The 2nd Annual Emerging Information Technology Conference

Nanotechnology,
MEMS,
System-on-Chip,
Bioinformatics
Workshops

November 1-2, 2002,
Friend Center, Princeton University,
Princeton, New Jersy, U.S.A.

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Welcome Message

On behalf of the organizing committee, we would like to welcome all the participants at EITC2002. The organizing committee, under the leadership of Mr. Michael Hwa Han Wang, has demonstrated a most efficient model and cooperative teamwork of putting together an outstanding technical program in the Internet information era. We wish to use this opportunity to express our most sincere gratitude to the selfless efforts by the entire conference team.

The series of Emerging Information Technology Conference (EITC) is held annually. The objectives are to facilitate technical and information exchange among professionals from the Pacific Rim and North America on emerging information technologies; to strengthen the technical and business ties between the IT industries and academics; and to jointly explore research and business opportunities in emerging information technologies. This year marks the first time that we attempt to cover a broad spectrum of key technologies, including Nanotechnology, MEMS, System-on-Chip, and Bioinformatics. It is also a new experience that this year's meeting is held in a university campus, Princeton University, to highlight the vital importance of fundamental and basic research in all of the selected disciplines. We are very pleased to be able to have attracted so many prominent technical experts and industrial leaders from both sides of Pacific.

We wish all of you a most enriching and wonderful experience at Princeton.

Chun-Yen Chang
Conference Co-Chair

Sun-Yuan Kung
Conference Co-Chair

Conference Themes

Nanotechnology Workshop

Nanotechnology, emerging from nanoscience and nanoengineering is expected to lead the next industrial revolution through the 21st century. It is tiny, on the scale of one billionth of a meter (nano-meter or nm), yet its impact on our life will be tremendous. It is expected to change everything from agriculture to medicine and from electronics to mechanics. Nanometer scaled devices are imagined to be the smallest and fastest computer, smart and potent medicine, and self-replicating machines. Two approaches are being adopted to fabricate these devices. The top-down process such as to shrink the MEMS to NEMS and the bottom-up approach by synthesizing nano- parts via self-assembly process.

There is an intense interest in Nanotechnology stemming from the fact that developed countries and visionary businesses are rushing to invest and taking a leading position in. Additionally this vast frontier technology is open to chemists, physicists, molecular biologists, material scientists, engineers and literally anyone with new ideas and a want to explore and discover. If you have a thirst for exploration and wish to make your mark in science history, join us to learn more, make contacts, and share ideas with other experts in this brand new field.

MEMS Workshop

Microelectromechanical systems (MEMS) is an enabling technology that will potentially impact the economy and society every bit as much as microelectronics have these past few decades. Silicon integrated-circuit fabrication technology, through the practice of batch fabrication and reduction of scale, revolutionized the electronics industry. Applying these same principles and similar technologies to MEMS, the future shall bring microsystems in the optical, chemical, biological, electrical or mechanical domains that will create new and unforeseen markets. Already, MEMS products have reached the consumer marketplace. Examples include the silicon accelerometer in the automotive and video/computer games industries and the Texas Instruments Digital Mirror Device for projection displays. Yet, this is only the beginning. MEMS have the potential to provide critical enabling solutions to many new technology areas including wireless communications, optical communications and biotechnology. Examples include RF switches and other passive elements for personal communication systems; micro-optical switches for optical fiber networks; and chemical “lab on a chip” for biomedical applications.

To further this vision the second Emerging Information Technology Conference is being organized by a group of Chinese-American professionals and professional organizations. The conference would be a forum for the latest developments, issues, and trends in MEMS in the areas of 1) Consumer Products (Automobile Industry); 2) Wireless Communications; 3) Optical Systems; 4) Biotechnology; 5) Aerospace Technology.

The rapid growth and success of high technology industries around Asia have transformed many economies including Taiwan’s, which has a thriving semiconductor and electronics industry. Now, with the movement of the high-tech sector into information technology, and biotechnology, MEMS may have a significant future role in these economies.

One goal of this conference is to build and strengthen technical and business relationships among professionals, institutions and industries around the Pacific Rim. The conference would provide an opportunity for experts and industry leaders to exchange research developments in MEMS technologies, business experiences and to jointly explore new directions and opportunities.

System on Chip Workshop

Electronic system design has entered a new era with the ability to integrate an entire system onto a single silicon chip. Driven by the rapid growth of the Internet, telecommunications technology, wireless systems, pervasive computing, multimedia, and consumer electronics, System-on-Chip (SoC) designs have become a dominant focus in today's application-specific ICs (ASIC) industry. The transition from tradition ASIC designs to more complex SoC designs has created new challenges in the areas of design methodologies, CAD tools, electronic design automation (EDA) and manufacturing and test.

Development of system-level software and hardware design methodologies are critical to enhance productivity and enable SoC designs to meet time-to-market and time-to-volume goals. The combination of reusable digital, analog and mixed-signal intellectual property (IP) cores /macros and embedded memories will become more pronounced. Third party IP and reusable methodologies will have to be integrated into EDA design flows. These design flows will have to be flexible enough to partition the SoC into software and hardware components, or even to manage concurrent software-hardware co-designs. The tight interaction between hardware and software in SoCs causes unique design and verification problems which demand specialized methodologies, tools and techniques.

The SoC track will bring together an interdisciplinary panel of experts from academics and industry to address critical software and hardware issues and concerns, such as compilers, operational systems and languages, embedded systems, architectures, synthesis, EDA, tools, VHDL, logic and memory, circuits, devices, physical design, implementation, integration, technology, verification and test related topics. The EITC-2002 workshop provides a forum for sharing advanced information in SoC designs, implementations and applications.

Bioinformatics Workshop

The human genome project has revolutionized the practice of biology and the future potential of medicine. The draft DNA sequence of the human genome has been published and complete genomes of other organisms continue to be sequenced *en masse*. Meanwhile, high-throughput studies are being conducted and rapid advances being made in areas such as gene expression, protein expression, protein structure and function, metabolic and signalling pathways, and protein-protein interactions and networks. With the enormous quantity and variety of data being produced, biology is becoming an increasingly quantitative science. Computational approaches, in combination with empirical methods, are expected to become essential for deriving and evaluating hypotheses.

Bioinformatics is an emerging field where biological and computational disciplines converge. The field encompasses the development and application of computational tools and approaches for the collection, analysis, management, and visualization of biological data, as well as mathematical modeling and computational simulation techniques for the study of biological systems. A wide range of bioinformatics methods have been developed, including sequence and structural alignment, molecular database design and mining, phylogenetic tree construction, prediction of protein structure and function, gene finding, and expression data clustering. The emphasis is on approaches integrating a variety of computational methods and heterogeneous data sources for biological knowledge discovery. Future progress may require new computational techniques in areas such as machine learning, information theory, data mining, natural language processing, supercomputing, pattern recognition, and image processing.

Advances in genomics and proteomics have highlighted the importance of bioinformatics approach to biotechnology, drug discovery, and disease diagnosis. The challenges are to determine the functional significance of each gene, understand the complex functional networks and control mechanisms, and figure out the role that genotype and environment play

in determining the phenotype. For example, the genetic variation (polymorphism) and gene expression profiling data generated by massive genotyping and DNA microarray studies may help elucidate the genetic basis of disease susceptibility and drug response. Disease diagnosis is possible with gene chip technology and statistical clustering algorithms that are capable of screening and analyzing the expression of thousands of genes correlated with disease states. The proteomic data may be translated into workable models or simulations of cells, pathways, or targets, providing guidance for target selection and drug development.

The Bioinformatics Track will bring together an interdisciplinary panel of experts from bioinformatics, biotechnology, information science, and statistics to address critical issues, stimulate ideas and collaborations, and foster technology transfer and strengthen communications between academics and industry. Our distinguished speakers will showcase examples of genomic approach to drug development, gene-expression profiling for disease diagnosis, knowledge base system for functional proteomics, and gene and protein chip technology, among other recent advancements.

Planning Committee

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Conference Program

	November 1, 2002 (Friday)	November 2, 2002 (Saturday)
8:00 AM to 9:00 AM	Registration	Registration
9:00 AM to 9:30 AM	Opening Remarks	Opening Remarks
9:30 AM to 10:50 AM	P1 – Plenary Session I *Nanotechnology/MEMS*	P3 – Plenary Session III *Systems on Chip*
10 Minutes	Break	Break
11:00 AM to 12:20 PM	P2 - Plenary Session II *Nanotechnology/MEMS*	P4 - Plenary Session IV *Bioinformatics*
12:30 PM to 02:00 PM	Luncheon Brown Bag Talks	Luncheon Brown Bag Talks
(Parallel) 02:00PM to 06:00 PM	T1 – Technical Session 1 *Nanotechnology*	T5 – Technical Session 5 *MEMS*
	T2 – Technical Session 2 *Nanotechnology*	T6 – Technical Session 6 *MEMS - Optoelectronics*
	T3 – Technical Session 3 *Systems on Chip*	T7 – Technical Session 7 *Systems on Chip*
	T4 – Technical Session 4 *Bioinformatics*	T8 – Technical Session 8 *Bioinformatics*

Day 1 (November 1, 2002)

08:00-09:00 AM Registration

09:00-09:30 AM Opening Remarks
Conference Chair: Chun-Yen Chang, National Chiao-Tung University

09:30-10:50 AM P1 - Plenary Session I: Nanotechnology/MEMS
Chair: Mow S. Lin, Brookhaven National Lab

"Nanotechnology – A Device Perspective"
H. S. Philip Wong, IBM T. J. Watson Research Center
Tony Heinz, Columbia University
Robert Austin, Princeton University

10:50-11:00 AM Break

11:00 AM-12:20 PM P2 – Plenary Session II: Nanotechnology/MEMS
Chair: Lurng-Kuo Liu, IBM T. J. Watson Research Center

"Nanopattern-Guided Growth of Single-Crystal Si on Amorphous Substrates at Low Temperature and High Performance Sub-100 nm Thin-film Transistors for 3-Dimensional Integrated Circuits"
Stephen Y. Chou, Princeton University
"Design for Reliability of MEMS /MOEMS for Lightwave Telecommunications"
Susanne Arney, Bell Labs, Lucent Technologies
"The New Jersey MEMS Initiative: from Concept to Commercialization"
Beau Farmer, New Jersy Institute of Technology

12:30-2:00 PM Luncheon: Brown Bag Talks
Chair: Daniel Lou, New York Life Insurance Company

Angelica O. Tang, U.S. Department of Labor
Zhenhong Fan, Merrill Lynch

02:00-06:00 PM Parallel Technical Sessions

T1 – Technical Session I: Nanotechnology
Chair: H. S. Philip Wong, IBM T. J. Watson Research Center
Organizer: Mow S. Lin, Brookhaven National Lab

"Nanopattern-Guided Growth of Single-Crystal Si on Amorphous Substrates at Low Temperature and High Performance Sub-100 nm Thin-film Transistors for 3-Dimensional Integrated Circuits"
Jian Gu, Princeton University
"Tunable Dielectric and Metallic Photonic Crystals for Info-Tech Applications"
Anvar Zakhidov, University of Texas at Dallas
"Carbon Nanotube NEMs"
Ethan Minot, Cornell University
"Overview of BNL Nanoscience Center"
Chi-Chang Kao, Brookhaven National Laboratory
"Nanoscale Functionalization Strategies"
Stanislaus Wong, Brookhaven National Laboratory

"Direct measurements of nanoscale electronic and magnetic properties using advanced electron microscopy"
Yimei Zhu, Brookhaven National Laboratory

T2 – Technical Session 2: Nanotechnology
Chair: Benjamin Chu, State University of New York - Stony Brook
Organizer: Mow S. Lin, Brookhaven National Lab

Robert McGraw, Brookhaven National Laboratory
"Combustion-Synthesized Nano-particles"
Daniel E. Rosner, Yale University
"Nanoparticles and Nanostructures in Catalysis"
C. J. Zhong, State University of New York at Binghamton
"Polymer Nanocomposites Technology"
Benjamin S. Hsiao, State University of New York at Stony Brook
"Electrospinning and the Use of Nanostructured Polymers for Biomedical Applications"
Benjamin Chu, State University of New York at Stony Brook

T3 – Technical Session 3: Systems on Chip
Chair: Ruby Lee, Princeton University
Organizer: Richard Wang, IBM T. J. Watson Research Center

"Configurable Security Modules for System-on-Chip Designs"
Ruby Lee, Zhijie Shi, Princeton University
"IC Design Industries and Governmental R&D Funding Policies in Taiwan"
Wen-Tsuen Chen, Natioanl Tsing Hua University
"Design Methodology for Wireless SoC"
Stella Kuei-Ann Wen, National Chiao-Tung University
"System-on-a-Chip and the Coming Design Revolution"
Stephen A. Edwards, Columbia University
"A 2.9ns Random Access Embedded DRAM Macro with Destructive Read Architecture and Direct Sensing"
Chorng-Lii Hwang, IBM T. J. Watson Research Center
"Dynamic Power Management Techniques for System-on-a-Chip"
Suhwan Kim, IBM T. J. Watson Research Center

T4 – Technical Session 4: Bioinformatics
Chair: Ruhong Zhou, IBM T. J. Watson Research Center
Organizer: Ruhong Zhou, IBM T. J. Watson Research Center

"High-Performance Computing Needs in Pharmaceutical Discovery"
Terry Stouch, Bristol Meyers Squibb Pharmaceutical Research Institute
"Gene Expression Microarray Analysis: from Technology to Application"
Yuhai Tu, IBM T. J. Watson Research Center
"New Knowledge-based Potentials from Known Protein Structures"
Yaoqi Zhou, State University of New York at Buffalo
"Protein Structural Codes: Applications in Protein Sequence and Structure Analyses"
An-Suei Yang, Columbia University
"Blue Gene: Protein Folding with Molecular Dynamics"
Ruhong Zhou, IBM T. J. Watson Research Center

Day 2 (November 2, 2002)

08:00-09:00 AM Registration

09:00-09:30 AM Opening Remarks
Conference Chair: Sun-Yuan Kung, Princeton University

09:30-10:50 AM P3 - Plenary Session III: Systems on Chip
Chair: Wei Hwang, National Chiao-Tung University

"Systems-on-Chip"
Reinaldo Bergamaschi, IBM T. J. Watson Research Center
"Design Challenges for Systems-on-Chips"
Wayne Wolf, Princeton University
"SOC Research Activities in National Taiwan University"
Sao-Jie Chen, National Taiwan University

10:50-11:00 AM Break

11:00 AM-12:20 PM P4 – Plenary Session IV: Bioinformatics
Chair: Cathy H. Wu, Georgetown University Medical Center

"Integrated Bioinformatics Projects on Functional Genomic Studies of Disease"
Chao Agnes Hsiung, National Health Research Institutes
"Research, Development and Education of Bioinformatics at EMBnet China Node"
Jingchu Luo, Peking University
"Bioinformatics and Functional Genomics/Proteomics: The Protein Information Resource"
Cathy H. Wu, Georgetown University Medical Center

12:30-2:00 PM Luncheon: Brown Bag Talks
Chair: Albert H. Wang, Philips Nizer LLP

Kenneth K. Fisher, Phillips Nizer Benjamin Krim & Ballon LLP
Peter A. Fileds, Phillips Nizer Benjamin Krim & Ballon LLP
Stephen M. Nagler, Phillips Nizer Benjamin Krim & Ballon LLP

02:00-06:00 PM Parallel Technical Sessions

T5 – Technical Session 5: MEMS
Chair: Norman C. Tien, University of California, Davis
Organizer: Wen H. Ko, Case Wester Reserve University

"Micromachined Variable Capacitors with Wide Tuning Range"
Wuyong Peng, New Jersey Institute of Technology
"RF MEMS – A Brief Overview"
James C. M. Hwang, Lehigh University
"Optically-Power Wireless Transmitter for High-Temperature MEMS Sensing and Communications"
Darrin Young, Case Western Reserve University
"Electrolytic Bubble Based Actuation for Microfluidics without Mechanically Moving Parts"
Susan Hua, State University of New York at Buffalo
"Radiation Hardness/Tolerance of Si Sensors"
Zheng Li, Brookhaven National Lab
"Comparison of Piezo-resistive, Capacitive and Resonant Type Physical Sensors"
Wen H. Ko, Case Wester Reserve University

T6 – Technical Session 6: MEMS
Chair: Li-Ji Wu, Internet Photonics Inc.
Organizer: Chuan Pu, Tellium Inc.

"Technologies for Large-Scale Optical Switching"
Shi-Sheng Lee, Private Consultant
"Frame-Based Exhaustive Matching (FEM) Scheme for Photoinc Packet Switch"
Zhi-Gang Jing, Polytechnic University
"Experimental Study of Micromachined Electrostatic Torsion Actuators with Full Travel Range"
Zhixiong Xiao, New Jersey Institute of Technology
"Integrated Optoelectronics—Key to Future Metro Optical Networks"
Zheng Zheng, Lucent Technologies
"Availability and Application of Free Space Optics (FSO) in Cellular Transport Radio Access Network (CT RAN)"
Ti-Shiang Wang, Nokia Research Center

T7 – Technical Session 7: Systems on Chip
Chair: Yarsun Hsu, National Tsing-Hua University
Organizer: Howard Chen, IBM T. J. Watson Research Center

"New Trend of Chip Design for Digital Speech/Audio Signal Processing"
Jhing-Fa Wang, National Cheng Kung University
"System-on-Chip (SoC) Implementation of Multimedia Systems"
Yu-Hen Hu, University of Wisconsin at Madison
"SoC Signal Integrity and Power Delivery Design Challenges and Solutions"
Charlie Chung-Ping Chen, University of Wisconsin at Madison
"A Practical Paradigm for Optimization-based Design Systems and its Applications to VLSI CAD"
Hsiao-Dong Chiang, Cornell University
"Firm IP Methodology for Low-Power, High-Performance ASIC and SoC Designs"
George Diedrich Gristede, IBM T. J. Watson Research Center

T8 – Technical Session 8: Bioinformatics
Chair: Sue-Jane Wang, FDA
Organizer: Tsu-Han Chen, Carnegie Mellon University

"Information-driven Biomedical Research: Integrating Genomics, Gene Expression and Proteomics"
Ueng-Cheng Yang, National Yang-Ming University
"Analysis of Gene Expression Data and Cancer Diagnosis"
Heping Zhang Yale University
"Design and Power Consideration in Pharmacogenomics/Pharmacogenetics Studies in Which Data Are Generated from Gene Expression Data or From Single Neucleotide Polymorphism Data"
Sue-Jane Wang, FDA
"3D Graphics and Bioinformatics: Protein Retrieval by Matching 3D Surfaces"
Shann-Ching Sam Chen, Tsu-Han Chen, Carnegie Mellon University
"Scatterplotting Protein Sequences"
Bruce L. Bush, Merck & Co., Inc.
"Building a fully integrated informatics tool to exploit the sequence databases"
Andrew T. Y. Kuo, Taiwan Genome Sciences, Inc.

Abstracts and Biographies

Conference Organizers

Cathy H. Wu

Georgetown University Medical Center

BIOGRAPHY

Positions and Employment
2001-Present: Professor of Biochemistry and Molecular Biology and Director of Protein Information Resource, Georgetown University Medical Center; 1999-2002: Director of Bioinformatics and Vice President, National Biomedical Research Foundation; 1990-1999: Assistant Professor (90-94), Associate Professor (94-98), Professor (98-99) of Biomathematics, University of Texas Health Center at Tyler

Education
B.S., Plant Pathology, National Taiwan University, 1978; M.S., Ph.D., Molecular Plant Pathology, Purdue University, 1982, 1984; M.S., Computer Science, University of Texas at Tyler, 1989

Primary Expertise/Activities
Conducting bioinformatics research since 1990 and developed several protein family classification systems including neural network systems and protein databases; Directing the Protein Information Resource (PIR); Teaching bioinformatics; Mentoring graduate students

Publications
Published over 75 research papers, authored a book and edited two books

Professional Activities
Advisory Board: Serve on Board of Directors, International Society for Computational Biology; Advisory Board, Association of Chinese Bioinformaticians
Organizing Committees: Organized several international bioinformatics conferences, including ISMB-2002; PSB-2003; PSB-2002; CBGI-2002; CBGI-2001; BIOKDD-2002; BIOKDD-2001
Grant Review Panels: Serve as an *ad hoc* reviewer and on numerous review panels and site visit panels for National Institutes of Health (NIH), National Science Foundation (NSF), Department of Energy (DOE), and National Science Council, Taiwan.

Invited Presentations
Over 30 invited seminars and tutorials in the last two years, including NIH Proteomics Course; ESF Training Course in Functional Genomics; Conference on Proteomics; CHI Beyond Genomics; Summer Institute on Bioinformatics, Taiwan; GCG/MSI Bioinformatics Workshop; ISMB-2001; BIBE-2001, SIAC-2001; CBGI-2001; MPSA-2000; University of Delaware; Medical College of Ohio; University of Alabama at Birmingham; George Mason University; Academia Sinica, National Taiwan University, National Chiao Tung University, National Health Research Institute, Yang Ming University, Taiwan

Profiled at *The Scientist* (10/15/2001)
Cathy Wu at the Crossroads: She saved the Protein Information Resource database and now aims to restore it to the world's best
(http://www.the-scientist.com/yr2001/oct/prof1_011015.html)

Conference Organizers

Wei Hwang

National Chiao-Tung University

BIOGRAPHY

Dr. Hwang is the Director of Microelectronic and Information Systems Research Center and Professor of Electronics Engineering Department of National Chiao-Tung University in Hsinchu, Taiwan since August 2002. Prior to that, he was a Research Staff Member at the IBM Thomas J. Watson Research Center, Yorktown Heights, NY from 1984 to 2002. He also served as an Adjunct Professor of Electrical Engineering at Columbia University in New York, NY from 1993 to 2001. He was Associate Professor of Electrical Engineering Department at Columbia University in New York from 1979 to 1984.He was Assistant Professor of Electrical Engineering at Concordia University in Montreal from 1975 to 1978. He received his M.S. and Ph.D. degrees from the University of Manitoba in 1970 and 1974 respectively, his M.S. degree from National Chiao-Tung University in 1967, and his B.S. degree from National Cheng-Kung University in 1964. His interests are in the general area of VLSI circuits and technology,
semiconductor memories, high-frequency server microprocessors, and embedded systems. His current research interests are in low power SoC design and technology, emerging information technology, systems and applications. He has received several IBM Awards, including sixteen Invention Achievement Awards and four Research Division Technical Awards and has been elected an IBM Master Inventor. He holds 106 international patents (including 53 U.S. patents). He has authored or coauthored one book, and over 110 technical papers in journals and conferences. Dr. Hwang is a Fellow of the IEEE.

