Introductory Remarks on the Special Issue on NCKU
EECS 2009 US Visit to Four Top-tier Universities

Helen Chang
The Banyan Editorial Office

On September 14-21, 2009, a delegation of NCKU EECS consisting of Dr. Yonhua Tzeng, Dean of College of Electrical Engineering and Computer Science, Dr. Shoou-Jinn Chang, Director of Institute of Microelectronics, Dr. Pau-Choo Chung, Director of Institute of Computer and Communication Engineering, Dr. Sheng-Tzong Cheng, Chair of Department of Computer Science and Information Engineering, Dr. Vincent S. Tseng, Director of Institute of Medical Informatics, and Dr. Wen-Feng Hsieh, Chair of Department of Electro-Optical Engineering, visited four top-tier US universities, including the Polytechnic Institute of NYU, Purdue University, Georgia Institute of Technology (GIT), and University of California at Los Angeles.

During their visit to each institution, the delegation had met with leadership and distinguished scholars for presentations, discussion, lab and classroom tour, and round-table discussion to enhance mutual understanding in education, research, administration and university-industry collaboration issues. They also established feasible plans for recruiting visiting faculty for NCKU-EECS, degree pursuing foreign students, exchange students for summer studies, MS dual degree and NCKU-US institution co-supervision Ph.D dual degree programs. To assist students to realize their ambition through such internationalized tracks, faculty and leadership from the involved institutions will provide administrative support programs on finance, life and cultural adaptation during their studying abroad. In addition, the delegation toured advanced multiple disciplinary labs and research centers, sharing their experiences and lessons learned on R & D institute management and development with host scholars. Participating scholars and administrators from all involved institutions formulated closer future bilateral student and faculty exchange and collaboration plans on their research strengths and focal strategic research fields. With strong research expertise, passion to nourish talents and a sense of mission to promote human wellbeing through technology advancement, during the highly compact schedule, the NCKU-EECS delegation achieved the most fruitful results and milestone accomplishments in collaboration with those top-tier universities.

In the four travel reports written by EECS Dean Yonhua Tzeng, also the founding and first Editor-in-Chief of the Banyan Research Express @ NCKU, you can read detailed records of the visit, features and key performances of the institutions, accomplishments of and outstanding contributions made by the scholars they had met, and sketches on the advanced multiple disciplinary research centers. Detailed account of the various undergoing academic and research collaboration programs and noteworthy research center operation model are also given in these reports.

Dean Tzeng, one of whose mottos is “what matters is not one's age, but how much more contribution one can still
make,” can always gain insight on real and crucial needs in promoting technological and academic development to the next level of excellence. Such acumen is partly owing to his relentless sense of mission for human wellbeing and compassion for the human condition. Not surprisingly, his noble ideals and dedication can attract outstanding and capable talents from home and abroad to realize their common goals. He has been recognized as a distinguished leader and, together with his team, they have created many exemplary accomplishments. In less than one year since the US visit, several exciting good news have been reported, such as UCLA Drs. Kang L. Wang and M.C. Frank Chang (member of US National Academy of Engineering) have been recruited as visiting chair professors to the EECS, a distinguished and selected exchange student from Purdue University, Mr. Matthew J. Barga, has arrived at NCKU-EECS and started internship with Delta Electronics, Inc. It is likely that Mr. Barga will take the opportunity to complete a research project at NCKU by the end of his internship period. On the other hand, this coming summer, Mr. Sheng-Hao Chen and Mr. Chieh-Lun Chiang, both supervised by Assistant Professor Chin-Lung Yang of Department of Electrical Engineering, will join the IDEAS (Integrated Design of Electromagnetically-Applied Systems) Laboratory at Purdue University led by Prof. William Chappell. Furthermore, Mr. Yen-Chia Chu, a Ph.D. student in the Department of Electrical Engineering supervised by Prof. Chang-Chien, Le-Ren and Mr. An-Ti Chiang, a Ph.D. student in the Institute of Computer and Communication Engineering supervised by Prof. Jar-Ferr Yang will start their NCKU-Polytechnic Institute of NYU co-advisory dual degree Ph.D. program in September 2010 and September 2011, individually. Prof. Dariusz Czarkowski and Prof. Yao Wang of Polytechnic Institute of NYU will be the co-advisors. Both Ph.D students are scheduled to finish their dual degree Ph.D. program in mid 2013.

We are honored to have invited Dean Tzeng to publish the four monumental reports in a devoted special issue with the Banyan, and we sincerely invited all friends who care about nourishing talents and the broad field of electrical engineering and computer science to savior them. To manifest dreams into reality with passion for real life wellbeing and practical convenience, these technology and science scholars and educators will enlighten and ignite your infinite creative power to create your unique glorious life.

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Fusion of NCKU EECS and POLY-NYU in Brain Power and Resources: A Full Day of Productive Dialogue with Leadership of Polytechnic Institute of NYU

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It was a wonderful day in Brooklyn, New York on September 14, 2009. A delegation consisting of six faculty members of College of Electrical Engineering and Computer Science of National Cheng Kung University, Tainan, Taiwan began the day with a series of presentations, discussion, lab and classroom tour, and then round-table discussion about how best to promote effective collaboration in both education and research.

The NCKU-EECS delegation consists of:

**Dr. Yonhua (Tommy) Tzeng**
Dean of College of Electrical Engineering and Computer Science and University Chair Professor of Electrical Engineering;

**Dr. S. T. Cheng**
Chairperson and Professor of the Department of Computer Science and Information Engineering;

**Dr. W. F. Hsieh**
Chairperson and Professor of the Department of Electro-Optical Engineering;

**Dr. S. J. Chang**
Director and Professor of Institute of Microelectronics;

**Dr. P. C. Chung**
Director and Professor of Institute of Computer and Communication; and

**Dr. Vincent Tseng**
Director and Professor of Institute of Medical Informatics.

The delegation met with the following leadership and scholars of Polytechnic Institute of NYU (Poly-NYU):
The well planned extensive brainstorming sessions would not be possible without the promotion by the outstanding alumnus of NCKUEE, Dr. David Chang, Chancellor of Polytechnic Institute of NYU, and the enthusiasm of Dr. Jonathan Chao, Head of Department of ECE of Polytechnic Institute of NYU, in pushing forward the establishment of a feasible dual-degree Ph.D. program between Poly-NYU and College of EECS of NCKU.

