightness, and inivation. I invented the neuromorphic adaptive photoreceptor circuit. The MOS pseudo resistor used in it is a key part of the most cited JSSC paper of the last decade in the neural-amplifier paper from R. Harrison. I also invented the “bump” circuit and open-source ultra wide dynamic range digitally programmable bias current generators used in many neuromorphic chips. My IEEE J. Solid State Circuits paper on the dynamic vision sensor silicon retina event camera is the 4th most cited in the 2005-2015 decade. These event camera developments inspired the Sensors Group's recent work on activity-driven AI hardware accelerators, e.g. NullHop and DeltaRNN, which are among the first to exploit neuromorphic activation sparsity for saving time and energy like spiking neural networks, but in a way that is much more compatible with DRAM storage of deep networks. My papers have been awarded 13 IEEE awards and in 2013 I was named a Fellow of the IEEE Circuits and Systems Society for my work on neuromorphic sensors and processing.