Conference Chairs

Chun-Yen Chang

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National Chiao Tung University
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BIOGRAPHY

I. Education:
B.S. National Cheng Kung University (EE) in 1960
M.S. National Chiao Tung University (EE) in 1962
Ph.D. National Chiao Tung University (EE) in 1970

II. Careers:
- President, National Chiao Tung University (1998-)
- National Endowed Chair Professor (1997-)
- Professor, the National Chiao Tung University (1969-)
- Foreign Associate, National Academy of Engineering, U.S.A. (2000-)
- Member, Academia Sinica (1996-)
- Advisor, President of R.O.C. Taiwan (2000-)
- Science & Technology Advisor, Executive Yuan, Premier's Office, R.O.C., Taiwan (1997-)
- Fellow, IEEE, "For his contributions to semiconductor device development and to education." (1998-)
- Executive Committee, VLSI Symposium.
- President, National Nano Device Laboratories (1990-1997)
- Dean, College of Electrical Engineering & Computer Sciences (1994-1995), College of Engineering (1990-1994), Division of Research & Development, (1987-1990)
- Visiting Professor, Stuttgart University (1989-1996)
- Visiting Professor, University of Florida (1987)
- MTS, AT&T Bell Laboratories (1981)
- Advisor to Nippon Seili, ERSO, Nova, Lovoltech, ULVAC etc.
- Chairman of the Board (2000-2001) and Board Member (2001-), China Aviation Development Foundation

III. Honors:
- Foreign Associate, National Academy of Engineering, U.S.A. "For his contributions to the Taiwanese electronics industry, education and to material technology."
- Member, Academia Sinica.
- IEEE third millennium medal.
- Fellow, IEEE, "For his contribution to semiconductor device development and to education."

IV. Outline:

Prof. C.Y. Chang has contributed significantly to the science and technology of microelectronics, information systems and optoelectronics. He has supervised 60 Ph.D. & 300 M.S. students. He has served as the director of the Microelectronics Information System Research Center (MIRC) and promoted the W3C project, the communication system project, and the P7 project, the basis for CPU research at MIRC. As the president of the National Nano

Device Labs (NDL), the scale research programs for ULSI and nano science technologies were established. As president of National Chiao Tung University and as advisory board member for the government of the Republic of China, he contributes a global vision on humanity, the social sciences, and education. The university's academic level has been promoted to a world class standard, and is ranked first in the number of IEEE publications contributed between 1995-2000. President Chang serves as an executive or advisory member to many international societies and communities including the VLSI Symposium, an IEEE chapter, and SSDM. His technical activities started during the 1960's and as an initiator and founder of so many research projects, he is regarded as the father of the Taiwan semiconductor industry. In 1969, he invented a method to stabilize a Si-SiO2 surface by using zinc (US Patent 3,873,384), a process that is still widely used to improve the reliability of power transistors and rectifiers. In 1981, he was first to demonstrate that the use of TEGa as the Ga source in low pressure MOCVD can significantly improve crystal quality while providing the lowest carbon concentrations. This method is still widely used in fabricating optoelectronics and microwave devices. He has published several pioneering papers in microelectronics including the 1971 work "Specific Contact Resistivty of Metal-Semiconductor System" and the 1984 work "The Method of Nitrodizing SiO2 to Prevent Impurity Diffusion and Current Stresses." These papers and others are of critical importance to the manufacture of giga bit scale ULSI devices. Another work "Modulation Doped Base Hot Electron Transistor" (US Patent 5,172,194) is a pioneering paper on nano-devices for quantum processors. President Chang has co-authored several books including "ULSI Technology," "High Speed Devices" (McGraw Hill), "ULSI Devices" (Wiley), and "Made by Taiwan" (World Scientific). His current research and administrative focus are directed toward promoting the National "Si-Soft" initiative to boost Taiwanese future IT prospects.

Conference Chairs

Sun-Yuan Kung

Princeton University

BIOGRAPHY

Professor Sun-Yuan Kung received his Ph.D. Degree in Electrical Engineering from Stanford University. Since 1987, he has been a Professor of Electrical Engineering at the Princeton University. In 1974, he was an Associate Engineer of Amdahl Corporation, Sunnyvale, CA. From 1977 to 1987, he was a Professor of Electrical Engineering-Systems of the University of Southern California, L.A. In 1984, he was a Visiting Professor of the Stanford University and the Delft University of Technology. In 1994 he was a Toshiba Chair Professor at Waseda University, Japan, and a Honorary Professor, Central China University of Science and Technology, China. In 2001, he was a Distinguished Chair of Multimedia Signal Processing, Hong Kong Polytechnic University, Hong Kong. His research interests include VLSI array processors, image/video/multimedia signal processing, neural networks for biometric and bioinformatic signal processing, and wireless digital communication.

Since 1990, he has served as an Editor-In-Chief of Journal of VLSI Signal Processing Systems. He was appointed as the first Associate Editor in VLSI Area (1984) and the first Associate Editor in Neural Network (1991) of the IEEE Transactions on Signal Processing. He served as a member of IEEE SPS (Signal Processing Society) Administration Committee (1989-1991). He was a founding member of IEEE-SPS Technical Committees (TC) on VLSI Signal Processing, TC on Neural Networks, and TC on Multimedia Signal Processing. He served as a founding member and General Chairman of various international conferences, including IEEE Workshops on VLSI Signal Processing, IEEE Workshops on Neural Networks and Signal Processing, IEEE Workshops on Multimedia Signal Processing, International Conference on Application Specific Array Processors, and International Computer Symposium.

Professr Kung has authored more than 300 technical publications. He has authored three books ``VLSI Array Processors'', (P-H, 1988) (with Russian and Chinese translations); ``Digital Neural Networks'', P-H, 1993; and ``Principal Component Neural Networks'', John-Wiley, 1996. He has edited numerous reference books, including: "VLSI and Modern Signal Processing," Prentice-Hall, 1985. (with Russian translation), ``VLSI Signal Processing, Vol.I&II (IEEE Press), ``Neural Networks for Signal Processing, Vol. I,II & III (IEEE Press), ``Multimedia Signal Processing, Vol. I (IEEE Press) and ``Systolic Arrays'', 1988, ``Application-Specific Array Processors, (IEEE Computer Society Press). He has recently co-edited a book on ``Multimedia Image and Video Processing'', CRC Press, 2001.

Dr. Kung is a Fellow of IEEE since 1988. He was the recipient of 1992 IEEE Signal Processing Society's Technical Achievement Award for his contributions on "parallel processing and neural network algorithms for signal processing". He was appointed as an IEEE-SP Distinguished Lecturer in 1994. He received 1996 IEEE Signal Processing Society's Best Paper Award for his publication on principal component neural networks. He was a recipient of the IEEE Third Millennium Medal in 2000.

Conference Program Chairs

Mow S. Lin

Brookhaven National Laboratory

BIOGRAPHY

Mow Lin, Chemist, Brookhaven National Laboratory, Ph D in chemistry, U. of Wyoming, MS in nuclear engineering, Polytech U. of NY, MBA Downling College. After two year NIH fellowship at U. Missouri, he has been working at the "Lab" since 1975. He has published more than a hundred papers and reports, granted ten US patents and won awards of R&D in biotechnology, fossil fuels and environment areas. He is currently conducting studies in nanofabrication of electronic and molecular imprinting process.

Conference Program Chairs

Lurng-Kuo Liu

Program Manager
Blue Gene SuperComputer
Exploratory Server System
IBM T.J. Watson Research Center
Email: lkliu@us.ibm.com

BIOGRAPHY

Dr. Lurng-Kuo Liu received the M.S. degree in control engineering from National Chiao-Tung University, Taiwan, in 1987, and the Ph.D. degree in electrical engineering from University of Maryland at College Park in 1993. In 1993, he joined the High Performance Computing and Communications (HPCC) department at IBM T.J. Watson Research Center as a Research Staff Member, where he was involved in the algorithmic development and architecture design of a multi-points and multi-standards capable video conferencing system. Dr. Liu is currently a program manager in the Exploratory Server System department at IBM T.J. Watson Research Center where he is involved in the IBM Blue Gene supercomputer project – A supercomputer for protein folding and life science applications. Dr. Liu has worked on broadband e-commerce, interactive TV, pervasive video streaming, Set-Top Box, MP3 audio, system architectures for H.324 video conferencing, very low bit rate video coding, motion estimation, low delay MPEG-2 video coding, MPEG-4 system multiplexing, immersion computer game systems, and vision-enhanced human computer user interface (HCI) system. Dr. Liu also participated in both H.324 and MPEG-4 standards activities. His research interests include digital video compression technology, digital signal and image processing, computer vision, interactive games, multimedia communications, broadband e-business, mobile computing, deep computing, and neural networks.

Conference Coordinators

Jung-Tao Liu

Wireless Advanced Technology Laboratory
Bell Laboratories, Lucent Technologies
Whippany, NJ, 07981
E-mail: jtliu@lucent.com

BIOGRAPHY

Jung-Tao Liu was born in Taipei, Taiwan, in 1970. He received the B.S. degree in electrical engineering from National Taiwan University, Taipei, Taiwan, in 1992 and the M.S. and Ph.D. degree from the School of Electrical and Computer Engineering at Purdue University in 1997 and 1999, respectively.

Since then, he has been at Lucent Technologies, Whippany, NJ, USA where he initially worked on the algorithm design for GPRS/EDGE receiver. Recently, he has been working on the high speed packet data for WCDMA, MIMO technologies for HSDPA in UMTS. Currently, He is a Member of Technical Staff in CDMA Systems Technology Group, Wireless Systems Core Technology Department, Wireless Network Group, working on multimedia broadcast and multicasting, high speed uplink data access in UMTS and high speed data using OFDM. In general, he is interested in the research of wireless communication theories; more specifically, His current interests include coding theory, equalization, multiple antenna technologies, adaptive modulation, link adaptation, fast scheduling, multi-tone/multi-carrier wireless communications. He received the Recognition of Excellence Award from Lucent Technologies in June 2000 while he was working on EDGE. He has authored more than ten papers and has over ten patents pending.

Conference Coordinators

Wei-Hsin Wang

NicheUSA, L.L.C.

BIOGRAPHY

Dr. Wei-hsing Wang is the co-founder and president of NicheUSA, L.L.C., a thriving start-up company based in Princeton, New Jersey. The company's flagship product, ZoomerOne, based on patent pending technologies, offers freedom, savings, and power to both web site providers and web users. And it is the only WIN-WIN solution on the market. The company is currently marketing ZoomerOne for teachers and ZoomerOne for scholars.

Before founding NicheUSA, L.L.C., Dr. Wang worked for BroadVision Inc. on projects serving companies in the eastern region, such as Liberty Mutual, AIG, Merrill Lynch, and First Union Bank. He has also worked for AT&T Bell Laboratories in the areas of Network Database, Wireless Systems, and Internet Services at various locations in New Jersey.

Dr. Wang received his Ph.D. degree in computer science from Boston University, and B.S. and M.S. degrees in Computer Science and Information Engineering from National Taiwan University. He can be reached at Wang@NicheUSA.com or www.NicheUSA.com.

Day1

Opening Remarks

Conference Chair

Chun-Yen Chang

National Chiao-Tung University

BIOGRAPHY

Prof. C.Y. Chang has contributed significantly to the science and technology of microelectronics, information systems and optoelectronics. He has supervised 60 Ph.D. & 300 M.S. students. He has served as the director of the Microelectronics Information System Research Center (MIRC) and promoted the W3C project, the communication system project, and the P7 project, the basis for CPU research at MIRC. As the president of the National Nano Device Labs (NDL), the scale research programs for ULSI and nano science technologies were established. As president of National Chiao Tung University and as advisory board member for the government of the Republic of China, he contributes a global vision on humanity, the social sciences, and education. The university's academic level has been promoted to a world class standard, and is ranked first in the number of IEEE publications contributed between 1995-2000. President Chang serves as an executive or advisory member to many international societies and communities including the VLSI Symposium, an IEEE chapter, and SSDM. His technical activities started during the 1960's and as an initiator and founder of so many research projects, he is regarded as the father of the Taiwan semiconductor industry. In 1969, he invented a method to stabilize a Si-SiO2 surface by using zinc (US Patent 3,873,384), a process that is still widely used to improve the reliability of power transistors and rectifiers. In 1981, he was first to demonstrate that the use of TEGa as the Ga source in low pressure MOCVD can significantly improve crystal quality while providing the lowest carbon concentrations. This method is still widely used in fabricating optoelectronics and microwave devices. He has published several pioneering papers in microelectronics including the 1971 work "Specific Contact Resistivty of Metal-Semiconductor System" and the 1984 work "The Method of Nitrodizing SiO2 to Prevent Impurity Diffusion and Current Stresses." These papers and others are of critical importance to the manufacture of giga bit scale ULSI devices. Another work "Modulation Doped Base Hot Electron Transistor" (US Patent 5,172,194) is a pioneering paper on nano-devices for quantum processors. President Chang has co-authored several books including "ULSI Technology," "High Speed Devices" (McGraw Hill), "ULSI Devices" (Wiley), and "Made by Taiwan" (World Scientific). His current research and administrative focus are directed toward promoting the National "Si-Soft" initiative to boost Taiwanese future IT prospects.

P1 - Plenary Session I: Nanotechnology/MEMS

Session Chair

Mow S. Lin

Brookhaven National Laboratory

BIOGRAPHY

Mow Lin, Chemist, Brookhaven National Laboratory, Ph D in chemistry, U. of Wyoming, MS in nuclear engineering, Polytech U. of NY, MBA Downling College. After two year NIH fellowship at U. Missouri, he has been working at the "Lab" since 1975. He has published more than a hundred papers and reports, granted ten US patents and won awards of R&D in biotechnology, fossil fuels and environment areas. He is currently conducting studies in nanofabrication of electronic and molecular imprinting process.

P1 - Plenary Session I: Nanotechnology/MEMS

Nanotechnology – A Device Perspective

Hon-Sum Philip Wong

IBM T. J. Watson Research Center

ABSTRACT

As CMOS devices scale into the nanometer regime, the material set and device structures employed by conventional FET are beginning to reach their limits. While alternative materials and devices such as strained silicon and double-gate FET are being actively explored to extend silicon technology, the fundamental and practical limits imposed by silicon technology will eventually prevail. The new opportunities offered by nanotechnologies such as new materials, new fabrication/assembly methods, and new devices are reviewed in this paper. We will illustrate these opportunities using examples such as the carbon nanotube transistor for logic circuits, nano-electromechanical systems (NEMS) for storage, self-assembled methods of fabricating nanocrystals, organic thin films, SiGe quantum dots, and the use of diblock co-polymers for the formation of regular arrays of materials of the order of 20-40 nm. We conclude with an outlook for nanotechnology for the next 20 years.

BIOGRAPHY

H.-S. Philip Wong received the Ph.D. degree in electrical engineering from Lehigh University, Pennsylvania, in 1988. He joined the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, in 1988, as a Research Staff Member. He is now Senior Manager of the Nanoscale Materials, Processes, and Devices Department. His department is responsible for defining and executing IBM's nanoscale science and technology roadmap. Prior to this appointment, he was Senior Manager of the Exploratory Devices and Integration Technology Department. His department was responsible for defining and executing IBM's exploratory devices and technology roadmap for silicon technology.

While he has managed a wide range of technical activities from e-beam lithography, silicon materials and devices, molecular electronics and assemblies, nanotechnology, to quantum device modeling, he maintains an active personal research career that centers on solid-state devices, device physics and fabrication technology, system applications of nano- and microelectronic devices, and solid-state image sensors.

He is a Fellow of the IEEE and serves on the IEEE Electron Devices Society (EDS) as elected AdCom member. He serves on the IEDM committee from 1998 to 2002 and serves on the ISSCC program committee from 1998 – 2003. He is a Distinguished Lecturer of the IEEE EDS. He has taught several short courses at the IEDM, ISSCC, SOI conference, and SPIE conferences.

P2 - Plenary Session II: Nanotechnology/MEMS

Session Chair

Lurng-Kuo Liu

Program Manager
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BIOGRAPHY

Dr. Lurng-Kuo Liu received the M.S. degree in control engineering from National Chiao-Tung University, Taiwan, in 1987, and the Ph.D. degree in electrical engineering from University of Maryland at College Park in 1993. In 1993, he joined the High Performance Computing and Communications (HPCC) department at IBM T.J. Watson Research Center as a Research Staff Member, where he was involved in the algorithmic development and architecture design of a multi-points and multi-standards capable video conferencing system. Dr. Liu is currently a program manager in the Exploratory Server System department at IBM T.J. Watson Research Center where he is involved in the IBM Blue Gene supercomputer project – A supercomputer for protein folding and life science applications. Dr. Liu has worked on broadband e-commerce, interactive TV, pervasive video streaming, Set-Top Box, MP3 audio, system architectures for H.324 video conferencing, very low bit rate video coding, motion estimation, low delay MPEG-2 video coding, MPEG-4 system multiplexing, immersion computer game systems, and vision-enhanced human computer user interface (HCI) system. Dr. Liu also participated in both H.324 and MPEG-4 standards activities. His research interests include digital video compression technology, digital signal and image processing, computer vision, interactive games, multimedia communications, broadband e-business, mobile computing, deep computing, and neural networks.

P2 - Plenary Session II: Nanotechnology/MEMS

Nanopattern-Guided Growth of Single-Crystal Si on Amorphous Substrates at Low Temperature and High Performance Sub-100 nm Thin-film Transistors for 3-Dimensional Integrated Circuits

Stephen Y. Chou

Princeton University

ABSTRACT

Growing single-crystal silicon on amorphous substrates at low temperature is highly desired for the fabrication of high performance thin-film transistors (TFTs) for many important applications, such as 3-dimensional integrated circuits and active matrix liquid crystal display. It is, however, very difficult to obtain single-crystal silicon on amorphous substrates because it cannot be grown epitaxially due to the amorphous nature of the substrates. In this talk, we will show that with nanopatterning technology and nickel induced lateral crystallization, single-crystal silicon can be achieved on amorphous substrates at low temperature. Pattern size effects on the formation of single-crystal silicon have been studied. Sub-100 nm silicon TFTs have also been demonstrated with performances comparable to that of silicon-on-insulator (SOI) devices.

BIOGRAPHY

Dr. Chou, Joseph C. Elgin Professor of Engineering, Princeton University, received his Ph.D. degree from the Massachusetts Institute of Technology in 1986. Then, he was on faculty of Stanford University and the University of Minnesota before coming to Princeton. In the past 10 years, Dr. Chou has been leading a group of 20 researchers in conducting innovative reach in nanotechnology. His inventions cover nanofabrication technology and innovative nanoscale electronics, photonics, magnetics, and biotech.

Among other awards he received are IEEE Follow, McKnight-Land Grant Professorship and George Taylor Distinguished Research Award at the University of Minnesota, Packard Fellow Award, IBM Faculty Development Award, DARPA ULTRA Significant Technical Achievement Award, and a number of Best-Paper Awards.

An entrepreneur, Dr.Chou, is the Founder of Nanonex Corp and NanoOpto Corp.

P2 - Plenary Session II: Nanotechnology/MEMS

Designing Reliable Optical MEMS for Telecommunications Applications

Susanne Arney

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ABSTRACT

Optical Micro-Electro-Mechanical Systems (Optical MEMS, or MOEMS) are a disruptive technology whose application to telecommunications networks is transforming the horizon for lightwave systems. Design flexibility, functionality and commercialization of MOEMS are complex functions of materials systems, processing subtleties, and reliability requirements. Specific technology and design choices influence all aspects of product development. Our strategy for building reliability into emerging MOEMS products while accelerating their development into commercial offerings comprises a fundamentals-driven, tight inter-dependent feedback loop between Component/ Subsystem/ System Design, Fabrication, Packaging, Manufacturing and Reliability.

BIOGRAPHY

Dr. Arney has been involved in MEMS component design, fabrication, and reliability for over 15 years. She received her Ph.D. in Electrical Engineering from Cornell University in 1992, the same year in which she joined AT&T Bell Labs. She currently heads the Micromechanics Research Department at Bell Laboratories, Lucent Technologies in Murray Hill, New Jersey.

For more info on Lucent's research in the arena of MEMS, see the following web site:
http://www.lucent.com/pressroom/lambda.html

P2 - Plenary Session II: Nanotechnology/MEMS

The New Jersey MEMS Initiative: from Concept to Commercialization

Kenneth R. Farmer, II (Beau)

Assoc. Prof. Physics, Director, Microelectronics Research Center
New Jersey Institute of Technology
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Email: farmer@njit.edu

ABSTRACT

In this talk I will describe the NJ MEMS Initiative (NJMEMSI), a research, education and commercialization program that links student and faculty research at NJIT and other area universities with real world industrial MEMS needs and applications. NJMEMSI was established in 1998 through funding from the NJ Commission on Science and Technology. Since that time the program has (1) undertaken the assessment and improvement of NJ MEMS fabrication and characterization capabilities at the university level, helping to strengthen and make more accessible the state's university MEMS research infrastructure; (2) conducted specific, industry-driven pilot projects, moving them along the pathway from concept to commercialization; (3) gone beyond the practice of commercialization to explore the theory of discontinuous innovation exemplified by the emerging MEMS field; and (4) developed an innovative educational program that attempts to couple training in leading-edge technological innovation with methodologies of entrepreneurship. While providing an overview of accomplishments in all four program areas, the talk will focus on technical accomplishments, particularly the development of novel devices, processes and products. We believe that the NJMEMSI marriage of multidisciplinary academic programs with real-world applications may become a new paradigm for mutually beneficial partnerships between industry and academia.

BIOGRAPHY

Kenneth R. Farmer, II (Beau) is an Associate Professor in the Department of Physics at New Jersey Institute of Technology, Director of the Institute's Microelectronics Research Center (http://www.njit.edu/mrc) and founder of a statewide Research and Development Excellence program called the NJ MEMS Initiative, sponsored through the NJ Commission on Science and Technology. Beau earned his B.S. in Engineering Science from the University of Virginia in 1983 and his Ph.D. in Applied Physics from Cornell University in 1990. He joined NJIT in 1992 after a two-year research position in the Department of Solid State Electronics at Chalmers University of Technology in Gothenburg Sweden. In ten years at NJIT he has developed an internationally recognized program of teaching and research that has led to university teaching awards, featured research in numerous invited presentations and publications, and many substantial state, federal and industrial grant-funded activities in microelectromechanical systems (MEMS) and microelectronics. Recently, in collaboration with researchers at Columbia University, he has developed a MEMS education program that gives students hands-on experience in MEMS design, modeling, fabrication, packaging and testing.

Luncheon Brown Bag Talks

Session Chair

Daniel Lou

New York Life Insurance Company

BIOGRAPHY

Daniel Lou is currently President of Chinese Investors Association, a leading professional and business network focused on investors' education, research and networking and business incubating.

Since the founding the association, Daniel has been intrumental in building up the professional image, network and business relationships for the group.

As a private investor and business writer, Daniel Lou has been involved in the planning of the launches of several startup financial and high-tech companies and published numerous articles on business and investment trends, entrepreneurship and others.

He is a partner of Univest Securities, CASB Ventures and Westport Financials.

Luncheon Brown Bag Talks

Angelica O. Tang

U.S. Department of Labor

BIOGRAPHY

Ms. Tang is the Representative to Secretary Elaine L. Chao of the U.S. Department of Labor in Region II. The Region encompasses the states of New York, New Jersey, Puerto Rico and the Virgin Islands. Ms. Tang is the Secretary's chief intergovernmental and constituency liaison in the region.