Following the simple and straight mission of Polytechnic University in Brooklyn, New York: “To produce and support the leaders of tomorrow, we will provide excellence in research and education in engineering, computing,
science and related fields for the New York region and the world,” the 150 some years old Polytechnic University has won its world wide reputation as one of the best “EECS University” in the world! The main strengths of Poly evolve with the needs of the New York region, the country, and the world. For modern economic needs, Poly developed one of the best educational and research program in telecommunication and related disciplines, which have successfully fused and integrated with regional and world wide industries.

Poly's strengths in telecommunication can be traced back to Poly's proud historical contributions in radar technology and continues to the modern wireless communication and its derivatives in cyber security, high speed and secure data center, and cooperative communication in the system level. Besides being a proud part of the best engineering university in Taiwan with 16th ranked academic productivity in the world, NCKU-EECS has, in he past 78 years, also been striving to produce and support the leaders of tomorrow, provide excellence in research and education in electrical engineering, computing, science and related fields for Taiwan and the world. NCKU-EECS has produced more than 12,000 EECS engineers since its establishment in 1931 and is instrumental in creating the economic miracle for the Silicon Island: Taiwan. Therefore, common strengths of NCKU-EECS and Polytech provide both sides with plenty of opportunities to share experiences and resources as well as proactive exchange of students and faculty members.

Dr. E. Dianne Rekow, Provost of Polytechnic Institute of NYU & Senior Vice Provost for Engineering &Technology, New York University presented a book entitled “Polytechnic University: Changing the World – the First 150 Years” to Dr. Yonhua Tzeng, Dean of EECS, NCKU as a gift to the NCKU-EECS delegation. Sitting by the table are Dr. Jonathan Chao, Head and Professor of ECE (left) and Dr. David Wang, Chancellor of Poly-NYU (right).

Dr. E. Dianne Rekow holds both the position of Provost of Polytechnic Institute of NYU and the position of Senior Vice Provost for Engineering &Technology of the New York University. Dr. Rekow assumed the Provost position for Poly-NYU and takes the challenge of merging Polytechnic Institute of Brooklyn with New York University. Polytechnic Institute of Brooklyn is well known by its engineering disciplines especially electrical engineering and computer science. New York University has well developed programs in laws, medicine, management, and sciences. The merger of these two institutions is expected to provide with the synergy needed to promote Poly-NYU into one of world-wide best universities. These two institutions are practically operating as one university except that there are two independent financial systems.

Dr. Kurt Becker, Associate Provost for Research & Technology Initiative, Polytechnic Institute of NYU represented Dr. Rekow to welcome us in the morning and attended the whole discussion session in the afternoon and provided constructive and critical instructions about a pending dual-degree Ph.D. program for NCKU EE doctoral students to be admitted to the Ph.D. program of Poly-NYU for earning two Ph.D. degrees from both NCKU and Poly-NYU simultaneously.

After the welcoming remarks, the whole day meeting and lab tour started with an overview of NCKU and College of EECS presented by me followed by a series of presentations by Dr. Jonathan Chao, Head of Departments of ECE, Dr. Keith Ross, Head of Department of CSE, Dr. Shivendra S. Panwar, Director of CATT, and a number of scholars about their main themes of research.
Dr. Jonathan Chao, Head of ECE visited NCKU three years ago to promote dual-degree Ph.D. program between NCKUEE and Polytechnic Institute of Brooklyn. No actions were taken to successfully enable any case of dual doctoral degree so far. Dr. Chao is instrumental in call for the leadership of ECE and CSE related research centers and labs to join the meeting and exchange their visions and wishes for collaboration with us.

Leadership of major EECS related research disciplines presented their scope of research and central themes in cooperative wireless communication (Dr. Elza Erkip of ECE), power electronics (Dr. Francisco de Leon of ECE), video coding and video analysis, MRI (Dr. Yao Wang of ECE), control and robotics (Dr. Farshad Khorrami of ECE), query processing over web (Dr. Torsen Suel of CSE, security and privacy of ubiquitous devices, RFID (Dr. Nitesh Saxena of CSE).

We found a common direction of development for both NCKU and Poly-NYU, i.e., local industry and economy feed and drive the main themes of research and education for both universities. The strong electro-optical research in LCD, LED, and solar cells at NCKU is driven by the neighboring industry such as Chimei Company. The telecommunication, multimedia, and high speed secure data processing at Poly-NYU were driven by companies, such as IBM, Lucent Technology, and abundant media companies in or near NYC. While NCKU appears to enjoy the strengths in devices, Poly-NYU is good at system level R&D.

Asked by me about how best to promote system level education and research at NCKU, the Poly-NYU experiences are that textbook teaching is not adequate for modern system level R&D needs. It takes a lot of experiences for a professor and even more experiences a professor can get helped with from other professors and industrial specialists to make a system level education and research effective. At Poly-NYU, there are several contracted professors who have had extensive industrial experiences. For example Dr. Michael Knox is one of those industrial Professors who established a wireless teaching and research laboratory which turns out to be quite welcome by students.

Provost E. Dianne Rekow and Chancellor David Chang joined us for a luncheon. Provost Rekow welcomes our pursuit of NCKU-Poly-NYU collaboration and promised to provide necessary assistance to make it successful. Poly-NYU is proud of its 150 years of accomplishments and contributions to the country, society and world. Provost Rekow presented a book entitled “Polytechnic University: Changing the World – the First 150 Years” as a gift to the NCKU-EECS delegation. As a return we presented two copies of “BANYAN for EECS” which summarizes outstanding accomplishments made by EECS faculty in the past two years. These two books were accepted by the Head of Departments of Electrical and Computer Engineering and Head of Department of Computer Science and Engineering.

After the luncheon, we took a tour of the Cyber Security Lab, the Wireless Communication Lab, and the High Speed Data Lab. In the Cyber Security Lab, doctoral students and undergraduate students are
working hand-in-hand on how best to secure cyber space data handling and communication. Contests are organized for students of common interest to compete in breaking in and protecting own systems from being attacked by opponents in a way pretty much like a game. When asked what hardware and equipment are needed for such a lab to operate, the doctoral student who presented the lab to us said that nothing much more than an oscilloscope, computers, and some FPGA and a lot of thinking are essential.