Before joining the U.S. Department of Labor, Ms. Tang was Executive Director of New York City Mayor's Office of Immigrant Affairs and Language Services. As a cabinet official under the administration of Mayor Rudolph Giuliani, Ms. Tang developed and implemented effective initiatives including the creation of a cost-saving naturalization assistance program, Citizenship NYC. Her notable publications include "A Sensible Immigrant Policy in New York City" (University of British Columbia, Vancouver) and "Immigrants and the Economic Revitalization of New York City" (St. John's University, New York.)

Ms. Tang's previous appointments in the Giuliani administration include: Director of International Business at the NYC Commission for International Business and the United Nations, and Director of Marketing at the NYC Department of Business Services. Prior to joining the mayoral administration, Ms. Tang was Director of Asian Affairs at the Office of the City Council President.

Ms. Tang is an elected Term Member of the Council on Foreign Relations, Trustee of the Lower East Side Tenement Museum and a Board Member of the International Center of New York. Fluent in Chinese and Spanish, she is a certified interpreter in both languages and has been an adjunct instructor at New York University. Ms. Tang is recipient of several civic and leadership awards. She is a graduate of Phillips Exeter Academy and Princeton University.

Luncheon Brown Bag Talks

Zhenhong Fan

Merrill Lynch

BIOGRAPHY

Zhenhong Fan has been a technology strategist with Merrill Lynch since 2000, where he has written extensively on investment strategies in information technology sector. Prior to Merrill Lynch, he was an investment analyst with Argonaut Capital Management LLP in New York, where his responsibility included covering software companies as well as devising hedging strategies for the equity portfolio. Dr. Fan also had experience with complex fixed income products working at Credit Suisse First Boston, Enhance Financial Services Group Inc., and he has consulted at various departments at Chase Manhattan Bank. Dr. Fan received his Ph.D. degree in business administration from New York University in 1999. He also has a MS degree in electrical engineering from Rutgers University. He's been quoted in publications including Wall Street Journal, Financial Times, National Post, Reuters and CFO Magazine. He has also appeared on SinoVision and Phoenix TV.

T1 - Technical Session I: Nanotechnology

Session Chair

Hon-Sum Philip Wong

IBM T. J. Watson Research Center

BIOGRAPHY

H.-S. Philip Wong received the Ph.D. degree in electrical engineering from Lehigh University, Pennsylvania, in 1988. He joined the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, in 1988, as a Research Staff Member. He is now Senior Manager of the Nanoscale Materials, Processes, and Devices Department. His department is responsible for defining and executing IBM's nanoscale science and technology roadmap. Prior to this appointment, he was Senior Manager of the Exploratory Devices and Integration Technology Department. His department was responsible for defining and executing IBM's exploratory devices and technology roadmap for silicon technology.

While he has managed a wide range of technical activities from e-beam lithography, silicon materials and devices, molecular electronics and assemblies, nanotechnology, to quantum device modeling, he maintains an active personal research career that centers on solid-state devices, device physics and fabrication technology, system applications of nano- and microelectronic devices, and solid-state image sensors.

He is a Fellow of the IEEE and serves on the IEEE Electron Devices Society (EDS) as elected AdCom member. He serves on the IEDM committee from 1998 to 2002 and serves on the ISSCC program committee from 1998 – 2003. He is a Distinguished Lecturer of the IEEE EDS. He has taught several short courses at the IEDM, ISSCC, SOI conference, and SPIE conferences.

T1 - Technical Session I: Nanotechnology

Organizer

Mow S. Lin

Brookhaven National Laboratory

BIOGRAPHY

Mow Lin, Chemist, Brookhaven National Laboratory, Ph D in chemistry, U. of Wyoming, MS in nuclear engineering, Polytech U. of NY, MBA Downling College. After two year NIH fellowship at U. Missouri, he has been working at the "Lab" since 1975. He has published more than a hundred papers and reports, granted ten US patents and won awards of R&D in biotechnology, fossil fuels and environment areas. He is currently conducting studies in nanofabrication of electronic and molecular imprinting process.

T1 - Technical Session I: Nanotechnology

Nanopattern-Guided Growth of Single-Crystal Si on Amorphous Substrates at Low Temperature and High Performance Sub-100 nm Thin-film Transistors for 3-Dimensional Integrated Circuits

Jian Gu, N. Yao, H. Zandbergen, and S. Y. Chou

Princeton University

ABSTRACT

Growing single-crystal silicon on amorphous substrates at low temperature is highly desired for the fabrication of high performance thin-film transistors (TFTs) for many important applications, such as 3-dimensional integrated circuits and active matrix liquid crystal display. It is, however, very difficult to obtain single-crystal silicon on amorphous substrates because it cannot be grown epitaxially due to the amorphous nature of the substrates. In this talk, we will show that with nanopatterning technology and nickel induced lateral crystallization, single-crystal silicon can be achieved on amorphous substrates at low temperature. Pattern size effects on the formation of single-crystal silicon have been studied. Sub-100 nm silicon TFTs have also been demonstrated with performances comparable to that of silicon-on-insulator (SOI) devices.

BIOGRAPHY

Jian Gu was born in Kaifeng, China, in 1973. He received the B.S. degree in physics from Peking University, Beijing, China, in 1995, the M.S.E.E. degree from University of Minnesota, Minneapolis, MN, in 1998, and is graduating with the Ph.D. degree in Electrical Engineering from Princeton University, Princeton, NJ, in 2002.

His doctoral research interests include nanopattern-guided growth of electronic materials, Si-based nanoscale thin-film transistors, and novel nanoprinting technologies.

T1 - Technical Session I: Nanotechnology

Tunable Dielectric and Metallic Photonic Crystals for Info-Tech Applications

Anvar Zakhidov and Ray H. BAUGHMAN

NanoTech Institute, University of Texas at Dallas

ABSTRACT

Optical photonic crystals have periodicities in dielectric contrast on the scale of optical wavelengths. Novel features result from such periodicities, including photonic band gaps and intra-gap states that can be used for manipulating light in optical circuitry, just as analogous electronic features are used for semiconductor devices. Reflecting interest in both photonic crystal properties and applications, enormous effort has been devoted to fabricating photonic crystals..

Our fabrication method for three-dimensional photonic crystals is by the self-assembly of colloidal spheres, which is the process that nature uses for forming structurally related natural opal. Depending upon the composition and structure of the targeted photonic crystal, subsequent infiltration and extraction steps are used to provide a photonic crystal that is either the direct or inverse lattice of the original close-packed array of colloidal spheres. Possible applications could eventually be enabled, from fibrous photonic crystal colorants for plastics to one-dimensional photonic crystal wires for optical sensors and probes, and demonstrated properties, such as tunable intra-gap lasing, new type of combinational elementary excitations, called “Braggaritons”, and other.

BIOGRAPHY

Dr. Anvar A. ZAKHIDOV, presently Professor of Physics, and Adjunct Professor of Chemistry at University of Texas at Dallas (UTD), and Deputy director of UTD-NanoTech Institute, is a well known expert in nanotechnology, carbon nanostructures, (carbon nanotubes and fullerenes) and photonic crystals. Before joining UTD he was a senior principal scientist at Honeywell labs (former AlliedSignal. Inc. R and T). Dr. Anvar Zakhidov obtained his Ph.D. in Physics (1981) from Institute of Spectroscopy of Academy of Sciences of USSR and M.S. in Physics (1975) from Tashkent Technical University. He hold the following positions: Visiting Research Scientist at AlliedSignal Inc. (1996-present); Head of Thermal Physics Laboratory, Department of Thermo-Physics, Uzbek Academy of Sciences (1988-present: on-leave-of-absence);Visiting Professor in Department of Electronics, Osaka University and Visiting Professor of Solid State Chemistry lab of the Institute of Molecular Science, Okazaki, Japan (1992-95); Visiting Professor of the Consorzio INFM, Genova Institute of Molecular Spectroscopy, CNR, Bologna, Italy (1992-93). His research interests include: Physics and Chemistry of Advanced materials, Theory of excitons, polarons, solitons, phonons in solids; Optical and microwave spectroscopy; Molecular superconductivity and ferromagnetism; Conducting polymers and fullerenes; Electronic molecular devices. During his scientific career he has been awarded and honored by: Fellowship of Ministry of Science, Education and Culture, Japan (1990-1991, and 1994); Fellowship of Italian Consorcia “Phyzika Materiali”, Genova (1992-1993); Fellowship of the Japan Society for Promotion of Science (1996). Prof. A. Zakhidov is a Managing Editor of *the International Journal of Nanosciences* (World Scientific), He is a member of Editorial Board of International Journal *"Molecular Materials"*, and was a Guest Editor of Synthetic Metals, Vol. 64, No 2-3 (1994) and Editor for Proceedings ELORMA '87 Intern. Conference (Moscow, 1987.) He has over 160 papers in international journals, one review chapter, and three patents.

T1 - Technical Session I: Nanotechnology

Overview of BNL Nanoscience Center

Chi-Chang Kao

Brookhaven National Laboratory

ABSTRACT

Department of Energy has recently approved the establishment of a Nanoscience research center at Brookhaven National Laboratory (BNL). The proposed BNL center will have close to 80,000 sq. ft. of laboratory space for advanced instrumentation. The total cost of the project is estimated to be 87 M with a staff of 70. The research at BNL center will focus on six areas: examining changes in the electronic response of metal oxides with nanoscale dimensions; probing magnetic interactions in nanomaterials; studying new ways to form nanocatalysts; understanding electronic conduction in molecular wires; studying the self-assembly of thin organic films; and applications such as building nanoscale electronic devices, ultrathin-film optical devices and advanced fuel cell catalysts. An overview of the center and the status of the project will be presented.

BIOGRAPHY

Chi-Chang Kao received his Ph.D. in Chemical Engineering from Cornell University in 1988. He then joined the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory. Currently, he is a senior physicist and the associate chairman for user science atNSLS. His research interest is in the development of new experimental techniques using synchrotron radiation, and their applications to condensed matter physics and material science. Last few years, he has been working on the proposed BNL Nanoscience center. Currently, he is a member of the BNL Nanoscience center management team.

T1 - Technical Session I: Nanotechnology

Nanoscale Functionalization Strategies

Sarbajit Banerjee, Michael G.C. Kahn, Landy K. Blasdel, and Stanislaus S. Wong*

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ABSTRACT

Understanding the chemistry of single-walled carbon nanotubes (SWNTs) is critical to rational manipulation of their properties. In this regard, we are interested in the synthesis of nanotubes covalently complexed to molecular coordination compounds. As an example, raw and oxidized SWNTs have been reacted with Vaska's complex. It has been found that Ir coordinates to these nanotubes by two distinctive pathways. With raw nanotubes, the metal attaches as if the tubes behaved as electron-deficient alkenes. With oxidized nanotubes, the reaction occurs by coordination through the increased number of oxygen atoms, forming a hexacoordinate structure around the Ir atom. The reaction process significantly increases oxidized nanotube solubility in dimethylformamide.

Another compound analyzed was Wilkinson's complex. It has been found that the Rh metal similarly coordinates to these nanotubes through the increased number of oxygenated species. The functionalization reaction, in general, appears to significantly increase oxidized nanotube solubility in DMSO and THF, traditionally poor solvents for nanotubes. The derivatization process results in exfoliation of larger bundles of SWNTs and may select for the presence of distributions of smaller diameter tubes. An application has been made of this particular system as supports for homogeneous catalysis.

In another experiment, oxidized SWNTs have been reacted with cadmium selenide nanocrystals as well as titanium dioxide nanocrystals to form nanoscale heterostructures, characterized by transmission electron microscopy and infrared spectroscopy. Based on the types of intermediary linking agents used, we have demonstrated a level of control over the spatial distribution of nanocrystals on these tubes.

BIOGRAPHY

Professor Stanislaus S. Wong and his group have wide-ranging interests in the science of nanotechnology. The focus of the research is to understand intermolecular interactions at the nanometer scale, critical in understanding problems such as friction and lubrication, binding energies on surfaces essential for the design of effective catalysts, as well as phenomena such as chemical and biological self-assembly. Hence, we study fundamental structure-property correlations in unique nanostructures, such as carbon nanotubes and oxide nanocrystals, with an intent on exploiting them for novel applications in physics, chemistry, and biology. Some of Dr. Wong's work has been featured in a cover article in *Nature* (1998). Dr. Wong earned a B.Sc. (First Class Honours) from McGill University, received his A.M. (1996) and Ph.D. (1999) degrees from Harvard University (advisor: Charles M. Lieber), and completed a postdoctoral fellowship at Columbia University (mentor: Louis E. Brus). Since September 2000, he has been an Assistant Professor in Chemistry at SUNY Stony Brook with a joint appointment at Brookhaven National Laboratory.

T1 - Technical Session I: Nanotechnology

Direct measurements of nanoscale electronic and magnetic properties using advanced electron microscopy

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ABSTRACT

Nanoscience and engineering are considered to be the science and engineering of the new century. Unique and useful properties of a material that can impact our daily life often emerge when the structures of the material are manipulated at nano-meter scales. In this presentation, we give a brief review of the Advanced Electron Microscopy Facility at BNL and the ongoing nanoscience research associated with it. The presentation will also give an introduction to various microscopy techniques, including state-of-the-art atomic imaging, nano-probe electron diffraction, spectroscopy and holography, to reveal atomic structure, electronic structure and magnetic structure of various materials, especially superconductors and hard and soft magnetic nano assemblies.

BIOGRAPHY

YIMEI ZHU
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Education
Research Associate, Univ. of Virginia (with D. Kuhlmann-Wilsdorf, member of National Academy), 1987
Ph.D. Physics, Nagoya University (with T. Imura, recipient of Japanese Emperor Award), Japan, 1987
M.S. Physics, Nagoya University (with T. Imura), Japan 1985
B.S. Physics, Shanghai Jiao-Tong University, China 1982

Professional History
- Senior Scientist, Group Leader, Cluster Leader of NanoScience Center, BNL

1997-2002 Scientist with Tenure, Group Leader, BNL,
1993-1997 Scientist, Dept. of Applied Science, BNL,
1990-1993 Associate Scientist, Dept. of Applied Science, BNL,
1988-1990 Assistant Scientist, Dept. of Applied Science, BNL.

Research interests
Advanced electron microscopy in solid-state physics and materials science, nano-scale structures, structural defects and interfaces in transition-metal oxides and magnetic materials. Research experiences include film growth, nano-patterning and electron lithography, quantitative analysis of intensity and phase of electron diffraction, spatially resolved atomic imaging, x-ray spectroscopy and electron energy-loss spectroscopy, energy-filtered spectroscopy imaging, electron holography and in-situ Lorentz microscopy.

Grants and awards
- $1.7M annual research grant (Sole PI, DOE/BES) on “Nanostructure of advanced materials”, BNL;

- BES Chunky Bullet Competition Award (with $50K), DOE (2001);
- Program Development Award, Energy, Environment and National Security, BNL (2001);
- Microscopy & Microanalysis prize: "Advances in Instrumentation & Techniques", Microscopy Society of America (2000);
- Kazuo Award, International Federation of Societies for Electron Microscopy (1986);
- Japanese Monbusho Fellowship, (1982-1987);
- Chinese 1st Nationwide Competition for Overseas-Graduate-Study Scholarship (1982);
- Best Student Award, Shanghai Jiao-Tong University, China (1979, 1980, 1981).

Professional activities

- Coordinator, National Transmission Electron Aberration-free Microscopy project (2002, DOE/BES)
- Adjunct professor, teaching at Dept. of Materials Sciences and Engineering, SUNY Stony Brook (1999-present).
- Symposium organizer: Symposium organizer: MRS Spring Meeting (1997, 2002), MRS Fall Meeting (2002), Microscopy Society of America (1998, 1999, 2001, 2002)
- National Review Penal, Instrumentation for Major Research and Materials Research Instrumentation, NSF (2002)
- DOE Review Panel for National Center for Electron Microscopy and Center for Advanced Materials at LBL, 2000;
- Review Committee of "DOE 2000, Materials Microcharacterization Collaboratory";
- Editorial Board of MICRON, the International Research and Review Journal for Microscopy (1995- present);
- Program Committee of Microscopy and Microanalysis (1998-present);

Publications:

Authored one book and three book chapters, edited three books, published 150 papers in refereed journals and 74 in conference proceedings, and presented 53 invited talks in major international conferences.

T2 - Technical Session II: Nanotechnology

Session Chair

Benjamin Chu

State University of New York - Stony Brook

BIOGRAPHY

Professor Chu obtained his B.S., magna cum laude degree from St. Norbert College and his Ph.D. in physical chemistry from Cornell University. He was a post-doctoral student with the late Professor Peter J. W. Debye for four years before he started his academic career at the University of Kansas. In 1968, he moved to USB where he is now a Distinguished Professor.

Professor Chu was an Alfred P. Sloan Fellow, a John Simon Guggenheim Fellow, a Fellow and Visiting Professor of the Japan Society for the Promotion of Science, and a Humboldt Awardee for Senior U.S. Scientists from the Alexander von Humboldt Foundation in Germany. He is a Fellow of the American Physical Society and of the American Institute of Chemists. In 1992, he was appointed an Honorary Professor of the Chinese Academy of Sciences, in 1996, an Honorary Professor of Nankai University, and in 1998 an Honorary Professor of Xiamen University, all of PR China.

In 1993, Professor Chu received the High Polymer Physics Prize from the American Physical Society. He was the Langmuir Distinguished Lecturer sponsored by the Division of Colloid and Surface Science of the American Chemical Society in 1994, received the Award for Distinguished Service in Advancement of Polymer Science, sponsored by the Society of Polymer Science, Japan, in 1997, and the 1998 Outstanding Achievement Award of Chinese Institute of Engineers/USA.

T2 - Technical Session II: Nanotechnology

Organizer

Mow S. Lin

National Brookhaven Laboratory

BIOGRAPHY

Mow Lin, Chemist, Brookhaven National Laboratory, Ph D in chemistry, U. of Wyoming, MS in nuclear engineering, Polytech U. of NY, MBA Downling College. After two year NIH fellowship at U. Missouri, he has been working at the "Lab" since 1975. He has published more than a hundred papers and reports, granted ten US patents and won awards of R&D in biotechnology, fossil fuels and environment areas. He is currently conducting studies in nanofabrication of electronic and molecular imprinting process.

T2 - Technical Session II: Nanotechnology

Robert McGraw

Brookhaven National Laboratory

BIOGRAPHY

ROBERT L. MC GRAW, b Phillipsburg, NJ, Jan 18, 49. PHYSICAL CHEMISTRY, STATISTICAL MECHANICS. Educ: Drexel Univ, BS, 72; Univ Chicago, MS, 74, PhD(chem), 79. Prof Exp: Res assoc, Dept Chem and Biochem, Univ Calif, Los Angeles, 77-80; asst scientist, 81-83, assoc scientist 83-85, Brookhaven Nat Lab; member tech staff, 85-93, Rockwell Internat. Sci Cent; Concurrent Pos: Sci advis board, N. Am. Aircraft, div. Rockwell Internat., 90-93; SCIENTIST, BROOKHAVEN NAT LAB, 93-.
Res: Statistical mechanics; thermodynamics; nucleation phenomena, aerosols; nonlinear optics. Mailing Add: Dept Environmental Science, Bldg 815E, Brookhaven Nat Lab, Upton NY 11973.

Research Interests: I have a long-standing interest in the homogeneous and heterogeneous nucleation of supercooled vapors and liquids that began during my postdoctoral collaboration with Prof. Howard Reiss at UCLA, and has continued as a member of the scientific staff in the Atmospheric Sciences Division at Brookhaven National Laboratory. Since returning to Brookhaven, I have been Principal Investigator on a NASA program investigating nucleation and growth processes of atmospheric aerosols and clouds. Recent achievements include the successful development of computational techniques based on the method of moments for the simulation of coupled nucleation and growth processes in complex environments. These results have now been successfully applied in regional-to-global scale atmospheric models and in models of industrial processes and plumes. Other interests include development of nucleation-based scaling approaches to the calculation of molecular cluster and surface properties. I have also been collaborating for several years now with Yale University in the development of models for nano-particle formation in combustion systems using the method of moments. At the Rockwell Science Center my research centered on the statistical physics and computational modeling of light propagation and scattering in complex materials for nonlinear optics applications. Materials include liquid-phase suspensions of microparticles (artificial Kerr media), critical point fluids, and photorefractive glasses. Processes include optical beam combination, information storage, and light-scattering thermal and quantum noise. Major collaborative efforts resulted in the prediction and first observation of phase conjugation at millimeter wavelengths (with Prof. Harold Fetterman of UCLA), and noise measurements in two-wave mixing (with Prof. Roberto Pizzoferrato of the University of Rome).

T2 - Technical Session II: Nanotechnology

Combustion-Synthesized Nano-particles

Daniel E. Rosner

Yale University

BIOGRAPHY

DANIEL E. ROSNER, b. New York City, NY, USA Oct 30, '33. CHEMICAL ENGINEERING, TRANSPORT PROCESSES. *Educ*: BME 1955 (*summa cum laude*), City College of New York, PhD '61 Aero Engrg.(*Chemical Propulsion*), Princeton. *Prof. Exp.*:'69-present: Prof. Chemical Engineering (Chairperson: '84-'87, '93-'96), Yale University; Head Interface Kinetics/Transport Res. Gp., AeroChem Div. Pfaudler Corp., Princeton NJ, '67-'69; Res. Scientist '58-'67. *Res:* Transport Processes in Chemically Reacting Flow Systems, Non-equilibrium Thermodynamics, Multi-phase Reaction Engineering, Aerosol Physics/Chemistry, Combustion Synthesis/Processing of Materials. *Mailing Add:* Yale University, Mason Laboratory, 9 Hillhouse Ave., New Haven CT. 06520-8286 USA; Ph: (203)432 4391; e-mail: <daniel.rosner@yale.edu>.

Research Interests: Prof. Rosner, founder/Director of the Yale *High Temperature Chemical Reaction Engineering* (HTCRE-) Laboratory and an engineering consultant to corporations/ consortia (which have included ALCOA, Babcock & Wilcox, Dresser-Rand, duPont, EPRI, EXXON, GE, IFPRI, Pfaudler, Praxair, SCM-Chemicals and Union Carbide), is active in research on: *convective energy and mass transport in reacting multi-phases systems, phase transformations, gas dynamics, fine particle technology, and combustion*----subjects on which he has published over 250 papers and an ASEE-1988 award-winning book: entitled: ***Transport Processes in Chemically Reacting Flow Systems***, Reprinted (DOVER Paperback with Supplements) in 2000. Some recent papers particularly relevant to the subject of this Symposium* are:

"Bi-variate Moment Simulation of Coagulating and Sintering Nano-particles in Flames" *AIChE J.***48**(3) 476-491(2002) (with Pyykonen, J.J.)