The wireless communication lab is run by an industrial professor with extensive hands-on experiences in wireless communication systems. Dr. Michael Knox is enthusiastic and excited in showing the delegation his custom designed wireless teaching and research laboratory. Dr. Knox is excited in introducing his software defined radio design and test-beds. When asked by Dr. S. T. Cheng, Chairperson of the Department of CSIE of NCKU, how much it would cost for setting up a software defined radio test-bed for education and research, Dr. Knox told us that it would cost about $30K for frequencies up to 2GHz but would cost nearly ten times the price when the frequencies increases beyond 2 GHz. We invited Dr. Knox to come to NCKU to help build a wireless communication teaching lab and he was pleased to help.

The round-table discussion session in the afternoon was attended by Poly-NYU leadership including Chancellor, Dr. David Chang and Associate Provost, Dr. Kurt Becker as well as Department Heads of both ECE and CSE and all NCKU EECS delegation. The first goal of this session is to draft an MOU for EECS of NCKU and Poly-NYU to sign so that doctoral students of NCKU EE after taking two years of doctoral course and passing both NCKU and Poly-NYU qualifying exams to be admitted to the doctoral program at Poly-NYU. These students will study and carry out dissertation research co-directed by a professor at NCKU and another at Poly-NYU for 2-3 years at Poly-NYU. Successful completion of the dual-degree doctoral program will allow the student to earn a doctoral degree from NCKU and another one from Poly-NYU simultaneously. The second goal is to extend this MOU to include doctoral students of the Department of Computer Science and Information Engineering.

The major barrier for the 3-year old dual-degree doctoral program has been in principle removed during the round-table discussion. The barrier is the high tuition fees at Poly-NYU relative to that in Taiwan. Poly-NYU agrees to extend the 6-credit hour per semester tuition waiver policy for Poly-NYU students who are sponsored by Poly-NYU professor to include dual-degree doctoral students from NCKU as long as these students are sponsored by either professors at NCKU or professors at Poly-NYU for their cost of living. In order to attract doctoral students among the best ones from NCKU EECS to come to Poly-NYU by this proposed dual-degree doctoral program, Poly-NYU or professors of Poly-NYU will pursue full-fellowship for qualified NCKU EECS students to participate in the dual-degree doctoral program. We set a goal of sending 2-3 students per year at the beginning to Poly-NYU.

We all agreed that a good start would be very important for a sustainable development of this dual-degree program and close collaboration among faculty members of both universities. All delegation of both universities was
pleased with the conclusion of this round-table discussion. The draft MOU will be subjected to approval by Poly-NYU and NCKU. A final MOU is expected to be signed before the end of this semester. Dr. David Chang will coming to NCKU on November 19-20, 2009. It will be a right time to follow up with the progress of the full-fellowship and the dual degree doctoral program for both EE and CSIE students at NCKU to study at Poly-NYU.

After the formal business meeting, we met with Dr Erich Kunhardt, former Provost of Poly-NYU prior to Dr. Rekow. Dr. Kunhardt was my dissertation advisor and good friend at Texas Tech University. Dr. Kunhardt initiated the “Technogenesis” program at Steven Institute of Technology before taking the position as a former Provost at Poly-NYU. He demonstrated a very successful case of incubation and technology transfer program at SIT. A successful spin-off company established by Dr. Kunhardt and his former student was sold for more than $20M after only a few years of operation. After returning to his alma mater, Dr. Kunhardt initiated a new program known as I²E (Invention, innovation, and entrepreneurship) at Poly-NYU.

We met with Dr. Kunhardt in his office after the formal business discussion sessions ended. Dr. Kunhardt is recently even more excited and enthusiastic in higher education. We discussed about the American higher education and that in Taiwan. Dr. Kunhardt believes that the stable system in US and American's freedom to fail are the key ingredients for the success of US. He also argues that one should get into the ring to fight for winning or losing instead of staying outside of the ring as an observer knowing nothing really is inside the ring. We happily concluded the whole day meeting and brainstorming with a delicious dinner in the China Town. Dr. Kunhardt promised to come to NCKU for a visit and share with us his experiences in successful entrepreneurship and more.

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Reconnection of Historical and Active Tie between EECS of NCKU and ECE and CS of Purdue University:
One and Half Days of Productive Dialogues with Leadership and Scholars of Purdue University

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On September 15, an NCKU delegation consisting of six faculty members of College of Electrical Engineering and Computer Science arrived at the home of Purdue University, West Lafayette, Indiana. The weather is wonderful in this most beautiful season of this area. Driving along a country road, we enjoyed seeing beautiful and colorful sunset on top of endless corn fields, which extended all the way to the far away horizon. Formal business meeting began in the following day on September 16 and extends until the morning of September 17. The missions of the EECS delegation included (1) revival of the historical collaboration between NCKU and Purdue University by the initiation of dialogues between Department of Electrical Engineering and Department of Computer Science and Information Engineering of National Cheng Kung University with the counterparts at Purdue University for collaboration and (2) the establishment of feasible plans for exchange of students and faculty of NCKU-EECS and School of ECE and Department of CS of Purdue University.

Extensive meetings by delegation of NCKU-EECS with leadership of ECE and CS as well as Global Engineering Program of Purdue University followed by a tour of the Discovery Park and a dinner discussion session on selected most executable student exchange and visiting faculty programs fill the whole day agenda of the delegation on September 17, 2009.

The itinerary includes a whole day of presentations, discussion, and site visits starting from 8:30am in the morning to 5pm in the afternoon. The delegation concluded the visit with a round-up session in the morning on September 17 about specifically how best to promote effective collaboration and exchange of faculty and students for both education and research.