"*In situ* Light Scattering Measurements of Morphologically Evolving Flame-Synthesized Oxide Nano-Aggregates", *Applied Optics* **38** (12) 2686-2697 (with Xing,Y., and U.O. Koylu)

"Prediction of Spherule Size in Gas Phase Nano-particle Synthesis", *J. Nano-particle Res.* **1**, 277-291 (1999) (with Xing, Y)

"Morphological Evolution of Oxide Nano-particles in Laminar Counterflow Diffusion Flames---Measurements and Modelling", *AIChE J.* (Special Issue on *Ceramics Processing*) **43** (11A) 2641-2649 (1997) (with Xing, Y., Koylu, U.O. and Tandon, P)

"Combustion Synthesis and Materials Processing", *Chemical Engineering Education* (ASEE), Fall 1997 Graduate Issue **31** (4) 228-235 (November 1997) *loc. cit.* **32**(1), 82-83(1998)

Princeton/BNL Nano-tech workshop* (www.eitc.org): Nov. 1,2, 2002.
Dr. Mow Lin <mow@bnl.gov>
***"Combustion-Synthesized Nano-particles", D. E. Rosner (speaker)**

T2 - Technical Session II: Nanotechnology

Nanoparticles and Nanostructures in Catalysis

Chuan-Jian Zhong* and Jin Luo

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ABSTRACT

This presentation will discuss emerging challenges and opportunities in nanostructured catalysis. We will present recent findings of an investigation of core-shell assembled metal nanoparticles as catalysts for electrooxidation of C1 molecules (e.g., CO, methanol). One of our aims is to understand the structural and morphological evolution and reconstitution upon catalytic activation. Gold and alloy nanoparticles of 2-5 nm core sizes are linked by molecular linkers into a network thin film assembly on planar substrate as a model system of the nanostructured catalyst. In addition to the detection of the potential-driven catalytic activation and the formation of surface oxygenated species, infrared reflection spectroscopy and atomic force microscopy provided important insights into the structural and morphological reconstitution of the nanostructured catalysts. Morphological changes were detected in terms of the particle size and interparticle spatial properties. The catalytic activation in alkaline electrolytes is believed to involve a partial or complete desorption of the interparticle shell components and the formation of surface oxygenated species. The findings have demonstrated that the catalytic activity of the nanostructured catalysts can be activated and controlled by manipulation of the core-shell structures and reactivities. The implication of the results to the design and preparation of nanostructured catalysts will also be discussed.

BIOGRAPHY

Professional Experience
Assistant Professor, (9/98-present), Dept of Chem., SUNY-Binghamton.
Associate Scientist, (93-98), Microanal. Instr. Center, Ames Lab, Iowa State University.
Postdoctoral Fellow, (91-92), Department of Chemistry, University of Minnesota.
Postdoctoral Fellow, (89-90), Fritz-Haber Institute, Max-Planck-Gesellschaft.

Education
Ph.D., Physical Chemistry, Xiamen University, 1988; M.S., Physical Chemistry, Xiamen University, 1985; B.S., Analytical Chemistry, Hunan University, 1982.

Selected Publications

1. M.M. Maye, S.C. Chun, L. Han, D, Rabinovich, C.J. Zhong, "Novel Spherical Assembly of Nanoparticles Mediated by a Tetradentate Thioether", *J. Amer. Chem. Soc.*, 124, 4958 (2002).
2. L. Han, D. R. Daniel, M. M. Maye, C. J. Zhong, "Core-Shell Nanostructured Nanoparticle Films as Chemically-Sensitive Interfaces", *Anal. Chem.*, 4441 (2001).
3. M. M. Maye, J. Luo, L. Han, C.J. Zhong, "Probing pH-Tuned Morphological Changes in Core-Shell Nanoparticle Assembly Using AFM", *Nano Letts.*, 1, 575 (2001).
4. W.X. Zheng, M.M. Maye, F.L. Leibowitz, C.J. Zhong, "Imparting Biomimetic Ion-Gating Recognition Properties to Electrodes with Hydrogen-Bonding Structured Core-Shell Nanoparticle Network", *Anal. Chem.*, 72, 2190 (2000).

5. J. Luo, N. Kariuki, L. Han, M. M. Maye, L. W. Moussa, S. R. Kowaleski, F. L. Kirk, M. Hepel, C. J. Zhong, "Interfacial Mass Flux at 11-Mercaptoundecanoic Acid Linked Nanoparticle Assembly on Electrodes", *J. Phys. Chem.*, in press.
6. C. J. Zhong, M. M. Maye, "Core-Shell Assembled Nanoparticles as Catalysts", *Adv. Mater.*, 13, 1507 (2001) (*invited*).
7. M. M. Maye, Y. Lou and C. J. Zhong, "Core-Shell Gold Nanoparticle Assembly as Novel Electrocatalyst of CO Oxidation", *Langmuir*, 16, 7520 (2000).
8. F. X. Zhang, W. Zheng, M. M. Maye, Y. Lou, L. Han, C. J. Zhong, "An Infrared Reflection Spectroscopic Assessment of Interfacial Derivatization and Reactivity at Inter-Shell Linked Nanoparticle Films" *Langmuir*, 16, 9639 (2000).
9. M. M. Maye, W. X. Zheng, F. L. Leibowitz, N. K. Ly, C. J. Zhong, "Heating-Induced Evolution of Thiolate-Encapsulated Gold Nanoparticles: A Strategy for Size and Shape Manipulations", *Langmuir*, *16*, 490 (2000).
10. F. L. Leibowitz, W.X Zheng, M.M. Maye, C. J. Zhong, "Structures and Properties of Nanoparticle Thin Films Formed via a One-Step Exchange-Crosslinking-Precipitation Route", *Anal. Chem.*, 71, 5076 (1999).
11. M. M. Maye, J. Luo, L. Han, C. J. Zhong, "Chemical Analysis using Scanning Force Microscopy: An Undergraduate Laboratory Experiment", *J. Chem. Edu.*, *79*, 207 (2002).

T2 - Technical Session II: Nanotechnology

Polymer Nanocomposites Technology

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ABSTRACT

Polymer nanocomposites consisting of nanosize fillers (e.g. clays and silsesquioxane molecules) and soft condensed materials (synthetic and natural polymers) can offer simultaneous improvements of mechanical and barrier properties, thermal stability, and reduced flammability. This new class of materials has found many applications in modern polymer industry. However, the improvements primarily depend on the degree of dispersion, exfoliation and orientation of nanofillers in the polymer matrix. We will describe several novel chemical and physical pathways to disperse/exfoliate these nanostructured fillers in the polymer matrix at the molecular level. In addition, we will describe the hierarchical structures (nano- to micro) in natural bone, a nanocomposite material containing nanosize inorganic apatite crystals embedded in an organic collagen matrix, and the current efforts to simulate the regeneration of bone-like materials.

BIOGRAPHY

Benjamin S. Hsiao is currently a Full Professor in the Chemistry Department at SUNY-Stony Brook. He received a B.S. degree in Chemical Engineering from National Taiwan University in 1980, a Ph.D. degree in Materials Science from University of Connecticut in 1987. He spent 2 years as a Postdoctoral Fellow in the Polymers Science and Engineering Department at University of Massachusetts (1987-1989). He worked as a Staff Scientist in DuPont Fibers from 1989-1993, and then as a Senior Scientist in DuPont Central Research & Development from 1993-1997. During his tenure in DuPont, he also held an Adjunct Associate Professor in Materials Science at University of Delaware from 1994-1997. He joined SUNY-Stony Brook in 1997. Currently he is the Spokesperson for the Advanced Polymer PRT Beamline (X27C) in the National Synchrotron Light Source, Brookhaven National Laboratory (since 1997); a Guest Professor in both Changchun Institute of Applied Chemistry and Beijing Institute of Chemistry, Chinese Academic of Sciences. He is also a co-founder (together with Benjamin Chu and Dufei Fang) of Stonybrook Technology and Applied Research, Inc., a biomedical start-up company located at Stony Brook, New York.

Benjamin Hsiao's current research interests include polymer physics (structure, morphology, property and processing) with an emphasis of nanostructured materials, and bioabsorbable polymers for biomedical applications. He is a member of Editorial Advisory Board for Journal of Macromolecular Science- Physics, Journal of Polymer Research and High Performance Polymers. His research activities have been supported by National Science Foundation, National Institutes of Health, National Institute of Standards and Technology, Department of Energy, Department of Defense, Center of Biotechnology in the New York State and several industrial companies.

T2 - Technical Session II: Nanotechnology

Electrospinning and the Use of Nanostructured Polymers for Biomedical Applications

Benjamin Chu

State University of New York - Stony Brook

ABSTRACT

A unique class of FDA-approved bioabsorbable non-woven membranes containing nanoscale filaments has been developed by scientists from Stonybrook Technology and Applied Research (STAR), and faculty members from the State University of New York at Stony Brook (SUNYSB) using a combination of chemical modifications and innovative processing technology, such as electrospinning. The products can be used to deliver medications at controlled rates; they can also be used as a new class of bioabsorbable scaffolds with controlled degradation rates and cell-compatibility for anti-adhesion applications. Some recent results will be presented.

BIOGRAPHY

Professor Chu obtained his B.S., magna cum laude degree from St. Norbert College and his Ph.D. in physical chemistry from Cornell University. He was a post-doctoral student with the late Professor Peter J. W. Debye for four years before he started his academic career at the University of Kansas. In 1968, he moved to USB where he is now a Distinguished Professor.

Professor Chu was an Alfred P. Sloan Fellow, a John Simon Guggenheim Fellow, a Fellow and Visiting Professor of the Japan Society for the Promotion of Science, and a Humboldt Awardee for Senior U.S. Scientists from the Alexander von Humboldt Foundation in Germany. He is a Fellow of the American Physical Society and of the American Institute of Chemists. In 1992, he was appointed an Honorary Professor of the Chinese Academy of Sciences, in 1996, an Honorary Professor of Nankai University, and in 1998 an Honorary Professor of Xiamen University, all of PR China.

In 1993, Professor Chu received the High Polymer Physics Prize from the American Physical Society. He was the Langmuir Distinguished Lecturer sponsored by the Division of Colloid and Surface Science of the American Chemical Society in 1994, received the Award for Distinguished Service in Advancement of Polymer Science, sponsored by the Society of Polymer Science, Japan, in 1997, and the 1998 Outstanding Achievement Award of Chinese Institute of Engineers/USA.

T3 - Technical Session III: System-on-Chip (SoC)

Session Chair

Ruby Lee

Department of Electrical Engineering
Princeton University

BIOGRAPHY

Ruby B. Lee joined Princeton University in September 1998 as the Forrest G. Hamrick Professor of Engineering and Professor of Electrical Engineering with an affiliated appointment in the Computer Science department. She is the director of the Princeton Architecture Laboratory for Multimedia and Security (PALMS). Her research is in designing security and new media support into core computer and communications architecture.

Prior to joining the Princeton faculty, Dr. Lee served as chief architect at Hewlett-Packard, responsible at different times for processor architecture, multimedia architecture and security architecture for e-commerce and extended enterprises. She was a key architect in the initial definition and the evolution of the PA-RISC processor architecture used in HP servers and workstations. Dr. Lee also co- led an Intel-HP multimedia architectural team for IA-64, recently released in Intel's Itanium microprocessors. As chief architect for HP's inter-disciplinary multimedia architecture team, Dr. Lee introduced innovative multimedia instruction-set architecture (MAX and MAX-2) in microprocessors, resulting in the industry's first real-time, high fidelity MPEG video and audio player, implemented entirely in software, on low-end desktop computers. Subsequently, every major microprocessor family has implemented similar subword-parallel, multimedia instructions in their instruction-set architectures, enabling more pervasive multimedia information processing. Concurrent with full-time employment at HP, Dr. Lee also served as Consulting Professor of Electrical Engineering at Stanford University.

Dr. Lee has a Ph.D. in Electrical Engineering and a M.S. in Computer Science, both from Stanford University, and an A.B.(with distinction) from Cornell University, where she was in the College Scholar program. She is a Fellow of ACM, a senior member of IEEE, and a member of Phi Beta Kappa and Alpha Lambda Delta. She has been granted 88 U.S. and international patents, with several patent applications pending.

T3 - Technical Session III: System-on-Chip (SoC)

Organizer

Richard Wang

IBM T. J. Watson Research Center

BIOGRAPHY

Dr. Li-Kong Wang received his Ph.D. degree in Physics from the University of Virginia in 1978. He worked at the AT&T Bell Laboratories from 1979 to 1983, and the IBM Thomas J. Watson Research Center from 1983 to 2002. Dr. Wang has reached the 17th IBM invention plateau with 70 patents filed. He has also received the IBM outstanding technical achievement award for the design of G4 processors, the IBM outstanding technical achievement award for 0.5um CMOS technology, the IBM technical group award for the x-ray lithography device program, and the IBM technical group award for 1um CMOS 64K SRAM process development.

T3 - Technical Session III: System-on-Chip (SoC)

Configurable Security Modules for System-on-Chip Designs

Ruby Lee and Zhijie Shi

Department of Electrical Engineering
Princeton University

ABSTRACT

Many applications using SOCs need security functions like message confidentiality, data integrity, user authentication, service availability and digital rights management. While there are cryptographic algorithms that can achieve some of these security functions, just including IP-cores for cryptographic algorithms on the SOC does not guarantee the security of the system. Any tiny mistake in design or usage may break the whole system, voiding all security measures. To allow SOCs to include security features without significantly delaying the development cycle, we propose the addition of flexible and configurable security modules that can be added to SOC designs. The flexibility comes from the inclusion of a programmable crypto-processor that can execute any cryptographic algorithm - whether standard, proprietary or new - very quickly. The security module also includes other security features, which are parameterized and scalable. The security module is also configurable. This includes secure initialization of the security module, as well as configuration and re-configuration of the security module in the field by authorized users. Such configurable and flexible security modules allow the designer to implement security features in SOCs without becoming a security expert, and hence preserve the time-to-market advantage of SOC designs.

BIOGRAPHY

Ruby B. Lee joined Princeton University in September 1998 as the Forrest G. Hamrick Professor of Engineering and Professor of Electrical Engineering with an affiliated appointment in the Computer Science department. She is the director of the Princeton Architecture Laboratory for Multimedia and Security (PALMS). Her research is in designing security and new media support into core computer and communications architecture.

Prior to joining the Princeton faculty, Dr. Lee served as chief architect at Hewlett-Packard, responsible at different times for processor architecture, multimedia architecture and security architecture for e-commerce and extended enterprises. She was a key architect in the initial definition and the evolution of the PA-RISC processor architecture used in HP servers and workstations. Dr. Lee also co- led an Intel-HP multimedia architectural team for IA-64, recently released in Intel's Itanium microprocessors. As chief architect for HP's inter-disciplinary multimedia architecture team, Dr. Lee introduced innovative multimedia instruction-set architecture (MAX and MAX-2) in microprocessors, resulting in the industry's first real-time, high fidelity MPEG video and audio player, implemented entirely in software, on low-end desktop computers. Subsequently, every major microprocessor family has implemented similar subword-parallel, multimedia instructions in their instruction-set architectures, enabling more pervasive multimedia information processing. Concurrent with full-time employment at HP, Dr. Lee also served as Consulting Professor of Electrical Engineering at Stanford University.

Dr. Lee has a Ph.D. in Electrical Engineering and a M.S. in Computer Science, both from Stanford University, and an A.B.(with distinction) from Cornell University, where she was in the College Scholar program. She is a Fellow of ACM, a senior member of IEEE, and a

member of Phi Beta Kappa and Alpha Lambda Delta. She has been granted 88 U.S. and international patents, with several patent applications pending.

Zhijie Shi is a Ph.D. student in electrical engineering at Princeton University. His research interests include computer architecture for cryptography, fast permutation operations, and secure configuration schemes for System-on-Chip designs. He received a B.E. and M.E. in Computer Science from Tsinghua University, China, and an MA in Electrical Engineering from Princeton University. His Ph.D. degree in Electrical Engineering is expected in 2003.

T3 - Technical Session III: System-on-Chip (SoC)

IC Design Industries and Governmental R&D Funding Policies in Taiwan

Wen-Tsuen Chen

Professor, Department of Computer Science
Dean, College of Electrical Engineering and Computer Science
National Tsing Hua University

ABSTRACT

In recent years, we have witnessed the proliferation of IC design companies in Taiwan. IC design industry plays an important role in supporting IT industries in Taiwan. For example, the LAN chips, PC chipsets, and CD/DVD-ROM controllers design companies have made the LAN, PC, CD/DVD industries and others the most successful ones in the world markets. IC design has been recognized as one of the most important segment of the IT industries, as evidenced by the governmental efforts in promoting IC Design through the National System-on-Chip (SoC) Project, beginning in 2001. In this talk, we first review development of IC industry and governmental efforts in promoting high-tech industries. Then we present the high-tech R&D funding mechanisms of the Ministry of Economic Affairs. We conclude this talk by assessing the impacts of these mechanisms on the development of IC design industry.

BIOGRAPHY

Wen-Tsuen Chen received the B.S. degree in nuclear engineering from National Tsing Hua University, Taiwan, Republic of China, and the M.S. and Ph.D. degrees in electrical engineering and computer sciences both from University of California at Berkeley, in 1970, 1973, and 1976, respectively.

He has been with the National Tsing Hua University since 1976 and is currently a Professor of the Department of Computer Science. From 1983 to 1988 he served as the Chairman of the Department. In 1980, he was a Visiting Professor in the Department of Electrical Engineering and Computer Sciences of the University of California at Berkeley. From 1988 to 1996, he has been a member of the Science and Technology Advisory Office of the Ministry of Education, Republic of China. From 1992 to 1996, he served as the Director of the above Advisory Office. He is currently the Director of the Computer and Communication Research Center, and the Dean of the College of Electrical Engineering and Computer Science, National Tsing Hua University. From 1990 to 2001, he has been a Co-Chairman and the General Secretary of the Technical Evaluation Board of the Ministry of Economic Affairs for Promoting High-Tech Products and Technologies. He is currently the Chairman of the above Evaluation Board. His research interests include computer networks, wireless Internet, multimedia communications, and parallel algorithms.

In 1994, Dr. Chen received the Academic Award in Engineering from the Ministry of Education, the most prestigious engineering award given annually by the Ministry of Education to a researcher with outstanding academic achievement. From 1996 to 2001, he was an Outstanding Scholarship Chair, a prestigious chair endowed by the Foundation for the Advancement of Outstanding Scholarship, founded by Nobel Laureate Dr. Y. T. Lee. He was a recipient of the Technical Achievement Award of the IEEE Computer Society in 1999 and the Dr. W. Y. Pan Outstanding Research Award in 2000. From 1996 to 2001, he was a Research Fellow of the National Science Council. In 2001 he was elected as a National Chair of the Ministry of Education for his contributions to software engineering, parallel processing, and

computer networking. In 1984, 1993, and 1995, he served as an IEEE Distinguished Visitor in region 10. He has also served as a member of the Board of Directors of the IEEE Taipei Section. Dr. Chen was the General Chair of the 2000 IEEE International Conference on Distributed Computing Systems and the Founding General Chair of the IEEE International Conference on Parallel and Distributed Systems. He is an IEEE Fellow and a member of the Chinese Institute of Engineers, the Chinese Institute of Electrical Engineers, and Phi Tau Phi.

T3 - Technical Session III: System-on-Chip (SoC)

Design Methodology for Wireless SoC

Stella Kuei-Ann Wen

National Chiao-Tung University

ABSTRACT

Due to the demands of multi-standards and user-friendly interface of target wireless communication systems, one of the key research issues in system realization is the reasonable development cost and turnaround time, no matter how system complexity is implied. In addition, due to the advance of VLSI technology, more functions can be integrated on a single chip to reduce system realization cost. The system-on-a-chip (SOC) design technology becomes a key for those innovative system explorations that would survive in the highly competitive world-wide technologies in the coming century. As a result, in this presentation, we would like to explain the thorough design flow development in NCTU with the long term cooperation with EDA, foundry, package, testing and even PCB manufactures. With the design flow being developed with the target for wireless design, RF, analog, digital, software portions are all included. Test design on Bluetooth, 802.11A/B had been done with this design flow and it proves that the design flow can drive a complete design platform to facilitate wireless SoC design. Moreover the design environment and flow is set up to reach more solid research results which are expected to improve the quality of local high-tech education as well as to promote the international visibility of local academic research.

BIOGRAPHY

Stella Kuei-Ann Wen received her B.S., M.S. and Ph.D. degrees in electrical engineering from National Cheng-Kung University, Taiwan, in 1983, 1985 and 1988, respectively. She is currently a full Professor in the Dept. of EE at National Chiao-Tung University, Taiwan. Dr. Wen's research interests are in the areas of SoC design and VLSI wireless communication circuit/system also including RF circuits and baseband design. She covers and enhances the curriculum for SoC integration, VLSI computing & signal processing, and RF wireless communication.

Stella has been involved in several key research projects including *advanced IC/VLSI for academic excellence*, and *technology transfer for successful high-tech*. She also set up the research cooperation laboratories with Agilent, Mentor Graphics and Synopsys for the development of wireless SoC design automation as well as the flow for industrial experts. Besides, she leads the Trans. Wireless Technology (TWT) Laboratory sponsored by United Microelectronics Co. (UMC) for the development of advanced CMOS RF. She also serves as vice president of IP Center and the leader of SoC Center at NCTU.

Dr. Wen plays a key role in *Si-soft Grand Project in Taiwan* to facilitate IP and SoC Design Services that best linking with foundry powerhouses such as TSMC and UMC to facilitate international SoC development. Stella receives numerous awards and recognition from her research achievements and service contributions. Her participation at Editorial Board of IEEE Transactions on VLSI Systems will gives her the great opportunity to serve large IEEE membership.

T3 - Technical Session III: System-on-Chip (SoC)

System-on-a-chip and the Coming Design Revolution

Stephen Edwards

Department of Computer Science
Columbia University

ABSTRACT

The ongoing onslaught of Moore's Law has made once unimaginable levels of integration an everyday thing. The circuity in the nightstand-sized PDP-8 in my colleague's office can now be implemented in less than a square millimeter of chip area. Furthermore, its design complexity is now considered low enough to give as a project to beginning students.

What will we do with this ability to build fantastic, tiny, complex, intelligent devices? Simply put, put them everywhere. The ubiquity of cell phones, DVD players, and digital cameras are just the harbingers of a major change in the objectives of information technology. Instead of clunky, general-purpose computing systems that must do everything with mediocrity, the focus will shift to systems designed to do one or a few things.

Such embedded systems consist of an enormous amount of circuitry integrated on a chip running a stunning amount of software. Modern cell phones have something like a million lines of code in them, and this number will only grow. Designing such large systems "from scratch" is simply impractical; the ability to assemble systems from components is becoming crucial, yet tools and methodologies to do this effectively remain in their infancy.

The need to verify these systems before they are fabricated also brings a host of new problems. Previously, it was practical to build a prototype on a printed circuit board and debug the software on it, but now these systems are much too complicated to prototype this way. Instead, these systems must be verified before a single transistor is built, which can currently only be done using a mismash of simulation (slow, incomplete) and formal (more complete, but capacity-limited and difficult) techniques. Designers cry out for a better way to do this.

I believe better languages that facilitate correctly assembling large systems from pieces will be part of the eventual solution. In this talk, I will survey the state-of-the-art in this area and discuss some possible ways in which it can be improved.