The NCKU-EECS delegation consists of

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Shoou-Jinn CHANG
Director of Institute of Microelectronics
The delegation met with the following leadership and scholars of Purdue University:

**Michael A. Brzezinski**
Interim Vice Provost for Global Affairs and Dean of International Programs

**Brian D. Harley**
Associate Dean, International Programs and Director, Programs for Study Abroad

**Michael T. Harris**
Associate Dean of Engineering for Undergraduate Education and Professor of ChemE

**Eckhard Groll**
Director, Office of Professional Practice and Professor of ME

**Yating Chang**
Assistant Director, Global Professional Practic

**Aditya P. Mathur**
Department Head and Professor of Computer Science

**Ragu Balakrishnan**
Interim Head and Professor, Electrical & Computer Engineering

**Mike Melloch**
Professor, Associate Head, ECE

**Jeff Gray**
Professor and Undergraduate Coordinator, ECE

**Stanislaw (Stan) Zak**
Professor and Graduate Coordinator, ECE
Purdue University is a private but also a land-grant university of the State of Indiana with about 40,000 undergraduate students and about 10,000 graduate students. The School of Electrical and Computer Engineering (ECE) is the largest School of Purdue University and has a rich history of research and education that dates back to 1888. Many landmark innovations in radiotelephony, television, and electric power were developed by Purdue faculty. The mission statement of Purdue ECE states that "The Purdue School of Electrical and Computer Engineering enriches society and advances engineering in three crucial ways: by educating electrical and computer engineering students from Indiana, the country, and the world so that they have the knowledge, ability, and skills to innovate, excel and lead in their professions; by contributing to the benefit of humanity through the discovery of fundamental knowledge, the solution of current technological problems, and the development of new applications; and finally, by sharing knowledge and expertise through meaningful engagement within and outside the Purdue community."
The school of ECE enrolls approximately one thousand undergraduates (sophomores through seniors) and five hundred graduate students as full-time students. The U.S. World & News Report ranks Purdue's Electrical/Electronic Engineering and Computer Engineering 12th and 11th respectively at the Undergraduate level [America's Best Colleges 2008]. The Graduate programs in both Computer Engineering and Electrical Engineering are ranked 10th in the nation [America's Best Graduate Schools 2009]. This high standing is a reflection of the following proud facts of Purdue ECE:

- Largest department/school at Purdue University and one of the largest in the nation.
- Highest volume of research among all schools and departments at Purdue.
- Birthplace of the Engineering Projects In Community Service (EPICS) program, the Birck Nanotechnology Center, and the Engineering Computer Network.
- Faculty include 23 IEEE Fellows, four members of the National Academy of Engineering (NAE), two NAE Gordon Prize winners, one National Medal of Technology Lauriat, and the President of the IEEE.
- The school attracts more than 1,500 applicants to its graduate program annually.
- The first electronic television was made in ECE.
- Former Head of ECE, Reginald Fessenden, invented radio telephony.

The NCKU delegation met with the following leadership of Purdue ECE: Dr. Ragu Balakrishnan, Interim Head and Professor, Dr. Mike Melloch, Associate Head and Professor, Dr. Jeff Gray, Undergraduate Coordinator and Professor, and Dr. Stanislaw (Stan) Zak, Graduate Coordinator and Professor in the ECE Meeting Room. Dr. Balakrishnan and I introduced the scope and strengths of each of our School and College.

Both NCKU EE and Purdue University ECE have about eighty faculty members. Both sides also have common strengths in microelectronics, computer engineering, and communication. Besides the main strengths, Purdue ECE also has mid-sized group in fields and optics and small-sized groups in biomedical informatics, control, energy system, VLSI, and an emerging area of engineering education. The world famous Nano Hub, which provides a free platform with extensive software packages for simulation and modeling of nanoscale materials and devices, and the new Birck Nanotechnology Center, which was established based on donations of $60M for building and $20M for equipment, in the Discovery Park for multidisciplinary research are among strengths of Purdue ECE. Nano Hub provides NCKU EECS with a free resource in software for teaching and research in simulation and modeling. Effective education in EECS is also an area which we need to learn from ECE of Purdue University.

Besides being a proud part of the best engineering university in Taiwan with 18th ranked academic publications in the world, NCKU-EECS has, in the past 78 years, been striving to produce and support the leaders of tomorrow, provide excellence in research and education in electrical engineering, computer science and related fields for Taiwan and the world. NCKU-EECS has produced more than 12,000 EECS engineers since its establishment in 1931 and is instrumental in creating the economic miracle for the Silicon Island of Taiwan. Therefore, common strengths of NCKU-EECS and Purdue University provide both sides with plenty of opportunities to share experiences and resources as well as proactive exchange of students and faculty members.

On behalf of College of EECS, I presented a bound copy of article digests published by EECS faculty in the Banyan magazine in the past two years to the Head of School of ECE of Purdue University, Dr. Ragu Balakrishnan. We concluded with a move to initiate a student exchange program involving faculty members of both sides as soon as possible with an aim at a large scope of collaboration to revive the historical active tie between NCKU and Purdue University.
University.

Formed in 1962, the department of Computer Science at Purdue University is the first computer science department in US. It is active in facing modern and future challenges associate with the rapidly changing issues related to architecture of computers, for example, as follows: Multi-core processors are here and are fast replacing the single-CPU/single-core desktop and laptop; Entertainment in the form of games, films, and music now relies heavily on high performance computing. Computer hardware and software pervades devices and equipment that we use everyday and has thus become the primary source of flexible and varied functionality - and hence a key driver of the global economy [from website of Purdue University Department of CS].

The NCKU delegation held a working lunch with Department Head and Professor of Computer Science, Dr. Aditya P. Mathur, who introduced his department following my introduction of the NCKU EECS. From the direct communication in person for the first time between the Department Chair of NCKU CSIE and the Department Head of Purdue University’s CS, it was found that plenty of room for collaboration exists. Dr. Mathur is enthusiastic in pursuing globalization in education and research. Purdue CS has a large scale program in database and data mining and is also exploring a new area of research in science information which is more fundamental in information than medical informatics and bio-informatics. Exchange of students and faculty was encouraged by both sides.

I took the chance to advertise the great opportunity for Purdue students to study abroad at NCKU. The offer of tuition waiver, free student dormitory and free Chinese language tutoring by NCKU for foreign students was quite impressive and attractive to our hosts in Purdue University. We hope to be able to recruit some Purdue students to come to NCKU for BS, MS, or doctoral degrees very soon. The meeting concluded with my presentation of a bound paper copy of Banyan article digests published by EECS faculty in the past two years for Dr. Aditya P. Mathur to keep and circulate among CS faculty members.

An introductory presentation and a guided tour of the Discovery Park and the Nanotechnology Center offered by Dr. Pankaj Sharma, Associate Director, Operations and International Affairs, Discovery Park gave us a clear idea of how multidisciplinary research is promoted and implemented at Purdue University. Several modern centers including a nanotechnology center were established in the Park for faculty members from various parts of Purdue University to jointly conduct multidisciplinary research in these centers. Dr. George B. Adams III, Deputy Director, Brick Nanotechnology Center introduced the Nano Hub to us and presented several teaching examples which made use of free simulation and modeling software offered by Nano Hub. Nano Hub will be a very useful resource for NCKU faculty to share with Purdue University.

The well planned and extensive brainstorming sessions would not be possible without the enthusiastic leadership and staff of the College of Engineering, Office of Professional Practice and Global Engineering Program including the following persons:

Dr. Michael T. Harris, Associate Dean of Engineering for Undergraduate Education and Professor of Chemical Engineering,

Dr. Audeen W. Fentiman, Associate Dean of Engineering, Graduate Education and Interdisciplinary Programs and Professor of Nuclear Engineering,

Dr. Eckhard Groll, Director of Office of Professional Practice and Professor of ME,

Dr. Yating Chang, Assistant Director of Global Professional Practice, and

Ms. Mary Schweitzer, Program Manager of Global Engineering Program.
Assistance by the outstanding alumnus of NCKU, Dr. Richard Liu of Industrial Engineering of Purdue University is also instrumental. We especially appreciate the dinner hosted by Dr. Groll and Dr. Chang for follow-up discussion about most affordable and feasible options for student exchange between NCKU EECS and Purdue University. Dr. Groll and Dr. Chang of Office of Professional Practice have visited NCKU before to promote the international internship program and are eager to see real actions happen.

Several successful models which have been implemented between Purdue University and foreign universities were introduced to us by our hosts. Most noticeable are the Purdue-THU-Beijin model. A newly conceived Purdue-SJTU model was also discussed. Both models are attractive and will be among our high priority goals for the very near future.

Among several proposed collaboration models, we found the following four most interesting and feasible:

1. **Summer student collaborative projects:**
   In this model of collaboration, NCKU EECS will accept two senior students from Purdue University to spend the first half (May-July) of a summer at NCKU EECS working with another team of NCKU senior students under supervision by a professor on a team project. Among the NCKU team, two students will be selected to go with those two Purdue University students to Purdue University to spend the second half of a summer to complete a project or to conduct another related project under the supervision of a professor of Purdue University. These two NCKU students will stay in the same student dormitory where two Purdue University students stay. The team of four students will have spent a whole summer together conducting research and sharing cultural experiences and two professors from NCKU and Purdue University will have co-directed all four students. Purdue University offers six credit hours for its students. NCKU can consider to offer similar number of credit hours to NCKU students. This is a more affordable program to start with. For NCKU students, it will only involve in the round-trip travel expenses plus the dormitory fees, and basic living costs estimated to be around $1000 considering the low cost of living at Purdue University. No tuition fee is involved in this program.

2. **Study/internship abroad by undergraduate or graduate students for one semester or one year while earning credit hours for their home university:**
   Up to a certain number of NCKU students will study abroad in Purdue University or practice internship in US through Purdue University for one semester or one year. These students will be allowed to register as students of Purdue University by paying tuition fees at home university, which will recognize the earned credit hours.
These NCKU students will only need financial support for round-trip travel expenses and cost of living at Purdue University without needing to pay high tuition fees to Purdue University. Up to an equal number of students of Purdue University will be allowed to study in NCKU with the same treatment received by NCKU students who study abroad in Purdue University. Details about how to qualify NCKU students for registering as students of Purdue University and vice versa for students of Purdue University will need to be worked out soon. This program is also affordable by many NCKU students. Fund raising for supporting NCKU students based on needs is also possible.

3. Invitation for faculty of ECE and CS of Purdue University to spend two months to one year sabbatical leave at NCKU and vice versa:
We will work out a plan to formally invite selected faculty members of ECE and CS of Purdue University for extended visits of NCKU for research and course teaching in English. NCKU will provide funds or help apply for NSC or MOE grants to support local expenses including housing for these visiting faculty members of Purdue University. It is our hope that by English teaching courses offered by professors of Purdue University who speak native English, students of NCKU will learn to get used to teaching in English more effectively. The cultural exchange between professors of Purdue University with other faculty of NCKU and class students will also be very welcoming benefits of this program. Through this program we wish to revive the historical active collaboration among faculties of NCKU and Purdue University in teaching with an extension to research on subjects of common interest.

4. “Four by one” double degree program involving distance learning:
NCKU senior students will be admitted to Purdue University and spend one year residence at Purdue University for course taking. These students will then spend their fifth year at NCKU under supervision by NCKU professors for thesis work while continue to take courses offered by Purdue University by distance learning. These students will each earn a BS degree from NCKU and a MS degree from Purdue University. If these NCKU students are allowed to pay NCKU tuition fees while studying abroad at Purdue University for one year, it will be much more affordable for many top talents who don’t have strong financial support by their parents. A proposed approach to resolve this is to allowed an equivalent number (more than the number of students with longer stay in Purdue University) of Purdue students to spend short periods of time studying at NCKU as an exchange.

The formal visit by NCKU-EECS delegation to Purdue University concluded with a round-up meeting in the morning on September 17, 2009 with Dr. Rabi H. Mohtar, Director and Ms. Mary Schweitzer, Program Manager of Global Engineering Program, Dr. Michael A. Brzezinski, Interim Vice Provost, Global Affairs, and Brian Harley, Assoc. Dean, International Programs and Director, Study Abroad. Both Director Mohtar of GEP and Interim Vice Provost of Global Affairs were extremely supportive and promised to do everything possible in their capacity to help our plans happen. Director Mohtar placed NCKU EECS as one of the strategic partners of Purdue University’s GEP. We had several actions planned, especially for the first three programs described above and wish to be able to send NCKU EECS students to Purdue University in the summer 2010 and welcome Purdue students to study abroad at NCKU EECS hopefully before the summer 2010.
Establishing Collaboration of College of EECS of NCKU with College of Computing, School of ECE, and Nanotechnology Research Center of Georgia Institute of Technology (GIT):

One Full Day of Productive Brainstorming with Leadership and Scholars of GIT

Yonhua (Tommy) Tzeng
Dean
College of Electrical Engineering and Computer Science
National Cheng Kung University
Tainan, Taiwan, ROC

[September 17-20, 2009]

In the evening of Thursday, September 17, 2009 an NCKU delegation consisting of six faculty members of College of Electrical Engineering and Computer Science arrived at the home of Georgia Institute of Technology, Atlanta, Georgia. It had been raining for three consecutive days at Atlanta. Our flight was delayed by the poor weather by one hour. Luckily, we brought good weather to Atlanta and enjoyed a shining following day on September 18, when a full day of meetings with about twenty GIT leadership and scholars were scheduled. College of Computing, School of Electrical and Computer Engineering and Nanotechnology Research Center at GIT are the best in the South of USA and all rank among top 10 in their categories in US.