BIOGRAPHY

Stephen A. Edwards received the B.S. degree in Electrical Engineering from the California Institute of Technology in 1992, and the M.S. and Ph.D degrees, also in Electrical Engineering, from the University of California, Berkeley in 1994 and 1997 respectively.

He is currently an assistant professor in the Computer Science Department of Columbia University in New York, which he joined in 2001 after a three-year stint with Synopsys, Inc., in Mountain View, California.

His research interests include embedded system design, domain-specific languages, and compilers. He is the author of Languages for *Digital Embedded Systems* (Boston: Kluwer, 2000) as well as numerous journal and conference papers. He is a recipient of the NSF CAREER Award.

T3 - Technical Session III: System-on-Chip (SoC)

A 2.9ns Random Access Embedded DRAM Macro with Destructive Read Architecture and Direct Sensing

Chorng-Lii Hwang

IBM T. J. Watson Research Center

ABSTRACT

A Destructive-Read architecture that reduces memory random access cycle time by delaying the write back operation to a later cycle is demonstrated. A single-ended direct sensing scheme is employed to further speed up the read and write operations. A prototype design fabricated in a 0.13um logic-based embedded DRAM technology is shown to improve the random access cycle time to 2.9ns.

BIOGRAPHY

Chornglii Hwang received his Ph.D. in electrical engineering from Yale University, New Haven, CT in 1994. He has worked in IBM Microelectronics for 8.5 years on DRAM technology and design. He is currently working on high speed serial link development. He is a senior engineer in IBM.

T3 - Technical Session III: System-on-Chip (SoC)

Dynamic Power Management Techniques for System-On-a-Chip

Suhwan Kim, Wei Hwang, and Stephen Kosonocky

IBM T. J. Watson Research Center
Yorktown Heights, NY 10598
suhwan@us.ibm.com

ABSTRACT

Advances of integrated circuit technology have enabled development of complex system-on-a-chip (SoC). As SoC products such as handheld computer systems become more miniaturized and inexpensive, more demands on speed or performance are constantly being required of them. Since more power is required for faster and more powerful SoCs, innovative solutions are required to conserve power and thereby extend the battery operating duration. Recently, the dynamic choices of power management have been studied, because non-uniform workloads during the operation time are common in communication networks and in almost any interactive system. It minimizes power under performance constraints or maximize performance under power constraints. Since each core or macro may come with different power and performance characteristics from a different source, however, designing a SoC supports dynamic power management is difficult and error-prone process. In this paper, we will review key dynamic power management techniques that are emerging for SoCs and also discuss the industrial trends of strategies to address these problems.

BIOGRAPHY

Suhwan Kim received the Ph.D degree in Electrical Engineering and Computer Science at the University of Michigan, Ann Arbor in 2001. Dr. Kim joined IBM T.J. Watson Research Center in 2001, where he currently is Research Staff Member. His research interests encompass high-performance and low-power circuits/micro-architecture and low-power design methodologies for high-performance VLSI signal processing.

Dr. Kim has received the 1994 Best Student Paper Award of the IEEE Korea Section and the First Prize in the VLSI Design Contest of the 2001 ACM/IEEE Design Automation Conference. He currently participates in the Technical Program Committee of the IEEE International ASIC/SOC Conference.

T4 - Technical Session III: Bioinformatics

Session Chair and Organizer

Ruhong Zhou

IBM T. J. Watson Research Center

BIOGRAPHY

Dr. Ruhong Zhou received his B.S in Physics (1988) and M.S in Theoretical Physics (1990) from Zhejiang University, China. He then joined the faculty (lecturer and then assistant professor) of Physics Department, Zhejiang University. He came to United States and enrolled in Columbia University in 1994, and received his Ph.D. in Chemistry from Columbia University with Prof. Bruce Berne in 1997. He joined IBM's Thomas J Watson Research Center as a staff scientist in 2000, working on protein folding and protein structure prediction projects along with many other IBM scientists worldwide. Before joining IBM, Dr. Zhou worked for Schrodinger as a senior scientist on polarizable force field development and ligand-receptor binding affinity predictions along with Prof. Richard Friesner (Columbia) and Prof. William Jorgensen (Yale). He is author of 48 publications and 3 patents. Dr. Zhou also won the Hammett Award from Columbia University and ACS Award on Computational Chemistry (for graduate students) from American Chemical Society.

T4 - Technical Session III: Bioinformatics

High-Performance Computing Needs in Pharmaceutical Discovery

Terry R. Stouch

Bristol-Myers Squibb Pharmaceutical Research Institute
P.O. Box 5400
Princeton, NJ 08543-5400

ABSTRACT

Questions posed by pharmaceutical research challenge the capabilities of computational chemistry on all fronts. Accuracy, precision, speed, and interpretability are all currently insufficient for computation to realize its desired potential. Current and desired future aspects of computation will be discussed; including structural genomics, dynamical simulation, ligand design, and chemical property calculation. Issues will include required advancements in molecular and atomic modeling sciences, increases in computational capability, and software enhancements to ease use and processing of results.

BIOGRAPHY

Terry Stouch is a Principal Scientist in the Macromolecular Structure Division of the Bristol-Myers Squibb Pharmaceutical Research Institute in Princeton, New Jersey, USA where he has been since 1989. In the Department of Computer-Assisted Drug Design, he uses supercomputers to study large biological molecules and biomolecular complexes and assists in the development of new pharmaceuticals through the application of molecular modeling and other computational methods. He is responsible for the in silico predictive ADME (Absorption, Distribution, Metabolism, Excretion) effort at BMS which seeks to improve the quality of drug candidates by improving their physical and biological properties and profiles.

Prior to this, he was a research scientist in the protein crystallography laboratory at the Naval Research Laboratory (NRL) in Washington D.C. and an independent consultant in computer-aided drug design and patenting issues. Under an Office of Naval Technology Postdoctoral Fellowship in the Laboratory for the Structure of Matter at the NRL, he pioneered some of the first supercomputing simulations of biological membranes, which he continues in studies of membrane permeation by drugs and in studies of the structure and dynamics of integral membrane proteins. Both his Ph.D. in chemistry (1985, with Prof. Peters Jurs) and B.S. in biochemistry (1980) were earned at the Pennsylvania State University.

His research interests include studies of molecular "potential energy functions" (for molecular modeling and molecular dynamics simulations), studies of molecular electrostatics, computer simulations of biomolecules, water and solvent structure, and methods of computer aided drug design, including pattern recognition, statistical analysis, database search, and molecular comparison.

He is author of over 45 publications and has presented over 90 invited lectures.

T4 - Technical Session III: Bioinformatics

Gene expression microarray analysis: from technology to application

Yuhai Tu

IBM T. J. Watson Research Center
Yorktown Hieghts, NY 10598'

ABSTRACT

The ultimate goal of genome projects is to assign and understand the functions of all newly discovered proteins. A complete understanding of protein functions requires the knowledge of the structures of all
proteins. This is the task of structural genomics projects – a large-scale structural determination by experimental techniques. However, not all structures of proteins can be solved by experimental techniques. Thus, the development and application of theoretical and bioinformatic tools for structure validation, refinement, and prediction are essential for the successful completion of genome projects.

The backbone of the current state-of-art structure prediction algorithms is knowledge-based potential derived from known protein structures. Despite more than 10 years of efforts, the best predicted structures for most proteins targeted in the recent blind predictions (CASP IV) are still not accurate enough for functional studies. Thus, there is an urgent need for the improvement of potentials that describe the interactions between amino acid residues and between amino acid residues and aqueous environment.

Knowledge-based potentials are also called statistical potentials because they were all generated by employing statistical methods. In this talk, we shall show how the principal of statistical mechanics can be utilized to improve the quality of extracted potentials for structure selection and stability prediction.

BIOGRAPHY

Education
Ph. D., Physics, September, 1991 University of California, San Diego
M.S., Physics, September, 1988 University of California, San Diego
B.S., Physics, July, 1987 University of Science and Technology of China

Research Interests
Biophysics; Statistical Physics; Dynamical Systems; Pattern Formation;
Growth Phenomena in Material Science

Research Experience
Research Staff Member, Physical Sciences Department
IBM T. J. Watson Research Center, Yorktown Heights 1994-present
Division Prize Research Fellow, California Institute of Technology, 1991-1994

T4 - Technical Session III: Bioinformatics

New knowledge-based potentials from known protein structures

Yaoqi Zhou

HHMI Center for Single Molecule Biophysics
Department of Physiology/Biophysics
State University of New York
Buffalo, NY 14214

ABSTRACT

The ultimate goal of genome projects is to assign and understand the functions of all newly discovered proteins. A complete understanding of protein functions requires the knowledge of the structures of all proteins. This is the task of structural genomics projects – a large-scale structural determination by experimental techniques. However, not all structures of proteins can be solved by experimental techniques. Thus, the development and application of theoretical and bioinformatic tools for structure validation, refinement, and prediction are essential for the successful completion of genome projects.

The backbone of the current state-of-art structure prediction algorithms is knowledge-based potential derived from known protein structures. Despite more than 10 years of efforts, the best predicted structures for most proteins targeted in the recent blind predictions (CASP IV) are still not accurate enough for functional studies. Thus, there is an urgent need for the improvement of potentials that describe the interactions between amino acid residues and between amino acid residues and aqueous environment.

Knowledge-based potentials are also called statistical potentials because they were all generated by employing statistical methods. In this talk, we shall show how the principal of statistical mechanics can be utilized to improve the quality of extracted potentials for structure selection and stability prediction.

BIOGRAPHY

Dr. Yaoqi Zhou earned a B.S. degree in Chemical Physics from University of Science and Technology of China in 1984 and a Ph.D. degree in Chemical Physics from State University of New York at Stony Brook in 1990. After graduation, he took a research position in a newly-founded company, Applied Physics and Chemistry Laboratory in southern California. In 1994, he came back to academics. He worked as a postdoctoral research fellow first with Dr. Carol Hall at North Carolina State University and then with Dr. Martin Karplus at Harvard University after receiving the awards of NSF and NIH postdoctoral fellowships. Since 2000, he is an Assistant Professor at State University of New York at Buffalo.

T4 - Technical Session III: Bioinformatics

Protein structural codes: applications in protein sequence and structure analyses

An-Suei Yang

Department of Pharmacology
Columbia University, 630 West 168th
St., New York, NY 10032

ABSTRACT

One of the main tasks in functional genomics projects is to identify sequence-structure-function relationships for proteins in sequence and structure databases. Sequence motifs are useful discriminators in sequence family diagnosis. Computational procedures in local structure prediction are used to associate structural information with sequence motif databases. Structures for sequence motifs provide structural context to enhance the prediction capacities in sequence motif search procedures.

BIOGRAPHY

POSITION: Assistant professor, Department of Pharmacology and Columbia Genome Center, Columbia University.

ADDRESS: Department of Pharmacology, Columbia University, 630 West 168th St., New York, NY 10032

EDUCATION:

National Tsing Hua University, Taiwan	B.S. 1979 Chemistry
Johns Hopkins University, Baltimore	Ph.D 1986 Chemistry

T4 - Technical Session III: Bioinformatics

Blue Gene: Protein folding with molecular dynamics

Ruhong Zhou

Computational Biology Center
IBM T. J. Watson Research Center
Yorktown Heights, NY 10598

ABSTRACT

Computer simulations of large biomolecular systems are computationally demanding tasks due to the complex systems and long timescales involved. In this talk, I will be describing some of the early results from the Blue Gene science project that we have been working on recently. The talk will be mainly focused on novel molecular dynamics and Monte Carlo algorithms developed for protein folding studies. Also, a new Linear Response Method for ligand-receptor binding affinity prediction and its application to various binding sets will be presented. I will also spend some time to go over the Blue Gene hardware project, including its goals, architecture, parallelization, software development, etc.

BIOGRAPHY

Dr. Ruhong Zhou received his B.S in Physics (1988) and M.S in Theoretical Physics (1990) from Zhejiang University, China. He then joined the faculty (lecturer and then assistant professor) of Physics Department, Zhejiang University. He came to United States and enrolled in Columbia University in 1994, and received his Ph.D. in Chemistry from Columbia University with Prof. Bruce Berne in 1997. He joined IBM's Thomas J Watson Research Center as a staff scientist in 2000, working on protein folding and protein structure prediction projects along with many other IBM scientists worldwide. Before joining IBM, Dr. Zhou worked for Schrodinger as a senior scientist on polarizable force field development and ligand-receptor binding affinity predictions along with Prof. Richard Friesner (Columbia) and Prof. William Jorgensen (Yale). He is author of 48 publications and 3 patents. Dr. Zhou also won the Hammett Award from Columbia University and ACS Award on Computational Chemistry (for graduate students) from American Chemical Society.

Day 2

Opening Remarks

Conference Chair

Sun-Yuan Kung

Princeton University

BIOGRAPHY

Professor Sun-Yuan Kung received his Ph.D. Degree in Electrical Engineering from Stanford University. Since 1987, he has been a Professor of Electrical Engineering at the Princeton University. In 1974, he was an Associate Engineer of Amdahl Corporation, Sunnyvale, CA. From 1977 to 1987, he was a Professor of Electrical Engineering-Systems of the University of Southern California, L.A. In 1984, he was a Visiting Professor of the Stanford University and the Delft University of Technology. In 1994 he was a Toshiba Chair Professor at Waseda University, Japan, and a Honorary Professor, Central China University of Science and Technology, China. In 2001, he was a Distinguished Chair of Multimedia Signal Processing, Hong Kong Polytechnic University, Hong Kong. His research interests include VLSI array processors, image/video/multimedia signal processing, neural networks for biometric and bioinformatic signal processing, and wireless digital communication.

Since 1990, he has served as an Editor-In-Chief of Journal of VLSI Signal Processing Systems. He was appointed as the first Associate Editor in VLSI Area (1984) and the first Associate Editor in Neural Network (1991) of the IEEE Transactions on Signal Processing. He served as a member of IEEE SPS (Signal Processing Society) Administration Committee (1989-1991). He was a founding member of IEEE-SPS Technical Committees (TC) on VLSI Signal Processing, TC on Neural Networks, and TC on Multimedia Signal Processing. He served as a founding member and General Chairman of various international conferences, including IEEE Workshops on VLSI Signal Processing, IEEE Workshops on Neural Networks and Signal Processing, IEEE Workshops on Multimedia Signal Processing, International Conference on Application Specific Array Processors, and International Computer Symposium.

Professr Kung has authored more than 300 technical publications. He has authored three books ``VLSI Array Processors'', (P-H, 1988) (with Russian and Chinese translations); ``Digital Neural Networks'', P-H, 1993; and ``Principal Component Neural Networks'', John-Wiley, 1996. He has edited numerous reference books, including: "VLSI and Modern Signal Processing," Prentice-Hall, 1985. (with Russian translation), ``VLSI Signal Processing, Vol.I&II (IEEE Press), ``Neural Networks for Signal Processing, Vol. I,II & III (IEEE Press), ``Multimedia Signal Processing, Vol. I (IEEE Press) and ``Systolic Arrays'', 1988, ``Application-Specific Array Processors, (IEEE Computer Society Press). He has recently co-edited a book on ``Multimedia Image and Video Processing'', CRC Press, 2001.

Dr. Kung is a Fellow of IEEE since 1988. He was the recipient of 1992 IEEE Signal Processing Society's Technical Achievement Award for his contributions on "parallel processing and neural network algorithms for signal processing". He was appointed as an IEEE-SP Distinguished Lecturer in 1994. He received 1996 IEEE Signal Processing Society's Best Paper Award for his publication on principal component neural networks. He was a recipient of the IEEE Third Millennium Medal in 2000.

P3 - Plenary Session III: System-on-Chip

Session Chair

Wei Hwang

National Chiao-Tung University

BIOGRAPHY

Dr. Hwang is the Director of Microelectronic and Information Systems Research Center and Professor of Electronics Engineering Department of National Chiao-Tung University in Hsinchu, Taiwan since August 2002. Prior to that, he was a Research Staff Member at the IBM Thomas J. Watson Research Center, Yorktown Heights, NY from 1984 to 2002. He also served as an Adjunct Professor of Electrical Engineering at Columbia University in New York, NY from 1993 to 2001. He was Associate Professor of Electrical Engineering Department at Columbia University in New York from 1979 to 1984.He was Assistant Professor of Electrical Engineering at Concordia University in Montreal from 1975 to 1978. He received his M.S. and Ph.D. degrees from the University of Manitoba in 1970 and 1974 respectively, his M.S. degree from National Chiao-Tung University in 1967, and his B.S. degree from National Cheng-Kung University in 1964. His interests are in the general area of VLSI circuits and technology, semiconductor memories, high-frequency server microprocessors, and embedded systems. His current research interests are in low power SoC design and technology, emerging information technology, systems and applications. He has received several IBM Awards, including sixteen Invention Achievement Awards and four Research Division Technical Awards and has been elected an IBM Master Inventor. He holds 106 internation patents (including 53 U.S. patents). He has authored or coauthored one book, and over 110 technical papers in journals and conferences. Dr. Hwang is a Fellow of the IEEE.

P3 - Plenary Session III: System-on-Chip

Systems-on-Chip

Reinaldo Bergamaschi

IBM T. J. Watson Research Center
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ABSTRACT

In the last 20 years embedded systems have become the most widespread carriers of advanced hardware and software technologies. In this period the technologies implementing embedded systems evolved from micro-controllers and discrete components to fully integrated systems-on-chip (SoC). SoCs and related technologies are the engines of embedded systems today and in the foreseeable future.

New and very demanding applications have appeared in the last 20 years, fueled by the boom of the PC, the Internet, and the home, office and wireless environments. These applications demanded processing power and levels of hardware integration much greater than could be offered by integrating discrete components on a printed circuit board. Product cycles continue to shrink as evidenced by the adoption rate of consumer electronics items. While color TV took over 10 years to sell 1 million units, DVD players took just over 1 year. This puts strong requirements on productivity increases and cost reduction.

CMOS technologies have evolved significantly in the last several years, allowing chip capacity to follow Moore's law and produce chips with over 70 million gates and gate delays of around 21ps. Large gate counts and high operating frequencies allied with new chip architectures led to considerable increases in processing power. At the same time, new design tools and methodologies were developed, which were able to take advantage of complex process technologies and deliver highly complex chips.

The concept of systems-on-chip is unique in leveraging the new technologies and architectures in order to provide the processing power and productivity increases needed by the new applications. Systems-on-chip started with the idea of integrating all components in a board into a single chip. To increase the productivity for future designs, the approach of reusable components was adopted. However, in the early days of SoCs, components were not really designed for reuse. The lack of standard deliverables as well as multiple interface protocols made it difficult for components to be taken from one design and reused in the next without modifications. Gradually component design evolved to include more parameterization, deliverables such as synthesis scripts and test vectors, and standard interfaces. This evolution led to a new industry devoted solely to the development of intellectual property cores (IPs), as the reusable building blocks of systems-on-chip.

The majority of embedded applications can be implemented on architectures built using common architectural blocks and customized with application specific components. Hence it was logical for SoC providers to develop these common architectural blocks formed by a CPU communicating with peripherals and memory over one or more shared busses. The common architectures typically include a CPU, memory and peripherals communicating over a fast bus (for the CPU and memory) and a slow bus (for the peripherals). This initial configuration can be extended with an MPEG decoder for video applications, or with an Ethernet controller for communications applications. These common architectures and the supporting technologies (IP libraries and tools) are called platforms and platform-based designs.

The factors above led to the current state-of-the-art in SoCs as IP-based, Platform-based systems-on-chip. These SoCs are systems that contain IP blocks such as embedded CPUs, embedded memory, real world interfaces (e.g., PCI, USB, Ethernet), mixed-signal blocks, and software components, such as device drivers, real-time operating systems and application code. The advent of SoCs has become an absolute necessity for embedded systems companies to remain competitive. Designing an SoC, however, is extremely complex, as it encompasses a range of difficult problems in hardware and software design.

At the same time that advanced technologies are key enablers of SoCs, the complexities of deep sub-micron scaling also cause significant problems. Power dissipation, signal integrity, technology integration and cost are challenges that will need to be solved if SoCs are to continue increasing in complexity in future deep sub-micron technologies.

This presentation provides an overview of the most important issues involved with SoC design, including challenges associated with deep sub-micron technology scaling, and details on the SoC design methodology and tools. One important aspect of an SoC is that it is significantly more complex to design than a traditional ASIC (application specific integrated circuit). Although both SoCs and ASICs can be very large, ASICs are simpler to design because its optimization metrics are usually area and delay, whereas SoC design involves a multi-domain optimization problem. For example, even if the clock period target of the SoC is met, it may not work properly because of wrong architectural decisions, inefficient software or signal integrity problems due to mixed signal IP. In SoC design the high-level design decisions (e.g., architecture, software) are much more interdependent on the low level design decisions (logic synthesis, layout, technology), than in ASIC design. This cross-domain optimization problem makes the SoC design much more complex thus requiring specialized tools and methodologies.

BIOGRAPHY

Reinaldo Bergamaschi graduated in Electronics Engineering (with Honors) from the Aeronautics Institute of Technology, Sao Jose dos Campos, Brazil, in 1982, and in 1984 he received the M.E.E degree (with Distinction) from the Philips International Institute, Eindhoven, The Netherlands. In 1989 he obtained the Ph.D. Degree in Electronics and Computer Science from the University of Southampton, England, and joined the IBM Thomas J. Watson Research Center, Yorktown Heights, USA. He has worked on several high-level tools and methodologies with the goal of improving design quality and productivity. His current interests are embedded systems design, high-level design languages and systems-on-chip.

P3 - Plenary Session III: System-on-Chip

Design Challenges for Systems-on-Chips

Wayne Wolf

Princeton University

ABSTRACT

Systems-on-chips open many new applications: communications, multimedia, etc. However, designing systems-on-chips requires design teams to master many new skills. This talk will cover some of the important problems in system-on-chip design methodologies, including embedded software, application-specific heterogeneous processors, and the role of mixed-signal design.

BIOGRAPHY

Wayne Wolf is professor of electrical engineering at Princeton University. Before joining Princeton, he was with AT&T Bell Laboratories, Murray Hill, New Jersey. He received the B.S., M.S., and Ph.D. degrees in electrical engineering from Stanford University in 1980, 1981, and 1984, respectively. His research interests include embedded computing, VLSI CAD, and multimedia information systems. He is the author of Computers as Components: Principles of Embedded Computing System Design and Modern VLSI Design: Systems on Silicon. Wolf has been elected to Phi Beta Kappa and Tau Beta Pi. He is a Fellow of the IEEE and a member of the ACM and SPIE.

P3 - Plenary Session III: System-on-Chip

SOC Research Activities in National Taiwan University

Sao-Jie Chen

National Taiwan University

ABSTRACT

In this presentation, the speaker will introduce a new member of the College of Electrical Engineering and Computer Science at National Taiwan University (NTU), the Graduate Institute of Electronics Engineering (GIEE). The talk focuses on the organization of a new SOC Research Center established in GIEE, its missions, actvities, and research directions. Some of the research results related to SOC Design and Systems are also presented, which show that NTU-GIEE is ready to face the challenge of coming SOC era.