The missions of the EECS delegation included (1) the initiation of dialogues between College of EECS of National Cheng Kung University with College of Computing and School of ECE of GIT for collaboration, (2) the establishment of feasible plans for recruiting degree pursuing foreign students, exchange students and visiting faculty for NCKU-EECS, and (3) learn the successful development story of GIT in the past twenty years and develop mid-term and long-term plans for the future development of the College of EECS of NCKU.

Friday, September 18 was a busy day filled with (i) extensive meetings by delegation of NCKU-EECS with leadership of GIT, College of Computing and School of Electrical and Computer Engineering, (ii) round-table discussion with undergraduate and graduate student representatives from Taiwan, (iii) guided tours of the Microelectronics Research Center/Nanotechnology Research Center and the Aware Home (iv) meetings with undergraduate and graduate students at GIT from Taiwan, and (v) a dinner discussion session with Professor Calton Pu of COC and Professor Sean Lee of ECE concluded our formal visit of GIT.

Several GIT students from Taiwan met with the...
NCKU-EECS delegation again on Saturday, September 19, 2009 to discuss about opportunities for internship in Taiwan and how to promote students from GIT to adopt NCKU as their top priority as the hosting university for their international program. GIT students who participate in international programs will get recognition which in many cases is also helpful for their job interviews and future career opportunities. Several actions of common interest were planned and would be followed through by both NCKU and GIT. The NCKU delegation left Atlanta on September 20 and flew to Los Angelus, CA.

The NCKU-EECS delegation consisted of

**Yonhua TZENG**  
Dean, College of Electrical Engineering and Computer Science  
Chair Professor, Institute of Microelectronics  
Department of Electrical Engineering  
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**Sheng-Tzong CHENG**  
Chair, Department of Computer Science and Information Engineering  
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**Vincent S. TSENG**  
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Department of Computer Science and Information Engineering  
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**Wen-Feng HSIEH**  
Chair of Department of Electro-Optical Engineering  
(wfhsieh@mail.nctu.edu.tw)

The delegation met with the following leadership and scholars of Georgia Institute of Technology (GIT):

**Dr. Steve McLaughlin**  
Vice Provost, International Initiatives
Dr. Jim Foley
Interim Dean and Stephen Fleming Chair in Telecommunications, College of Computing (CoC)

Dr. Ron Arkin
Associate Dean for Research & Director of the Mobile Robot Lab, CoC

Mr. Mike McCracken
Assistant Dean & Director, GT-L Program, CoC

Dr. Gary May
Professor and Steve W. Chaddick School Chair, School of ECE, College of Engineering (CoE)

Dr. Ellen Zegura
Chair of School of Computer Science, CoC

Dr. Richard Fujimoto
Chair, Computational Science and Engineering, CoC

Dr. Aaron Bobick
Chair, School of Interactive Computing, CoC

Dr. Leo Mark
Associate Professor & Director, International and Professional Programs

Dr. Sudahkar Yalamanchili
Chair, Computer Engineering TIG, School of ECE, CoE

Dr. Bruno Frazier
Chair, Bioengineering TIG, School of ECE, CoE

Dr. Mustaque Ahamad
Professor and Director, Georgia Tech Information Security Center – GTISC, CoC

Dr. Kishore Ramachandran
Professor & Director, Samsung Tech Advanced Research Center – STAR & Korean Programs, CoC

Dr. Joel Saltz
Director, Center for Comprehensive Informatics, Emory University

Dr. Calton Pu
Co-Director, Center for Experimental Research in Computer Systems, Professor, John P. Imlay, Jr. Chair in Software, CoC

Mr. Brian Jones
Director, Aware Home Research Initiative – AHRI

Dr. Kevin Martin
Principle Research Scientist and Associate Director, MiRC/ Nanotechnology Research Center

Dr. Sham Navathe
Professor, School of Computer Science, CoC
The School of Electrical and Computer Engineering, College of Engineering of GIT has about 110 faculty members and 2300 students (about 1200 undergraduates, 500 MS and 600 Ph.D. students) and is slightly larger in its scope and size compared to Department of Electrical Engineering of National Cheng Kung University. The School of ECE ranks the 4th in US only next to MIT, Stanford University, and UC Berkeley and is the best program of its kind in the Southern USA. The College of Computing has about 80 faculty members, 900 undergraduate students and 800 graduate students and ranks the 9th in US in Computer Science. It is much larger in scope and size than the Department of Computer Science and Information Engineering of NCKU. GIT received generous donations to help build a $100M Nanotechnology Building as an addition to the already well established Microelectronics Research Center (MiRC), which was recently renamed as Nanotechnology Research Center.

Twenty years ago, GIT was only a small university serving the Atlanta region. The visionary leadership by prior and current presidents successfully transformed the regional GIT into a world class research university. As a state university of State of Georgia, GIT receives only 20% of its expenditure from the State with the remaining 80% budget coming from self-earned or raised funds.

GIT is very proactive in internationalization. It has several foreign campuses/programs in France, Korea, India, China, Spain, etc. Dr. Steve McLaughlin, Vice Provost for International Initiatives introduced to us GIT's many creative international collaborative programs ranging from GIT's campuses in foreign countries with courses taught by faculty members of GIT. GIT students take courses in these foreign campus and gain international experiences and credit hours.

Foreign countries, such as Korea, awarded a grant of $1.5M for GIT to dispatch 8-10 faculty members during the summer break and 4-5 faculty members during the semesters to Korea to teach courses for selected industrial employees as well as university students. Instead of dual degree programs, GIT offers joint degree programs, which award doctoral degrees with, for example, three universities, GIT, Emory, and SJTU shown as the granter of a joint degree. Visiting faculty and pre-postdoctoral students and the bilateral student exchange program, in which students pay tuition fees to their home universities are the simplest programs to implement. Vice Provost Dr. McLaughlin promised to follow up with our discussion today and work out executable plans with us by email.
that the best way for in-depth collaboration is for faculty members with common interest from two institutions to spend an extended period of time working hand-in-hand in one institution. A sample MOU was provided to us by Dr. W. Michael McCracken, Assistant Dean of College of Computing. The clear impression I received was that most GIT administrators and professors have extensive experiences in international collaboration and are enthusiastic in promotion and participation by themselves.

After meeting with university level and college level leadership on platform and mechanisms for collaboration, the NCKU-EECS delegation split into two groups with one group meeting with Chairs and professors of Schools and Directors of Centers of College of Computing while the other group met with Chairs and professors of School of Electrical and Computer Engineering. Dr. Gary May, Professor and Steve W. Chaddick School Chair, School of ECE, College of Engineering is a specialist in semiconductor manufacturing. We met with him in his office and introduced to each other strengths of each university and discussed about how best to arrange for collaboration between faculty members of NCKU-EE and GIT-ECE.

I took the opportunity to request him for help announce the offer by NCKU to qualified foreign students with tuition waiver, free student dormitory, and tutoring in Chinese language. Dr. May was surprised by such a generous offer and thought that American students would be interested in applying for it. After the meeting, I presented to Dr. May a bound copy of “Banyan for EECS” which includes articles digests selected from NCKU’s Banyan weekly online magazine, for research accomplishments published by NCKU EECS faculty in top 5% journals. Another copy of the “Banyan for EECS” was presented to Dean of College of Computing, Dr. Jim Foley, through Dr. Calton Pu for circulation among faculty of CoC.

Chairperson and two faculty members of the Computer Engineering Group of School of ECE including Professor Sean Lee, who had visited NCKU and been interacting with professors at NCKU-EE met with us and introduced to us their main themes of research. We also presented our strengths and interest in collaboration. The Computer Science Group of ECE works closely with faculty of the College of Computing to form one of the best computing team in the world. Professor Lee will visit with us at NCKU again later this year. Through Professor Lee's assistance, we expect to have effective collaboration.

While part of our delegation met with faculty members of School of ECE, the rest of our delegation met with Chairs and faculty members of College of Computing. Dr. Ellen Zegura, Chair of School of Computer Science, Dr. Richard Fujimoto, Chair of School of Computational Science and Engineering, Dr. Aaron Bobick, Chair of
School of Interactive Computing, Dr. Mustaque Ahamad, Director of Georgia Tech Information Security Center – GTISC, Dr. Kishore Ramachandran, and Director of Samsung Tech Advanced Research Center – STAR & Korean Programs participated in the meeting and introduced to our delegation their strengths and proud history of development from a small academic division into the best College of Computing of its kind in the world in 10-20 years. Dr. Joel Saltz, Director of Center for Comprehensive Informatics of nearby Emory University also joined our meeting to discuss about future collaboration in biomedical informatics with NCKU. Being a great university with a College of Medicine and Hospital, Emory University joins forces with the strong College of Computing to explore the needs by the huge health care market for biomedical informatics. This meeting was undoubtedly very inspiring to Chair Cheng of the Department of Computer Science of NCKU and Director Tseng of the Institute of Medical Informatics and the overall long-term development of the Computing and Information disciplines for NCKU.

Chair Cheng of CSIE and Director Tseng of IMI met with Professor Kishore Ramachandran, Director of Samsung Tech Advanced Research Center (STAR). Kishore's main research themes are embedded systems and pervasive computing. The techniques developed by Kishore can be applied to home-land security by quickly perceiving and detecting anomalous behaviors. He also introduced the multi-model sensing (in both high-bandwidth and low-bandwidth sensing). It is a programming model for large distributed system. In addition, Kishore briefed his collaborative program in embedded system between GIT and Korean University (KU). The goal of the program was to create a MS program in the area of embedded software. This MS program was to be run by an US institute starting from 2007. GIT got the bid. In this program, eleven courses were offered by GIT, and one course by KU. Employees from Samsung took one year leave from the company for this program. KU expects these participants to continue the education after the program expires and that the industry benefits from such a program.

Dr. Sham Navathe, who is a professor of School of Computer Science and director of Database Research Group, is a leading researcher in the field of database modeling and management. He has published numerous papers on the fields of database modeling, biological genome databases, data mining, modeling of database security, and knowledge base design. He is also on the editorial boards and chairs/committee members of a number of premier journals and conferences. Dr. Navathe introduced his current role in School of Computer Science for leading the database researches in the context of emerging applications, including engineering design, biological databases, document and text databases, and data mining and knowledge discovery. In particular, he has been conducting research works/projects related to bioinformatics, through collaborations with the Medical School of Emory University. Director Tseng of IMI, NCKU introduced to him NCKU's Institute of Medical Informatics, in particular the research groups related to knowledge discovery and information retrieval in biomedical databases. Dr. Navathe was impressed with the rich research results at NCKU and showed interest in collaboration.

Professor Xu's research areas are in the development of system/network performance evaluation methodologies such as new data streaming algorithms and large deviation techniques. He introduced theoretic work done on network data streaming. While his research areas are theory-oriented, research passion and enthusiasm can be perceived from discussion with him.

Dr. Joel Saltz, director of Center for Comprehensive Informatics (CCI) of Emory University is also a professor of the Departments of Pathology, Biostatistics and Bioinformatics, and Mathematics and Computer Science at Emory University as well as an Adjunct Professor of Computational Science and Engineering at GIT and Georgia Research Alliance Eminent Scholar in Biomedical Informatics. Dr. Saltz explained to us his current role in leading CCI as a multi-disciplinary research center carrying out a broad range of research areas in high performance computing, biomedical informatics, translational research informatics, and imaging informatics. In particular, CCI has formed a strong research team in biomedical informatics by integrating researchers in GIT's CoC and Emory
Dr. Saltz recognized high-quality and successful inter-disciplinary research having been conducted in IMI, NCKU. He also expressed high interest in establishing collaborative research projects/centers in biomedical informatics by leveraging the strengths of both sides.