BIOGRAPHY

Sao-Jie Chen received the B.S. and M.S. degrees in electrical engineering from the National Taiwan University, Taipei, Taiwan, ROC, in 1977 and 1982 respectively, and the Ph.D. degree in electrical engineering from the Southern Methodist University, Dallas, USA, in 1988.

Since 1982, he has been a member of the faculty in the Department of Electrical Engineering, National Taiwan University, where he is currently a full professor. From 1985 to 1988, he was on leave from National Taiwan University and working toward his Ph.D. at Southern Methodist University. During the fall of 1999, he was a visiting scholar in the Department of Computer Science and Engineering, University of California, San Diego. His current research interests include: VLSI physical design automation, RF IC design, and SOC hardware/software co-design.

Dr. Chen is a member of the Chinese Institute of Engineers, the Association for Computing Machinery, the IEEE, and the IEEE Computer Society

P4 - Plenary Session IV: Bioinformatics

Session Chair

Cathy H. Wu

Georgetown University Medical Center

BIOGRAPHY

Positions and Employment
2001-Present: Professor of Biochemistry and Molecular Biology and Director of Protein Information Resource, Georgetown University Medical Center; 1999-2002: Director of Bioinformatics and Vice President, National Biomedical Research Foundation; 1990-1999: Assistant Professor (90-94), Associate Professor (94-98), Professor (98-99) of Biomathematics, University of Texas Health Center at Tyler

Education
B.S., Plant Pathology, National Taiwan University, 1978; M.S., Ph.D., Molecular Plant Pathology, Purdue University, 1982, 1984; M.S., Computer Science, University of Texas at Tyler, 1989

Primary Expertise/Activities
Conducting bioinformatics research since 1990 and developed several protein family classification systems including neural network systems and protein databases; Directing the Protein Information Resource (PIR); Teaching bioinformatics; Mentoring graduate students

Publications
Published over 75 research papers, authored a book and edited two books

Professional Activities
1) Advisory Board: Serve on Board of Directors, International Society for Computational Biology; Advisory Board, Association of Chinese Bioinformaticians
2) Organizing Committees: Organized several international bioinformatics conferences, including ISMB-2002; PSB-2003; PSB-2002; CBGI-2002; CBGI-2001; BIOKDD-2002; BIOKDD-2001
3) Grant Review Panels: Serve as an *ad hoc* reviewer and on numerous review panels and site visit panels for National Institutes of Health (NIH), National Science Foundation (NSF), Department of Energy (DOE), and National Science Council, Taiwan.

Invited Presentations
Over 30 invited seminars and tutorials in the last two years, including NIH Proteomics Course; ESF Training Course in Functional Genomics; Conference on Proteomics; CHI Beyond Genomics; Summer Institute on Bioinformatics, Taiwan; GCG/MSI Bioinformatics Workshop; ISMB-2001; BIBE-2001, SIAC-2001; CBGI-2001; MPSA-2000; University of Delaware; Medical College of Ohio; University of Alabama at Birmingham; George Mason University; Academia Sinica, National Taiwan University, National Chiao Tung University, National Health Research Institute, Yang Ming University, Taiwan

Profiled at *The Scientist* (10/15/2001)
Cathy Wu at the Crossroads: She saved the Protein Information Resource database and now aims to restore it to the world's best
(http://www.the-scientist.com/yr2001/oct/prof1_011015.html)

P4 - Plenary Session IV: Bioinformatics

Integrated Bioinformatics Projects on Functional Genomic Studies of Disease

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ABSTRACT

Genes and environmental factors interact to control risk of the complex diseases such as hypertension, diabetes and various cancers, etc. There are many approaches to study the mechanism. In this talk we will share some of our experience in building up the infrastructure to conduct genetic studies in order to map the genes for diseases which are genetically complex. Analytical and statistical issues in the genetic studies will be discussed.

We will also talk about the experience in forming an integrated bioinformatics project on functional genomic studies of the mechanism of the infection diseases agent ---- enterovirus (EV), especially EV 71, which was the major factor in causing the death of infected children in Taiwan in the 1998 outbreak.

BIOGRAPHY

Chao Agnes Hsiung is currently the Director of the Division of Biostatistics and Bioinformatics, National Health Research Institutes in Taiwan. The division works closely with scientists and clinicians to carry out research on bioinformatics and statistical genetics in genomic medicine. The division also provides statistical support on design and analyze of clinical trials.

Chao Agnes Hsiung was awarded her master and PhD degrees in statistics by Columbia University. She joined the Institute of Statistical Science, Academia Sinica in 1985 as a research fellow. In 1992, she started to be in charge of the statistical center of Taiwan Cooperative Oncology Group (TCOG). In 1997, she moved to National Health Research Institutes, where she is the founding director of the Division of Biostatistics and Bioinformatics.

She is an elected member of International Statistical Institutes since 1985 and an elected fellow of Institute of Mathematical Statistics since 1994. Her fields of interest are biostatistics, clinical trials and genetics/genomics statistics.

P4 - Plenary Session IV: Bioinformatics

Research, Development and Education of Bioinformatics at EMBnet China Node

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ABSTRACT

The proposed presentation will give a brief view of the rapid growing infrastructure as well as the research, development and education of bioinformatics at the Centre of Bioinformatics, Peking University, the national node of at the European Molecular Biology Network. Topics will cover biological resource on the Internet, secondary database construction, software development, genome sequence assembly, molecular modeling and drug discovery as well as bioinformatics training and education.

BIOGRAPHY

Education:
Graduated from Department of Biology, Peking University in 1970

Visiting experience:

1987.11-1989.5	University of Maryland, USA, Computer programming, molecular modelling
1991.8-1992.2	Imperial Cancer Research Fund, UK, Molecular modelling
1994.1-1994.5	Imperial Cancer Research Fund, UK, Protein domain analysis
1995.9-1996.3	Imperial Cancer Research Fund, UK, Protein domain database
1997.4-1997.10	Imperial Cancer Research Fund, UK, Protein loop database
1998.7-1999.1	Imperial Cancer Research Fund, UK, Bioinformatics

Research Experience:

Professor Luo is a principle investigator of the several projects on bioinformatics supported by China High-Tech (863) program, the Ministry of Education, Beijing Municipal Committee of Science and Technology. He is the node manager of the European Molecular Biology Network since 1996 and organized several bioinformatics workshops and courses in PKU. He has published some 40 papers and written some chapters on molecular modeling and bioinformatics. He is taking care of the bioinformatics service at CBI and running a course "Introduction to Bioinformatics" for graduate students at PKU.

Selected Publications:

1. Luo JC, et al, Chinese translation of Introduction to Bioinformatics (Attwood and Parry-Smith), Peking University Press, 2002.
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16. Aihua Pan, Feng Tie, Meizhu Yang, Jingchu Luo, Zhengxing Wang, Xiang Ding, Lingyuan Li, Zhanglian Chen and Binggen Ru. Construction of multiple copy of alpha domain gene fragment of human liver metallothionein-IA in tandem arrays and its expression in transgenic tobacco plants. Protein Engineer. 6, 775-762, 1993.
17. Paul A. Bates, Jingchu Luo and Michael J.E. Sternberg. A predicted three-dimensional structure for the carcinoembryonic antigen(CEA). FEBS Letters, 301,207-214, 1992.
18. Jingchu Luo, Paul A. Bates and Michael J. E. Sternberg. (1992) Knowledge-based computer modelling for the N-terminal domain of Carcinoembryonic Antigen (CEA). Proceedings of Chinese Peptide Symposium, 1992, November 4-7, Hang Zhou, China, Science Press, Beijing.
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P4 - Plenary Session IV: Bioinformatics

Bioinformatics and Functional Genomics/Proteomics: The Protein Information Resource

Cathy H. Wu

Georgetown University Medical Center

ABSTRACT

The human genome project has revolutionized the practice of biology and the future potential of medicine. With the accelerated accumulation of high-throughput genomic and proteomic data, computational approaches are increasingly important for deriving scientific knowledge and hypotheses. There is a pressing need to develop advanced bioinformatics infrastructure for biological knowledge discovery. As an integrated public resource of protein informatics, the Protein Information Resource (PIR) provides many databases and analytical tools to support genomic and proteomic research and scientific discovery. The Protein Sequence Database (PSD) is the major annotated protein database in the public domain, containing more than 283,000 sequences covering the entire taxonomic range. To provide high quality annotation and promote database interoperability, the PIR uses rule-based and classification-driven procedures based on controlled vocabulary and accepted ontologies, and includes evidence attribution to distinguish experimentally determined from predicted protein features. PIR-NREF, a non-redundant database containing over 1,000,000 proteins from PIR-PSD, Swiss-Prot, TrEMBL, GenPept, RefSeq, and PDB, provides a timely and comprehensive sequence collection with source attribution for protein identification, ontology development of protein names, and detection of annotation errors. The iProClass database addresses the database interoperability issues arising from the voluminous, heterogeneous, and distributed data. It provides comprehensive family relationships and functional and structural features for about 830,000 proteins in PIR-PSD, Swiss-Prot, and TrEMBL, with rich links to over 50 databases of protein families, functions, pathways, protein-protein interactions, post-translational modifications, structures, genomes, ontologies, literature, and taxonomy. An integrated protein knowledgebase, connecting the underlying data warehouse and sequence analysis and data mining tools with graphical user interfaces, is being developed for large-scale gene expression and proteomic data analysis, functional categorization, and pathway identification. The PIR databases are implemented in an object-relational database system and accessible from our web site (http://pir.georgetown.edu) for exploration of proteins and their comparative analysis. It helps users to answer complex biological questions that may typically involve querying multiple sources and detect interesting relationships among protein sequences and groups. Such knowledge is fundamental to the understanding of protein evolution, structure, and function, and crucial to functional genomic and proteomic research.

The PIR is supported by the NIH grants P41 LM05798 and U01 HG02712; the iProClass project is supported by the NSF grants DBI-9974855 and DBI-0138188; and the Protein Name Ontology project is supported by the NSF grant ITR-0205470.

BIOGRAPHY

Positions and Employment

2001-Present: Professor of Biochemistry and Molecular Biology and Director of Protein Information Resource, Georgetown University Medical Center; 1999-2002: Director of Bioinformatics and Vice President, National Biomedical Research Foundation; 1990-1999: Assistant Professor (90-94), Associate Professor (94-98), Professor (98-99) of Biomathematics, University of Texas Health Center at Tyler

Education
B.S., Plant Pathology, National Taiwan University, 1978; M.S., Ph.D., Molecular Plant Pathology, Purdue University, 1982, 1984; M.S., Computer Science, University of Texas at Tyler, 1989

Primary Expertise/Activities
Conducting bioinformatics research since 1990 and developed several protein family classification systems including neural network systems and protein databases; Directing the Protein Information Resource (PIR); Teaching bioinformatics; Mentoring graduate students

Publications
Published over 75 research papers, authored a book and edited two books

Professional Activities
4) Advisory Board: Serve on Board of Directors, International Society for Computational Biology; Advisory Board, Association of Chinese Bioinformaticians
5) Organizing Committees: Organized several international bioinformatics conferences, including ISMB-2002; PSB-2003; PSB-2002; CBGI-2002; CBGI-2001; BIOKDD-2002; BIOKDD-2001
6) Grant Review Panels: Serve as an *ad hoc* reviewer and on numerous review panels and site visit panels for National Institutes of Health (NIH), National Science Foundation (NSF), Department of Energy (DOE), and National Science Council, Taiwan.

Invited Presentations
Over 30 invited seminars and tutorials in the last two years, including NIH Proteomics Course; ESF Training Course in Functional Genomics; Conference on Proteomics; CHI Beyond Genomics; Summer Institute on Bioinformatics, Taiwan; GCG/MSI Bioinformatics Workshop; ISMB-2001; BIBE-2001, SIAC-2001; CBGI-2001; MPSA-2000; University of Delaware; Medical College of Ohio; University of Alabama at Birmingham; George Mason University; Academia Sinica, National Taiwan University, National Chiao Tung University, National Health Research Institute, Yang Ming University, Taiwan

Profiled at *The Scientist* (10/15/2001)
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(http://www.the-scientist.com/yr2001/oct/prof1_011015.html)

Luncheon Brown Bag Talks

Session Chair

Albert H. Wang

Phillips Nizer Benjamin Krim & Ballon LLP
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BIOGRAPHY

Albert H. Wang is a senior attorney in the Corporate Department of Phillips Nizer LLP. Mr. Want concentrates his practice in the area of corporate and financial transactions, including securities transactions, mergers and acquisitions, international and domestic joint ventures, acquisitions of distressed assets, broker-dealer regulation and aircraft finance and leasing transactions.

Mr. Wang graduated from the University of California, Los Angeles, *Phi Beta Kappa* with a B.A. in Business Economics and an M.A., *Magna Cum Laude*, in Economics in 1990. He received his J.D. from Cornell University, School of Law in 1994, where he was a member of the Niagara International Moot Court Team from 1992-1994.

Mr. Wang is the legal counsel and an advisory member of the Asian American Business Development Center, and a member of the Chinese Finance Society, the American Bar Association and the New York State associate at Schulte Roth & Zabel LLP. He is admitted to practice in the State of New York. Mr. Wang is fluent in Mandarin Chinese and Taiwanese, and conversational in Spanish.

Luncheon Brown Bag Talks

Kenneth K. Fisher

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Phone: 212.841.0552, kfisher@phillipsnizer.com

BIOGRAPHY

Kenneth Fisher is a partner of Phillips Nizer LLP. Mr. Fisher has a broad ranging practice that includes general corporate and corporate litigation, with an emphasis on public policy, including administrative and regulatory law, government contracting, health care, labor & employment and real estate. For many of his clients, Mr. Fisher acts as outside general counsel and provides strategic business and legal advice, as well as direct legal services such as negotiations and litigation.

Prior to joining Phillips Nizer, Mr. Fisher ran a solo practice based in Brooklyn and Manhattan. Earlier, he was as a partner at the law firm founded by his father, Harold L. Fisher, the late chairman of the New York Metropolitan Transportation Authority. He has represented public figures, public agencies, major real estate developers, health care institutions, public employee unions and not for profit organizations. Mr. Fisher has appeared in the United States Court of Appeals and Federal District Courts, as well as the New York State Court of Appeals, three Appellate Divisions, numerous state trial courts, and administrative agencies including the NYS Insurance Department, NYS Liquor Authority, NYS Board of Elections, NYC Board of Standards & Appeals, NYC Tax Commission and the NYC Landmarks Preservation Commission.

Mr. Fisher served as a Member of the New York City Council from 1991 - 2001. Ranked by the *New York Daily News* as one of the five "most effective" Members of the Council in 1993, Mr. Fisher's district included the neighborhoods of Park Slope, Brooklyn Heights, Downtown Brooklyn, Williamsburg and Greenpoint.

As Chair of the Council's Land Use Subcommittee on Landmarks, Public Siting & Maritime Uses, Mr. Fisher helped shape the landscape of New York and oversaw the approval of hundreds of millions of dollars of public works. Mr. Fisher was the prime sponsor of the Landmarks Protection Act of 1998, as well as Mayor Rudolph Giuliani's organized crime legislation regulating the City's wholesale food markets, including the Fulton Fish Market, and the private carting industry. The latter was one of the first local laws formally incorporating the IPSIG approach. Mr. Fisher served as Chair of the Council's Committee on Standards and Ethics, and as a member of the Council's Committee on Contracts. He has extensive experience in public integrity matters.

Mr. Fisher chaired the Youth Services Committee of the Council and is credited with creating the NYC Childhood Asthma Initiative and the New American Youth Initiative, as well as having led the effort to save the Summer Youth Employment Program for teenagers. He also served at various times on the Council's Contracts, Economic Development, Ethics, and Parks Committees.

Mr. Fisher has authored numerous articles on public policy and has been the recipient of many awards for his work on the City Council, including a Certificate of Commendation, the New York City Police Department's highest civilian award for bravery; the Landmark Conservancy's Lucy G. Moses Award; and a special Public Awareness Award from the American Lung Association. He also is host of 'Citywide', a monthly public affairs television show produced by the CUNY-TV, and is a frequent lecturer at various colleges.

Mr. Fisher received his law degree from the Syracuse University College of Law in 1976 and his Bachelor of Arts from the University of the Pacific in 1973. He served in the House of Delegates of the New York State Bar Association, and is also a member of the Brooklyn Bar Association. Mr. Fisher previously chaired the Insurance Law Committee of the Association of the Bar. Mr. Fisher is admitted in the State of New York, the United States District Courts for the Eastern and Southern Districts, the Second Circuit Court of Appeals and the United States Supreme Court.

Luncheon Brown Bag Talks

Peter A. Fileds

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BIOGRAPHY

Peter A. Fields concentrates his practice in the areas of corporate law, entertainment law and technology law.

In the corporate area he advises U.S. and international clients in connection with public and private financings, mergers and acquisitions and the day-to-day aspects of organizing, operating and expanding their businesses. His entertainment law practice involves representation of motion picture, television and video producers, distributors and investors as well as actors, writers, directors, musicians and authors in a variety of intellectual property related transactions. Prior to practicing law Peter worked at Tri-Star Pictures and Columbia Pictures in New York. He draws upon this industry experience when counseling his entertainment clients. As part of his technology law practice, he works regularly with software developers and distributors, e-commerce ventures and Internet service and content providers. His practice in this area was highlighted two years in a row by AlleyCat News in its yearly issue on the leading lawyers focused on technology matters.

Peter is the founder and director of the firm's New Business Networking Group. With over 500 members in a variety of fields, the Group meets periodically at the firm to network and discuss current topics of interest. Peter acts as a moderator and speaker at each meeting together with guest speakers.

Peter has lectured and written on media, technology and general business topics in the U.S. and abroad.

Luncheon Brown Bag Talks

Stephen M. Nagler

Phillips Nizer Benjamin Krim & Ballon LLP

BIOGRAPHY

Mr. Nagler is counsel in the Corporate Department of Phillips Nizer LLP. Through a wide ranging network of investment bankers, venture capitalists, merchant bankers, and asset and non-asset based lenders, Steve Nagler assists clients of the firm in arranging financing to accomplish their goals. Both private and public financings, as well as mergers and acquisitions have been accomplished through his efforts. His clients include biotechnology, health services, medical devices, media, technology, software and consumer products companies, both foreign and domestic. His list of clients includes companies and investors in Canada (especially Quebec), Hungary, France, Italy, Switzerland, China, Japan and Australia. Mr. Nagler's activities focus on the introduction of clients to financing contacts and the active negotiation of financing terms and conditions. He successfully closed five financing transactions and two acquisitions in 2001.

Mr. Nagler previously served as General Counsel of Patlex Corporation where he structured the successful licensing program on which the success of the company was based. He also established contacts throughout the corporate world which enable him to assist his corporate clients with the development of corporate partnering arrangements. He understands the needs of his clients to form such alliances as a means of expanding their ability to secure financing as well as in the manufacturing and marketing of their products.

Mr. Nagler's ability to arrange and structure financings meshes with the entrepreneurial capabilities of his partners and their ability to complete the corporate and securities documentation needed to close transactions.

T5 - Technical Session V: MEMS

Organizer

Wen H. Ko

Electrical Engineering and Computer Science Department
Case School of Engineering
Case Western Reserve University
Cleveland, Ohio, 44106, USA

BIOGRAPHY

Dr. Wen H. Ko received his B.S. in E.E. from Amoy (Xiamen) University of China in 1946, and his M.S. and Ph.D. degrees from Case Institute of Technology, Cleveland, Ohio, USA, in 1956 and 1959 respectively. He has been an assistant, an associate and a full professor of Electrical Engineering Department and Biomedical Engineering Department, at Case Western Reserve University (CWRU), Cleveland, Ohio, USA. since 1959, 1962 and 1967, respectively. He becomes a Professor Emeritus in Electrical Engineering of CWRU in 1993.

Dr. Ko has 317 publications, with 131 in referenced journals and chapters in books, in areas of: solid state electronics, micro-sensors and actuators, bio-medical instrumentation, implant electronics and control system design. He also has 18 patents and three pending in industrial control systems, electronic devices, medical electronics and micro sensors and actuators. He supervised 185 graduate students on their theses.

Dr. Ko is a fellow of IEEE and American Institute of Medical and Biological Engineering. He is on the editorial board of Sensors and Actuator, Sensors and Materials, Micro-system Technologies, Telemetry and Patient Monitoring (1974--1984), and Medical Progress Through Technology (1983--1988) and is a reviewer
for professional journals in his fields of interest. (Such as IEEE Trans. Electron Devices and Trans. on Bio-Med. Engineering, J. of Bio-Med. Eng. Etc.) He was the chairman of International steering committee on solid state sensors and actuators conferences from 1983 to 1987, and the general chairman of 1985 conference in Philadelphia, USA. He also was the chairman of the international steering committee on chemical sensor meetings from 1991 to 1993. He is the president of the Transducer Research Foundation that sponsors the Hilton Head Conferences on Sensors and actuators, in America, since 1992

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T5 - Technical Session V: MEMS

Micromachined Variable Capacitors with Wide Tuning Range

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ABSTRACT

Electronically tunable capacitors are key elements in communication circuits such as voltage-controlled oscillators and tunable capacitor filters. In an integrated circuit design, a variable capacitor is usually realized with a reversed p-n junction, which gives a 335% tuning range. However, the silicon p-n junction usually has large series resistance plus parasitic capacitance to the substrate. Here, we present two kinds of micromachined variable capacitors with parallel plate drive and comb drive electrode structures. Ultra-thin silicon wafers, SU-8 bonding and deep reactive ion etching technology have been combined for the fabrication of folded spring, dual electrostatic drive and vertical plate devices with displacement limiting bumpers. The SU-8 bonding replaces the use of expensive SOI wafers and decreases the parasitic substrate capacitance. Due to the presence of the bumpers, our variable capacitor with parallel plate drive electrodes has two tuning voltage regimes: first a parabolic region that achieves roughly a 290% tuning range, then a linear region that achieves an additional 310%, making the total tuning range about 600%. Our variable capacitor with comb drive electrodes has a similar performance, with a total tuning range of about 240%.

BIOGRAPHY

Wuyong Peng is currently working on his Ph.D. degree in Materials Science and Engineering at New Jersey Institute of Technology (NJIT) with particular interest in MEMS. His work involves bimorph structure optimization, thermal and RF MEMS. He worked for China Petroleum & Chemical Corporation (SINOPEC) as a Research Engineer from 1993 to 1998 before he started his study at NJIT. Wuyong Peng received his B.S. degree in Materials Science from Zhejiang University, P. R. China, in 1993.

T5 - Technical Session V: MEMS

RF MEMS – A Brief Overview

James C. M. Hwang

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ABSTRACT

This overview will start with typical MEMS for RF applications that include both passive and active RF components. Comparison will be made between RF MEMS and conventional silicon-based MEMS for other applications. Advantages of RF MEMS in terms of performance, size and cost will be reviewed. MEMS applications in the RF front ends of many systems will be illustrated. MEMS switches, both the ohmic and capacitive types, will be used as examples to illustrate the packaging, performance, reliability, and commercialization issues faced by RF MEMS.

BIOGRAPHY

James C. M. Hwang graduated from National Taiwan University with a B. S. degree in Physics in 1970. He completed his M. S. and Ph. D. in Materials Science and Engineering from Cornell University in 1973 and 1976, respectively. He had twelve years of industrial experience working at IBM, AT&T, GE and GAIN. In 1988, he joined Lehigh University as Professor of Electrical Engineering and Director of Compound Semiconductor Technology Laboratory. Most recently, he helped establish the $30+ million Center for Optical Technologies of Lehigh University and became its first director. In addition, he currently holds a part-time appointment as Nanyang Professor at Nanyang Technological University, Singapore and dabbles in as a business angel. He has been a consultant for the U. S. Government and many electronic companies, in the area of RF/microwave devices and integrated circuits. He co-founded GAIN and QED and saw the former go bankrupt while the latter become a public company (IQE). He has published over 150 technical papers and has been granted four U. S. patents. He is a Fellow of the Institute of Electrical and Electronic Engineers.

T5 - Technical Session V: MEMS

Optically-Power Wireless Transmitter for High-Temperature MEMS Sensing and Communications

Darrin J. Young

EECS Department, Case
Western Reserve University

ABSTRACT

Low-power high-temperature wireless sensor communication network with on-board power supply is critical for industrial, automotive and aerospace sensing and data communications. Typical temperature for these applications ranges from 200 °C to 600 °C. Conventional microelectronics and battery technologies suffer from severe performance degradation and failure for temperature above 150 °C. In this presentation, a low-power (micro-Walt) wireless sensor communication module with an on-board optical-based power generator is proposed for high-temperature applications. The wireless system employs a silicon tunnel diode oscillator capable of transmitting pressure information inside a high-temperature test chamber to an external receiver. A GaAs photodiode is used to convert an incoming laser beam into electrical energy to power the system thus eliminating any feed-through wire. The prototype design achieves a telemetry distance of 1.5 meters up to 250 °C.

BIOGRAPHY

Darrin J. Young received his BS, MS, and PhD degrees from the Department of Electrical Engineering and Computer Sciences at University of California at Berkeley in 1991, 1993, and 1999, respectively. His doctoral dissertation emphasizes on microelectromechanical devices design and fabrication technologies for radio frequency analog signal processing. Between 1991 and 1993, he worked at Hewlett-Packard Laboratories in Palo Alto, California, where he designed a shared memory system for a DSP-based multiprocessor architecture. During the summer of 1997, he worked at Rockwell Semiconductor Systems in Newport Beach, California, where he designed silicon bipolar RF analog circuits for cellular telephony applications. Between 1997 and 1998, he was also at Lawrence Livermore National Laboratory, working on the design and fabrication of three-dimensional RF coil inductors for wireless communications. Dr. Young joined the Department of Electrical Engineering and Computer Science at Case Western Reserve University as an assistant professor in 1999. His main research interests include MEMS device design and fabrication, and integrated analog circuits design for wireless communications, sensing, biomedical implant, and general industrial applications.

T5 - Technical Session V: MEMS

Electrolytic bubble based actuation for microfluidics without mechanically moving parts

Susan Z. Hua[a], Frederick Sachs[b] and Harsh Deep Chopra[c]

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[b]Department of Physiology & Biophysics, SUNY at Buffalo, Buffalo, NY 14214
[c]Mechanical and Aerospace Engineering Department, SUNY at Buffalo, Buffalo, NY 14260

ABSTRACT

Development of microfluidic systems is a rapidly growing area of MEMS for applications in fields ranging from microbiology, biotechnology, and drug delivery, to combinatorial and analytical chemistry. Large-scale manufacture of microfluidic systems requires development of fluid handling protocols that would enable ease of microfabrication, on-chip electrical control, and low power consumption. Toward this goal, various actuation methods (such as, piezoelectric, electrostatic, thermopneumatic, and electromagnetic) have been devised and prototyped. Electrolysis bubbles have also been used as one of the actuation mechanisms in which a membrane or a flexible moving mechanical part is displaced by the bubble. In this work we directly use electrolytic bubbles in the role of active control element (valves, pumps, switches), thus eliminating the need for any moving mechanical parts. The approach is based on the fact that gas bubble are generated in an aqueous solution by applying an appropriate voltage between two electrodes; the dynamics of bubble formation and collapse follows electrochemical principles. Such an approach requires no manufactured moving parts, thus eliminating the need for precision micromachining. The actuator units are electrically addressable, and can function in digital or analog modes. Response times can be in the millisecond range and the power requirements are small (μW).

Using standard photolithography technology, we have built prototype valves, pumps, fluid switches and distribution networks to demonstrate the working principle of our approach. The fluid components were tested under different input pressures, corresponding to different flow rates, ranging from 5mm/s to 30mm/s. We have also run tests on a broad range of solvents and solutes, including aqueous solutions of salts, weak and strong acids and bases, mixtures of water and organic solvents such as ethanol and acetonitrile, and tissue culture media to demonstrate the broad applicability of this technology. The bubbles are not toxic to cells.

Results show that the actuation is highly controllable, repeatable, and reversible. This technology can be used to build portable, dispensable lab-on-a-chip for bio/chemical analysis as well as implantable microdevices for drug delivery.

BIOGRAPHY

Dr. Susan Zonglu Hua

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Education:

Ph.D. Materials Science & Engineering, University of Maryland, College Park, MD. 1993
M.S. Physics, Peking University, Beijing, China. 1984

B.Sc. Physics, Peking University, Beijing, China. 1982

Professional Experience:

9/00-present:	Bio-MEMS Facility Director, School of Medicine, SUNY, Buffalo, NY.
12/00-present:	Research Associate Professor, Mechanical & Aerospace Engineering Department, SUNY, Buffalo, NY
11/94–08/00:	Senior Scientist, and Co-Technical Director, Materials Innovation Inc., West Lebanon, NH.
6/93 – 11/94:	Postdoctoral Research Associate, National Institute of Standards & Technology, MD.

Professional Membership and Activities:

Memberships:
Society for Bio-MEMS and Bio-Medical Nanotechnology
American Society of Mechanical Engineers
Materials Research Society

Awards & Honors:

- Honored as a "Promising Inventor" within SUNY system by Chancellor R. L. King at State University Plaza on May 20, 2002.
- Following paper highlighted by various scientific bodies: ["Ballistic magnetoresistance exceeding 3000% in Ni nanocontacts at room temperature", Harsh Deep Chopra and Susan Z. Hua, *Physical Review B*, Vol. 66, 020403 (2002)] by AAAS, Science, Science News, Physics World, AIP/APS Physics News Update, NSF, etc.

T5 - Technical Session V: MEMS

Radiation Hardness/Tolerance of Si Sensors

Zheng Li

Brookhaven National Laboratory,
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ABSTRACT

Silicon sensors, widely used in high energy and nuclear physics experiments, suffer severe radiation damage that leads to degradations in sensor performance. These degradations include significant increase in leakage current, bulk resistivity, and space charge concentration. The increase in space charge concentration is particularly damaging since it can significantly increase the sensor full depletion voltage, causing either breakdown if operated at high biases or charge collection loss if operated at lower biases than full depletion. Si sensors can be, however, made more radiation hardness/tolerant by employing three different engineering technologies: Material/Impurity/Defect Engineering (MIDE), Device Structure Engineering (DSE), and Device Operational Mode Engineering (DOME). Sensor radiation hardness/tolerance can be improved by a factor from 2-10 using these three engineering technologies. In this paper, details of radiation induced sensor degradations and current sensor radiation hardness/tolerance techniques will be reviewed. Future trends in this field will be predicted.

Key words: Si sensor, radiation, hardness, tolerance.

BIOGRAPHY

Zheng Li received his B.S. degree in physics from Peking University in 1982. He got his Ph.D. in physics from Pennsylvania State University in 1986. From the end of 1986 to present, he has been working in Brookhaven National Laboratory. He is now a Physicist and the group leader of the BNL Instrumentation Division's Semiconductor Detector Development and Processing Lab. His research interests are: development and fabrication of novel position sensitive Si detectors for nuclear and physics experiments; analysis of radiation induced defects; and development of radiation hard Si detectors.

T5 - Technical Session V: MEMS

Comparison of Piezo-resistive, Capacitive and Resonant Type Physical Sensors

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ABSTRACT

This overview will start with typical MEMS for RF applications that include both passive and active RF components. Comparison will be made between RF MEMS and conventional silicon-based MEMS for other applications. Advantages of RF MEMS in terms of performance, size and cost will be reviewed. MEMS applications in the RF front ends of many systems will be illustrated. MEMS switches, both the ohmic and capacitive types, will be used as examples to illustrate the packaging, performance, reliability, and commercialization issues faced by RF MEMS.

BIOGRAPHY

Dr. Wen H. Ko received his B.S. in E.E. from Amoy (Xiamen) University of China in 1946, and his M.S. and Ph.D. degrees from Case Institute of Technology, Cleveland, Ohio, USA, in 1956 and 1959 respectively. He has been an assistant, an associate and a full professor of Electrical Engineering Department and Biomedical Engineering Department, at Case Western Reserve University (CWRU), Cleveland, Ohio, USA. since 1959, 1962 and 1967, respectively. He becomes a Professor Emeritus in Electrical Engineering of CWRU in 1993.

Dr. Ko has 317 publications, with 131 in referenced journals and chapters in books, in areas of: solid state electronics, micro-sensors and actuators, bio-medical instrumentation, implant electronics and control system design. He also has 18 patents and three pending in industrial control systems, electronic devices, medical electronics and micro sensors and actuators. He supervised 185 graduate students on their theses.

Dr. Ko is a fellow of IEEE and American Institute of Medical and Biological Engineering. He is on the editorial board of Sensors and Actuator, Sensors and Materials, Micro-system Technologies, Telemetry and Patient Monitoring (1974--1984), and Medical Progress Through Technology (1983--1988) and is a reviewer
for professional journals in his fields of interest. (Such as IEEE Trans. Electron Devices and Trans. on Bio-Med. Engineering, J. of Bio-Med. Eng. Etc.) He was the chairman of International steering committee on solid state sensors and actuators conferences from 1983 to 1987, and the general chairman of 1985 conference in Philadelphia, USA. He also was the chairman of the international steering committee on chemical sensor meetings from 1991 to 1993. He is the president of the Transducer Research Foundation that sponsors the Hilton Head Conferences on Sensors and actuators, in America, since 1992

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T6 - Technical Session VI: MEMS – Optoelectronics

Session Chair

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BIOGRAPHY

Liji Wu received the B.S., M.S., and Ph.D. degrees in electronic engineering from Tsinghua University, Beijing, China, in 1988, 1991 and 1997, respectively. After his research and development work on multimedia DSP chips, in April 1997, he joined Center for Advanced Technology in Telecommunications, Dept. of Electrical Engineering, Polytechnic University, Brooklyn, New York, as a Postdoctoral Fellow, worked on design and implementation of high-speed digital control circuits and systems utilized in WDM ATM Multicast optical switching systems sponsored by DARPA. In May 2000, he joined TyCom Laboratories (former AT&T Bell Labs on Undersea Optical Fiber Communications), Eatontown, New Jersey, as a senior member of technical staff, worked on design and implementation of HPOE (High Performance Optical Equipment). In October of 2001, he joined Internet Photonics Inc., Shrewsbury, New Jersey, working on carrier-grade Gigabit Optical Ethernet solutions with 10Gigabit DWDM transport. His current interest is on high-speed circuits and systems for optical fiber communications and ASIC design of ATM switch chips and DSP chips, he had numerous papers published in the related fields and received Tsinghua University Excellence Graduate Award and Medal in 1988. He is a member of IEEE and OSA, a lifetime member of CIE-USA, Opto-Electronics Session Chair of WOCC'2002. He is a reviewer of IEEE Photonics Technology Letters and ICC.

T6 - Technical Session VI: MEMS – Optoelectronics

Organizer

Chuan Pu

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BIOGRAPHY

Chuan Pu is a senior member of technical staff at Tellium, Inc, New Jersey since November of 2000. He is a member of the CTO group that is responsible for forward-looking research on optical networking technologies and network architectures. He has primarily participated in the research and development of MEMS based large-scale optical crossconnects (OXC). Prior to joining Tellium, Chuan Pu was a senior member of technical staff at AT&T research labs from 1999 to 2000. He was with the division of lightwave networks performing research in the areas of optical transmission and networking. His major research work was on optical MEMS and its applications in optical switching, PMD compensation, and in various aspects of transmission systems.

Chuan Pu majored in physics at Peking University from 1990 to 1994. He later received an MS and a Ph.D. in applied physics from Cornell University in 1998 and 1999, respectively. Chuan Pu has published about twenty journal and conference papers, and holds two US patents. He is a member of IEEE, OSA and SPIE. He is also a reviewer for JLT, JSTQE, and JM3.

T6 - Technical Session VI: MEMS – Optoelectronics

Technologies for Large-Scale Optical Switching

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ABSTRACT

For the past decade, the explosive growth of Internet data communication, together with the ever-increasing traffic demand for traditional voice service, has fueled the rapid development of optical communication systems. While the aggregate traffic demand is largely met by the deployment of DWDM technologies and higher transmission bit rates toward OC-768, the current optical communication system has also evolved into a complicated multi-wavelength system, which asks for many innovative technologies for realizing its vast capacities and promises. One such greatly desired network element is a large-scale optical cross-connect (OXC) in the core network to handle traffic at the wavelength level, because the traffic volume at the core network is mostly aggregated at OC48, OC192 and above. OXCs facilitate optical layer networking, provide fast provisioning and network restoration at the wavelength level, and therefore greatly improve the network efficiency. An OXC can either have an electronic switch fabric (OEO), or an optical switch fabric (OOO). In recent years many technologies have been studied as potential candidates. Many advances have been made, and many new lessons learned. In this presentation, we will discuss the architectural and performance requirements for OXC, and analyze various optical switching technologies. Primarily we will focus on the micro-electro-mechanical-systems (MEMS) technology that has demonstrated vast promise for large-scale OXCs, with detailed discussions on its optics, devices, as well as position control mechanisms.

BIOGRAPHY

Shi-Sheng Lee received the M.S. and Ph.D. degrees in electrical engineering from University of California, Los Angeles, in 1995 and 1998, respectively. In 1998, he joined the Global Optoelectronics Division of AMP, Inc. as a Senior Development Engineer, where he was involved in the development of MEMS-based optical switches. In 1999, he joined the Microelectromechnical Systems (MEMS) Department of Rockwell Science Center as a Member of Technical Staff, where he conducted researches on MEMS technologies in optical and space applications. In May 2000, he joined Tellium, Inc. as a Senior Member Technical Staff, where he is currently working on the development of core optical cross-connect switches based on MEMS technologies. Currently, Dr. Lee is working as a private consultant. He has authored and co-authored more than forty technical publications in the area of MEMS processing and optical MEMS. Dr. Lee is a member of IEEE and Eta Kappa Nu.

T6 - Technical Session VI: MEMS – Optoelectronics

Frame-Based Exhaustive Matching (FEM) Scheme for Photoinc Packet Switch

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ABSTRACT

Photonic interconnect technologies that are capable of providing a scalable, transparent bandwidth while offering large-dimensional interconnections have shown great potentials in the implementation of switching fabric for next-generation packet-centered applications. A large port count of 1296x1296 based on a single-stage MEMS cross-connect has been demonstrated with a 2.07-petabit/s capacity. Several other approaches also demonstrate terabit capacity with large-dimension interconnections using a single stage switch. Since the switching action takes place on a per-packet basis, two stringent time constrains are currently limiting the potential use of such photonic technologies for the packet switching applications: 1) The time required to reconfigure the switch interconnections must be much less than the packet time. 2) The arbitration time needed to resolve the contention by the switch arbitrator must be less than the slot time as the dimension and port speed increase in the switch. For example, an increase of port speed to 40 Gbits/s requires the arbitration time to be less than 12.6 ns, which becomes extremely challenging with today's electronic technology. We propose an extended frame-based packet-scheduling scheme that relaxes the time constrains by aggregating multiple packets to form a photonic frame. A new scheduling scheme, called frame-based exhaustive matching (FEM), is proposed and analyzed to show its capability of resolving the contention efficiently while providing high throughput, no input starvation, and satisfactory delay performance under various traffic conditions.

BIOGRAPHY

Dr. Zhigang Jing is currently with Department of Electrical and Computer Engineering, Polytechnic University, NY. His current research areas are focused on highly scalable switching technology (Optical & Electrical), implementable scheduling schemes, high-speed networking, Buffer Management and Congestion Control, multimedia communication, Differentiated Services, Multi-Protocal Label Switching. In these areas, he published more than 20 Journal and conference papers, and two book chapters published by John Wiley & Sons, Inc.

Zhigang Jing was awarded his Ph.D., M.S.E.E, and B.S.E.E. degrees in Electrical Engineering from University of Electronic Science & Technology of China. Then he was accepted in EE department, Tsinghua University as a Postdoctorate Fellow. Since March 2000, he joined ECE department, Polytechnic University, NY, as a Postdoctorate Fellow.

He is a member of IEEE and ACM. He is a reviewer of IEEE/ACM Transaction on Networking, IEEE Journal of Selected Area on Communications, IEEE Communication Letters, INFOCOM'2002, ICC'2002, and Globecom'2002 etc.

T6 - Technical Session VI: MEMS – Optoelectronics

Experimental Study of Micromachined Electrostatic Torsion Actuators with Full Travel Range

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ABSTRACT

Electrostatic torsion actuators are an important component in microelectromechanical systems (MEMS), especially for applications in the emerging all optical telecommunications network such as cross-connects, switches and variable attenuators, and for use in optical scanning technology for imaging and display applications. A number of papers have addressed rectangular torsion actuators and the related pull-in voltage, beyond which the applied electrostatic torque overcomes the spring restoring torque. Design approaches that use variable length fixed electrodes under the moving plate have been proposed to realize full travel range devices. Full travel range occurs when the pull-in angle θ_{pin}, measured as a percentage of the maximum tilt angle for a given design, reaches 100%. In torsion mode dominated systems, if the ratio of the electrode length to the actuator length, $\beta = a2/a3$, is smaller than 44%, no pull-in is expected.

In this paper, we investigate the pull-in effect in rectangular electrostatic torsion actuators designed for full travel range using fractional buried electrodes. We find that the presence of charge, due at least in part to moisture on silicon dioxide or silicon nitride surfaces under the actuator, has a large effect on the pull-in performance. This charge decreases the measured travel range and pull-in voltage well below designed values. Two ambient environments, vacuum and dry nitrogen, are used in an attempt to remove this charge effect, but we find that while these methods can reduce the impact of the charge, they cannot entirely eliminate it. In addition to these experiments, we also investigate the use of ground shield electrodes and find that they almost entirely remove the charge effect. Coventor 2001 finite element analysis software is used to compare simulation with experimental results.

BIOGRAPHY

Zhixiong Xiao received the B.S. and Ph.D. degree in semiconductor physics from Southeast University, China, in 1992 and 1996, respectively. From 1996 to 1998 and 1999 to 2000, he was with the Microelectronics Center, Peking University, and the Instrumentation Laboratory, Delft Technology University, The Netherlands, as a Postdoctoral Associate on MEMS, respectively. In July 2000, he joined the Microelectronics Research Center, New Jersey Institute of Technology (NJIT), Newark, as a Research Professor. His current research interests are in the design and fabrication of MEMS micromirrors and cross-connects and other optical devices.

T6 - Technical Session VI: MEMS – Optoelectronics

Integrated Optoelectronics—Key to Future Metro Optical Networks

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ABSTRACT

In contrast to the current economic downturn and the burst of the 'fiber bubble', metro market remains as a bright spot left, if not the only, in the optical fiber telecommunication industry with still sizable investments. Carriers still see the deployment of metro fiber systems as a means to break the bandwidth bottleneck and to generate the desperately needed revenue. The challenge faced by the telecom equipment manufacturers is to design and deliver low-cost and high-performance optical metro systems to meet this need. The characteristics of the metro optical systems can be vastly different from those of the long haul systems. Network flexibility for traffic growth and changes and the need to support a large variety of customer service, from FICON/ESCON, Gig Ethernet to OC-192, are the emphases in metro system designs. The existence of the diverse legacy infrastructure and technologies may further complicate the issue. A balance has to also be struck between lowering the start-up costs and the fully-loaded system costs. The hefty performance/cost requirements put on the next generation optical metro products may only be realized through technical innovations. Many new technologies may see their first applications in the metro networks, in order to bring dramatic cost reduction and performance improvements. Programmable optical add drop, low-cost optical amplification and dispersion compensation are some of the critical areas of interests for metro optical systems, where integrated optical devices may offer tremendous savings in component and operating costs and yet realized good performance and functionality. Photonic integrated circuits, tunable lasers, integrated optical gain blocks and other novel optical components and their system impacts are illustrated here. Novel high-speed electronic chips also make their way into the optical systems to replace their traditional, more costly optical counterparts.

BIOGRAPHY

Zheng Zheng is currently a Member of Technical Staff in the Metro Optical Technologies and Application Group of Lucent's Metro EON BU in Holmdel, NJ. The group is responsible for designing Lucent's next generation metro/regional optical WDM systems, as well as forward-looking studying and evaluating the emerging optical technologies for metro communication applications. He is currently involved in studying new technologies in optical transport layer relating to optical transmitters and receivers, novel optical dispersion compensation techniques, and specifying requirements for the related components for Lucent metro optical products.

In his previous assignment, he was with the Advanced Optical Networking and Technology Department of Lucent Technologies. He carried out research work of fiber optic technology, systems and networks in support of the design and development of all-optical crossconnect and optical layer networking products.

Zheng Zheng received his Bachelor's degree with honor in Electronic Engineering at Tsinghua University, Beijing, China and received his Master's and Ph. D. degree in Electrical Engineering from Purdue University. He joined Lucent Technologies in 2001. He has authored or co-authored ~20 journal papers and conference talks.

T6 - Technical Session VI: MEMS – Optoelectronics

Availability and Application of Free Space Optics (FSO) in Cellular Transport Radio Access Network (CT RAN)

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ABSTRACT

The advent of 3G communication systems with their ability to process real-time multimedia applications and large bandwidths will greatly enhance mobile Internet access and the evolution to the all IP target has been widely discussed. That is, the advent of 3G communication systems with their ability to process real time multimedia applications and their large bandwidth will greatly enhance mobile Internet access. The progressive introductions of 3G illustrate the evolution from voice-only to multimedia mobile service. In the future beyond, the technology map can be extended to include access technology for transmission at more than 50 Mb/s for fast moving users as well as ultra wide band systems for wider area coverage.

In this talk, we will in general discuss the architecture of cellular transport radio access network (CT RAN and its possible evolution path will also be introduced. Then we will summarize some key features (pros and cons) of free space optics (FSO) and its availability from vendor's points of view. Due to its "fiber-like" property, applications and impact of FSO on CT RAN will be described. Finally we draw a conclusion.

BIOGRAPHY

Ti-Shiang Wang (ti-shiang.wang@nokia.com) received the B.S. and M.S. degree from Automatic Control Engineering, Feng Chia University, Taiwan, in 1986 and 1988. He received the Ph.D. degree from Electrical Engineering, Polytechnic University, New York, USA, in 1998. He has served as a lecturer in Nan-Kai Institute of Technology, Taichung, Taiwan, during 1991. From 1991 to 1998, his works were focused on control theory, detection and estimation, digital signal processing and optical packet switching systems areas. Since 1999, Dr. Wang has been working as a senior research engineer and a project manager in Nokia Research Center, Boston, USA. His areas of works are currently engaged in the research and development of IP and WDM networks, optical/radio access networks, terabit optical packet switches and wireless networks. Dr. Wang has published more than 20 papers in conferences and journals, and also has one patent granted in the optical networking area. Dr. Wang is a senior member of IEEE.

T6 - Technical Session VI: MEMS – Optoelectronics

Hands-On MEMS

Luc Frechette[1], Vijay Modi[2], Floyd Miller[3] and Kenneth Farmer[4]

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ABSTRACT

We have developed an innovative MEMS education program that combines virtual fabrication with actual testing of classic MEMS devices. This approach is suitable both for large classes and in university environments that do not have access to large fabrication facilities. The virtual fabrication software tool allows students to create mask designs, and then construct devices using simulated process steps, from wafer cleaning and photolithography to oxidation, deposition and etching. The students control all aspects of fabrication including process time, temperature and environment, loading wafers, dispensing chemicals, starting pumps and opening and closing valves. The software has the added benefits of time compression and showing device cross-sections in real time. Once the students fabricate their device using virtual reality, they are given an actual version of the device fabricated by the MRC staff. To date, we have had the students test classic, bulk micromachined, piezoresistance-sensed acceleration, pressure and flow sensors, and an electrostatic microactuator formed by fusion wafer bonding and deep reactive ion etching. In groups of three or four, the students mount and test their devices using simple control and data acquisition equipment such as DC supplies and multimeters, and compare their measurements to theoretical predictions. In the last two years, over 90 students at NJIT and Columbia University have taken the course, attracting mechanical, electrical, chemical, biomedical and computer engineers, physicists and materials scientists enrolled at the two schools, and about 10 non-matriculated students from area industries. Currently we are refining the curriculum to allow the course to be easily adopted by other schools.

BIOGRAPHY

Kenneth R. Farmer, II (Beau) is an Associate Professor in the Department of Physics at New Jersey Institute of Technology, Director of the Institute's Microelectronics Research Center (http://www.njit.edu/mrc) and founder of a statewide Research and Development Excellence program called the NJ MEMS Initiative, sponsored through the NJ Commission on Science and Technology. Beau earned his B.S. in Engineering Science from the University of Virginia in 1983 and his Ph.D. in Applied Physics from Cornell University in 1990. He joined NJIT in 1992 after a two-year research position in the Department of Solid State Electronics at Chalmers University of Technology in Gothenburg Sweden. In ten years at NJIT he has developed an internationally recognized program of teaching and research that has led to university teaching awards, featured research in numerous invited presentations and publications, and many substantial state, federal and industrial grant-funded activities in microelectromechanical systems (MEMS) and microelectronics. Recently, in collaboration with researchers at Columbia University, he has developed a MEMS education program that gives students hands-on experience in MEMS design, modeling, fabrication, packaging and testing.

T7 - Technical Session VII: System-on-Chip

Session Chair

Yar-Sun Hsu

National Tsing-Hua University

BIOGRAPHY

Dr. Hsu received both the B.S. and M.S. degrees in electronics engineering from National Chiao Tung University, Taiwan, in 1971 and 1973, respectively, and his Ph.D. degree from Rensselaer Polytechnic Institue in 1979. After working three years at General Electric Company, he joined the IBM Thomas J. Watson Research Center in 1982 as a research staff member. Since 1984, he had been involved in the design and analysis of multiprocessor systems, initially working on a MIN-based (Multistage Interconnection Network) shared-memory scalable parallel system, and lately on technologies for IBM SPx machines. From 1988 to 1999 he was the manager of a system group responsible for performance modeling and parallel input/output, as well as the design and implementation of a parallel file system. In 1999 he took a one year leave of absence to teach at National Tsing Hua University, Hsinchu, Taiwan. From 2000 to 2002 he worked on a high speed network protocol engine using silicon on chip technology with IBM Blue Gene as the core. He returned to the same university in 2002 to become a professor in the Department of Electrical Engineering. Dr. Hsu received 9 US patents, one IBM Outstanding Technical Achievement Award, and several IBM Research Division Awards. He has also received the best system paper award in the 2000 ACM SIGMETRICS Conference.

T7 - Technical Session VII: System-on-Chip

Organizer

Howard Chen

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BIOGRAPHY

Dr. Howard Chen received his Ph.D. degree from the University of California, Berkeley in 1987. Since then, he has been with the IBM Research Division, Thomas J. Watson Research Center, in Yorktown Heights, New York, where he is currently a research staff member. Dr. Chen has received the IBM Invention Achievement Award for 7 U.S. patents, the IBM Research Division Award for contributions to the design and realization of the Alliance G4 microprocessor, the IBM Outstanding Contribution Award for design and realization of the Alliance G5 microprocessor, and the IBM Research Division Award for design and implementation of Freeway G7 microprocessor.

T7 - Technical Session VII: System-on-Chip

New Trend of Chip Design for Digital Speech/Audio Signal Processing

Jhing-Fa Wang

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ABSTRACT

We start with a review of the current developments and products of digital speech/audio. This includes the current speech/audio algorithms and products. In spite of the significant progress in this field, there is still much that can be greatly improved. We then give some new trends at the speech/audio algorithms and discuss where they can be used. Finally, the potential hardware architectures for new speech/audio algorithms will be examined and discussed.

In summary, the outline of this talk is show below:

- Introduction
- Current developments of digital speech/audio signal processing
- New trends of the speech/audio IP design
- Conclusion and Future Research
- References

BIOGRAPHY

Jhing-Fa Wang is now a professor in National Cheng Kung University, Tainan, Taiwan. He received his Master and Bachelor degrees in the department of Electrical Engineering from National Cheng Kung University in 1979 and 1973, respectively and Ph.D. degree in the Department of Computer Science and Electrical Engineering from Stevens Institute of Technology, U.S.A. in 1983. He is now a board Chairman of Journal of The Chinese Institute of Electrical Engineering. He is now also on the Board of Governors of IEEE Taipei Section. He got outstanding awards from Institute of Information Industry in 1991 and National Science Council in 1990, 1995, and 1997, respectively. His current research areas include VLSI/CAD, speech recognition, speech coding, optical character recognition, and natural language processing. He has developed a Mandarin speech recognition system called Venus-Dictate known as a pioneering system in Taiwan. He has published about 77 journal papers and 185 conference papers since 1983. He was elected as an IEEE Fellow in 1999 for contributions to software-hardware co-development of large-vocabulary Mandarin speech processing and recognition systems.

T7 - Technical Session VII: System-on-Chip

System-on-Chip (SoC) Implementation of Multimedia Systems

Yu-Hen Hu

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ABSTRACT

SoC-based design will integrate ready-made designs (Intellectual Properties, IP) of programmable cores, data processing blocks with caches, peripherals, and analog (mixed signal) components into the same chip. Challenges and opportunities when applying SoC design to implement real time multimedia systems will be discussed. Specifically, two issues will be investigated: communication, and interface.

While it is well known that physical layer on-chip communication cost is a major factor in designing sub-micron SoC chips, it is equally important to address communication issues at higher level of abstraction. We will discuss the impact of communication on algorithm design, and memory access and data movement design in the context of multimedia system implementation.

Current available IP market lacks a De facto standard similar to that of the basic MSI logic devices. As such, interface between different IPs becomes major bottleneck in a SoC based project. We stress the need to develop novel interface component IPs that promise self-reconfigurable IP interface logic that is capable of auto-sensing, and plug-n-play functions.

To incorporate these design issues into multimedia system implementation, we will survey several existing approaches.

BIOGRAPHY

Yu Hen Hu is a faculty member at the Department of Electrical and Computer Engineering, University of Wisconsin, Madison. He received BSEE from National Taiwan University, and MSEE and PhD degrees from University of Southern California. Prior to joining University of Wisconsin, he was faculty in the Electrical Engineering Department of Southern Methodist University, Dallas, Texas. His research interests include multimedia signal processing, artificial neural networks, fast algorithms and design methodology for application specific micro-architectures, as well as computer aided design tools. He has published more than 180 technical papers in these areas.

Dr. Hu is a fellow of IEEE. He is a former associate editor (1988-1990) for the IEEE Transaction of Acoustic, Speech, and Signal Processing in the areas of system identification and fast algorithms. He is currently associate editor of IEEE Signal Processing letters (2002-2003), Journal of VLSI Signal Processing, and European Journal of Applied Signal Processing. He is a founding member of the neural network signal processing technical committee of IEEE signal processing society and served as chair from 1993-1996. He is a former member of VLSI signal processing technical committee of the signal processing society. He served as the secretary of the IEEE signal processing society (1996-1998), a board member at IEEE neural network council. He is currently a steering committee member of the international conference of Multimedia and Expo on behalf of IEEE Signal processing society, an associate editor for IEEE signal processing letters, European Journal of Applied signal processing, and an area editor for IEEE signal processing magazine.

T7 - Technical Session VII: System-on-Chip

SoC Signal Integrity and Power Delivery Design Challenges and Solutions

Charlie Chung-Ping Chen

University of Wisconsin at Madison

ABSTRACT

This talk presents signal integrity and power delivery design challenges and possible solutions for high-speed, low power, deep sub-micron, and millions-of-transistors SoC VLSI design. Starting from technology scaling trends, several signal integrity issues such as capacitance and inductance modeling, electrical and magnetic coupling noises will be discussed. Novel signal integrity analysis algorithms, optimization methods, and design methodology will be presented. Power delivery issues such as IR drop, Ldi/dt drop, and packaging resonance problems will also be discussed in details. Several comprehensive power delivery design methodology and efficient analysis techniques such as preconditioned Krylov space method and Alternative Direction Implicit method will also be presented.

BIOGRAPHY

Charlie Chung-Ping Chen received his B.S degree in computer science and information engineering from the National Chiao-Tung University, Hsinchu, Taiwan, in 1990 and his M.S. and Ph.D. degrees in computer science from the University of Texas at Austin in 1996 and 1998. From 1996-1999 he
was with Intel Corporation as a senior CAD engineer with Strategic CAD Labs. He was in charge of several interconnect and circuit synthesis projects in the micro-processor group. Since 1999, he has been an assistant professor in the ECE Department at the University of Wisconsin, Madison. His
research interests are in the areas of computer-aided design and microprocessor circuit design with an emphasis on interconnect and circuit optimization as well as signal integrity analysis and optimization.

Prof. Chen received the D2000 award from Intel Corp. and National Sciences Foundation Faculty Early Career Development Award (CAREER) at 1999 and 2001, respectively. He also received the 2002 Sigda/ACM Outstanding Young Faculty award and 2002 Peter Schneider Faculty Development award.

T7 - Technical Session VII: System-on-Chip

A Practical Paradigm for Optimization-based Design Systems and its Applications to VLSI CAD

Hsiao-Dong Chiang

Cornell University

ABSTRACT

Optimization technology has practical applications in almost every branch of science, business and technology. For most practical applications, the task of searching the solution space of a nonlinear optimization problem to find the global optimal solution is very challenging. Relatively speaking, searching for a local optimal solution is a much easier task. From the engineering and the economic viewpoints, the value of obtaining the global optimal solution is the highest when compared to alternative solutions. The great majority of existing numerical methods/techniques, and heuristic for solving nonlinear optimization problems usually find a local optimal solution, but not the global one. They usually become trapped at every local optimal solution and are unable to escape from those solutions. This drawback has motivated the recent development of a number of more sophisticated numerical methods designed to find better solutions by introducing some mechanisms that allow the search process to escape from local optimal solutions. However, many research and numerical studies indicate that these sophisticated numerical methods suffer from several problems, among others, requiring intensive computational efforts and yet still unable to find the global optimal solution; and yielding inconsistent solutions. To resolve these difficulties, we have developed a practical paradigm for finding the global optimal solution. This paradigm has numerous desired features and advantages that surpass all the other optimization technologies.

BIOGRAPHY

Dr. Hsiao-Dong Chiang received B.S. and M.S. in Electrical Engineering from National Taiwan University in 1979 and 1981 respectively, and PhD in Electrical Engineering from University of California, Berkeley in 1986. He is currently Professor of Electrical and Computer Engineering at Cornell University, Ithaca, NY. His research interests include nonlinear computations and applications in electric signals, circuits and power systems and global optimization technology and practical applications

Prof. Chiang received the Presidential Young Investigator Award in 1989, the Outstanding Educator Award (from Cornell University) in 1990 and was elected to IEEE Fellow in 1996. He and his research co-workers have published about 160 refereed papers and was awarded 6 U.S. patents with another 3 pending. Dr. Chiang and his development team has developed 10 computer packages for industrial applications with more than 30 users world-wide.

T7 - Technical Session VII: System-on-Chip

Firm IP Methodology for Low-Power, High-Performance ASIC and SoC Designs

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ABSTRACT

A novel design methodology for low-power, high-performance ASIC and SoC designs is presented allowing mixed, custom/semi-custom designs in much less time than previously possible. Schematics, layouts etc. are generated by small programs calling toolkit library functions layered above design system programming languages, significantly reducing initial design time, fully exploiting hierarchy, repetition and advanced technology features, maximizing technology independence, re-mapping and re-design efficiency, and optimizing power/delay trade-offs. The re-use methodology has been demonstrated in 0.18µm and 0.13µm CMOS technologies and is being used for the datapath and register arrays of an ultra-low-power, high-performance embedded processor and system-on-chip (SoC) designs.

BIOGRAPHY

George Diedrich Gristede was born in Mt. Kisco, N.Y., USA in 1962. In 1984, he graduated from Columbia College with a B.A. degree in Professional Option Engineering. In 1985, 1988, 1990 and 1992, he received the B.S., M.S.,P.Phil and Ph.D. degrees from Columbia University, all in Electrical Engineering. His Ph.D. thesis dealt with the derivation of a new mathematical formulation for analyzing the convergence properties of relaxation-based simulation methods. In 1992 Dr. Gristede joined the IBM Thomas J. Watson Research Center as a Research Staff Member where he has
done extensive work in the areas of high-performance circuit design and the development of a new generation of custom CAD tools to support such designs. His research interests include high-performance circuit design, automated circuit checking and optimization, and automated custom physical design. Dr. Gristede is a member of Tau Beta Pi and Eta Kappa Knu.

T8 - Technical Session VIII: Bioinformatics

Session Chair

Sue-Jane Wang

U.S. Food and Drug Administration

BIOGRAPHY

Dr. Sue-Jane Wang received her master degree from University of California, Los Angeles, CA and Ph.D. from University of Southern California. She is currently the biostatistics representative of FDA/CDER Pharmacogenomics/Pharmacogenetics Working Group. Dr. Wang's major activities include controlled clinical trials; genetic and epidemiologic studies; statistical methods for analysis of microarray data and pharmacogenomics/ pharmacogenetics data in drug development; and teaching in biostatistics. Her professional activities include Editor-in-Chief: International Chinese Statistical Association (ICSA) Bulletin; Section Editor: Controversial Statistical Issues; Member: the Board of Directors, Publication committee and Award committee of ICSA; Chair: statistics sessions and biotechnology sessions in conferences, symposium, workshops including Pharmacogenomics Session at the FDA/Industry workshop, Statistics in Genetic Epidemiology at the ICSA applied statistics symposium, Bio-Chip Technology and Data Mining session at the Symposium on Biomedical Technology Development, etc. Dr. Wang received FDA Award of Merits and FDA/CDER Excellence in communication Award.

T8 - Technical Session VIII: Bioinformatics

Organizer

Tsu-Han Chen

Carnegie Mellon University

BIOGRAPHY

Tsuhan Chen has been with the Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, since October 1997, where he is now a Professor. He directs the Advanced Multimedia Processing Laboratory, striving to turn multimedia technologies from science fiction into reality. His research interests include multimedia signal processing and communication, audio-visual interaction, multimodal biometrics, processing of 2D/3D graphics, bioinformatics, and building collaborative virtual environments. From August 1993 to October 1997, he worked in the Visual Communications Research Department, AT&T Bell Laboratories, Holmdel, New Jersey, and later at AT&T Labs-Research, Red Bank, New Jersey, as a senior technical staff member and then a principle technical staff member.

Tsuhan helped create the Technical Committee on Multimedia Signal Processing, as the founding chair, and the Multimedia Signal Processing Workshop, both in the IEEE Signal Processing Society. His endeavor later evolved into the founding of the IEEE Transactions on Multimedia and the IEEE International Conference on Multimedia and Expo, both joining the efforts of multiple IEEE societies. He has recently been appointed as the Editor-in-Chief for IEEE Transactions on Multimedia for 2002-2004.

Before serving as the Editor-in-Chief for IEEE Transactions on Multimedia, he also served in the Editorial Board of IEEE Signal Processing Magazine and as Associate Editor for IEEE Trans. on Circuits and Systems for Video Technology, IEEE Trans. on Image Processing, IEEE Trans. on Signal Processing, and IEEE Trans. on Multimedia. He has co-edited a book titled Advances in Multimedia: Systems, Standards, and Networks.

Tsuhan received the B.S. degree in electrical engineering from the National Taiwan University in 1987, and the M.S. and Ph.D. degrees in electrical engineering from the California Institute of Technology, Pasadena, California, in 1990 and 1993, respectively. He received the Charles Wilts Prize for outstanding independent research in Electrical Engineering leading to a Ph.D. degree at the California Institute of Technology. He has published many technical papers and holds thirteen U.S. patents. He is a recipient of the National Science Foundation CAREER Award, titled "Multimodal and Multimedia Signal Processing," from 2000 to 2003.

T8 - Technical Session VIII: Bioinformatics

Design and Power Consideration in Pharmacogenomics/Pharmacogenetics Studies in which data are generated from gene expression data or from single neucleotide polymorphism data

Sue-Jane Wang* and James Chen, FDA

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National Center for Toxicology Research, U.S. Food and Drug Administration

ABSTRACT

Advances in genomics with use of microarray technologies and single nucleotide polymorphisms (SNPs) have highlighted the importance of pharmacogenomics and pharmacogenetics approaches to drug discovery, drug development and disease diagnosis. An overview of the methods adopted in pharmacogenomics/pharmacogenetics studies will be described. The utilities and limitations from literature publications with emphasis on pharmacogenomics and pharmacogenetics studies for drug discovery and drug development will be explored. We will focus on the design consideration with statistical validity and statistical power for such studies. One of the crucial statistical issues is the replication of array numbers of the gene expression data or SNPs data. In this talk, we will propose a mathematical model to evaluate the number of microarrays needed in the toxicogenomics application or pharmacogenomics/pharmacogenetics studies to identify differentially expressed genes.

BIOGRAPHY

Dr. Sue-Jane Wang received her master degree from University of California, Los Angeles, CA and Ph.D. from University of Southern California. She is currently the biostatistics representative of FDA/CDER Pharmacogenomics/Pharmacogenetics Working Group. Dr. Wang's major activities include controlled clinical trials; genetic and epidemiologic studies; statistical methods for analysis of microarray data and pharmacogenomics/ pharmacogenetics data in drug development; and teaching in biostatistics. Her professional activities include Editor-in-Chief: International Chinese Statistical Association (ICSA) Bulletin; Section Editor: Controversial Statistical Issues; Member: the Board of Directors, Publication committee and Award committee of ICSA; Chair: statistics sessions and biotechnology sessions in conferences, symposium, workshops including Pharmacogenomics Session at the FDA/Industry workshop, Statistics in Genetic Epidemiology at the ICSA applied statistics symposium, Bio-Chip Technology and Data Mining session at the Symposium on Biomedical Technology Development, etc. Dr. Wang received FDA Award of Merits and FDA/CDER Excellence in communication Award.

T8 - Technical Session VIII: Bioinformatics

3D Graphics and Bioinformatics: Protein Retrieval by Matching 3D Surfaces

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ABSTRACT

Folding into complex 3D structures, protein molecules are responsible for carrying out nearly all of the essential functions in living cells by properly binding to other molecules with a number of chemical bonds connecting neighboring atoms. Locations of these atoms are called the binding sites. To help biologists identify the protein functions, which is essential important to drug design and disease prediction, it is desirable to retrieve common binding sites among proteins. We use the geometric hashing algorithm to identify similar binding sites among protein structures. Biologists have suggested that, in the next decade a large amount of proteins structures will be derived without knowing its functions. Our work is promising in helping biologists identify the functions of unknown proteins and to discover new functions of known proteins.

BIOGRAPHY

ShannChing Chen is currently a second year graduate student of Electrical and Computer Engineering, Carnegie Mellon University. With strong signal processing background, he has been evolved in the field of bioinformatics. He works on protein structure comparison and has been developing a system that can retrieve proteins with similar three-dimensional structures.

ShannChing Chen got his Bachelor degree in Computer Science and Information Engineering Department of National Taiwan University in 1999. In 2001, he joined Electrical and Computer Engineering, Carnegie Melon University (CMU), as a graduate student.

T8 - Technical Session VIII: Bioinformatics

Building a fully integrated informatics tool to exploit the sequence databases

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ABSTRACT

One of the challenges for experimental biologists in the post-genome era is to rapidly identify interesting sequences and decipher their biological functions from massive amount of sequence information in various databases. The informatics tools currently available, in general, are low throughput; and most importantly those are difficult to use for bench scientists, whom are most capable of interpreting and designing experiments to explore the functionality of interesting sequences. In the past two years, we have built a web based fully integrated bioinformatics tool for bench scientists to harness the high speed computing tools so that they can use such information in combination with high throughput genomics experimental tools, like microarray, to render the genome sequences.

The tool we have developed centered on the well-documented blast algorithm; however, it allows individual user to manage and interact with search results and sequence databases. The tool supports multiple sequences search against a plurality of databases regardless the format of the sequences. It also allows user to perform multiple sequence alignment, survey expression profile with EST information, and generate PCR primer sets with a click of button from sequence search result. The user can also create and manage their own sequence of interest and create their own searchable sequence databases. We believe tools like this will facilitate the discovery process for bench scientists in the post genome era.

BIOGRAPHY

Andrew T.Y. Kuo, is the CEO of Taiwan Genome Sciences, Inc. in Taiwan, Republic of China. Mr. Kuo has over ten years of industry experience in project management and an extensive experience in the biotechnology industry in both operation and investment side. Mr. Kuo is the founder of many biotechnology companies in North America including partnering with Dr. Leroy Hood in forming PhneoGenomics Corporation, an informatic-driven drug discovery company located in Seattle, WA. In the field of bioinformatics, Mr. Kuo is the Board of Director of LifeSpan Biosciences in Seattle, WA. On the investment side, Mr. Kuo is the executive director of Alliance Biomedica, a bioscience venture fund in Taiwan. Mr. Kuo's distinguished career in venture management made him the 1997 Alfred P. Sloan Fellow, Sloan School of Management, MIT. Mr. Kuo received his MBA and M.S. in Mechanical Engineering from MIT.