In the afternoon, two student representatives from Taiwan came and discuss with us about programs which they might apply to spend time in Taiwan for research. Mr. Dan Liu was born in US and is currently a senior student studying ECE at GIT.

Mr. Ping-Chang Shih is a doctoral student at GIT-ECE. He graduated from NCTU in Taiwan before studying in medical imaging at School of ECE of GIT. They apparently were very excited to see us coming a long way from Taiwan to visit with GIT. According to them, it is popular for GIT students to enroll in the option of international program. With this option, the graduation diploma will indicate that the student has international experiences. However, they also said that Taiwan was not on the list for students to choose as a hosting country for the student international program. It is our hope that our efforts in coming a long way to visit GIT and the warm welcome we received from GIT leadership and scholars will put Taiwan, especially NCKU, on the list of hosting institutions for GIT students to study abroad very soon.

Dr. Kevin Martin, Principle Research Scientist and Associate Director, MiRC/ Nanotechnology Research Center gave us a tour of the well equipped and managed Microelectronics Research Center. Looking into the MiRC’s clean room from window, we saw numerous researchers stay busy in using various fabrication equipments for their projects. MiRC charges users of its facilities by hourly rate of $22 based on the length of time a user spend inside the clean room. The Center also is equipped with a top of line e-beam lithography system which costs $5-6M with the capability of defining feature size of 10nm.

Dr. Kevin explained to us that the MiRC cost GIT $2M a year, which added to $1.4M collected user fees, $1.6M NSF funding for the National Nanotechnology Infrastructure Network (NNIN) and miscellaneous expenses provide by GIT to come up with about $6-7M annual expenditure for the operation. In return, the Center made it possible for GIT faculty and non-GIT equipment users of the Center to win contracts and grants of about $70M per year. That demonstrates a 10 times return in investment and proves the significant contributions of the MiRC.

Dr. Martin brought the delegation to visit a newly built Nanotechnology Building based on donation of close to $100M. The building is well designed for both dry nanotechnology and wet bio-nanotechnology to work side by side through a contamination prevention interface. This new design allows future promotion of research in nano-biomedicine. The new building has more space than what is needed now. Nevertheless, the space is not wasted but instead is well preserved for future uses and expansion. It is estimated that by the time the new building is filled with modern equipment in the following ten years or so, the total cost to the new Nanotechnology Research Center would be nearly $250M.

NCKU delegation visited the GIT Aware Home, which is installed with various kinds of sensors to monitor and study human behaviors in a living environment. This Aware Home is one of the first few facilities of its kind in the world and was ready for operation about ten years ago. Although cameras and other equipment are becoming out-of-dated, it served the unique function for research in human behaviors and innovations for assisting in healthy aging of people. It is more than a fancy home with sensors and interactive mechanism everywhere. The Aware Home has been a facility with creative research which benefited human society. Mr. Brian Jones, Director of Aware Home Research Initiative – AHRI showed us a number of studies in human behaviors which had been
carried out in the Aware Home. Numerous scientific and engineering papers based on these studies have been published. NCKU also has an Aspire Home, which was established a few years ago and is currently being continuously updated and improved by the support of an NSC grant and NCKU. NCKU team can learn from the GIT Aware Home projects in how to make use of such a unique facility in conducting creative research which is beneficial to human society.

Through presentations by us and extensive discussion, Dr. Bruno Frazier of ECE realized that NCKU EECS had a strong research team in compound semiconductors such as GaN, Micro-electro-mechanical systems (MEMS), organic electronics, solar energy, etc. and added to the itinerary and showed us the building where extensive research in MOCVD and organic electronics were conducting. Dr. Frazier pointed out that there are a lot of demonstrated innovations at GIT which were not fully utilized because there was not a suitable industrial infrastructure near GIT or in US like we do at NCKU. GIT has extensive connection with industries in the region, US, and around the world. By collaboration with NCKU, they will be able to add industries in Taiwan to their network of industrial partnership. Collaboration would, therefore, be beneficial to both universities.

Thanks to very effective organization of the itinerary for our visit by Dr. Calton Pu and Dr. Bruno Frazier, NCKU EECS delegation met with about twenty GIT leadership and scholars in such a short one-day visit! Dr. Frazier proposed to organize additional video conferences for GIT's research team in selected areas to discuss in further depth about how best for NCKU and their team to collaborate.

Professor Calton Pu of College of Computing and Professor Sean Lee of the Computer Engineering Group of School of Electrical and Computer Engineering invited the NCKU-EECS delegation for a dinner. This relaxing event allowed everyone to review information gathered during the daytime and to brainstorm about all possibilities of collaborative programs. A draft plan for establishing an international collaborative center of excellence in applied computing science and technology at NCKU EECS that meets the needs for economic development in Taiwan was conceived. We will recommend outstanding NCKU students to study abroad at GIT for doctoral degrees.

On Saturday, September 19, 2009, Taiwanese students at GIT met with the delegation again to chat about their excitements and homesickness while living far away from their home in Atlanta, Georgia. They pointed out that there wasn't a Science and Technology Office of NSC in this major city of Atlanta, which is managed by NSC's Science and Technology Office in Washington DC. Our visit has motivated Taiwanese students at GIT and our new friends and collaborators at GIT to work with NSC's Science and Technology Office to help bring more visiting faculty, postdocs, and students to this great university. This visit of GIT has been a very enjoyable and fruitful experience for the NCKU EECS delegation.

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Visit of NCKU Outstanding Alumnus, Professor Kang L. Wang and Friends at UCLA by Delegation of NCKU EECS

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[September 21, 2009]

A delegation of NCKU EECS arrived at Los Angeles, California on Sunday, September 20 and spent a full day of visit on Monday, September 21, 2009 with leadership and scholars of Department of Electrical Engineering (EE), Department of Computer Science (CS), and California NanoSystems Institute (CNSI). NCKU outstanding alumnus, Dr. Kang L. Wang, Professor, Director of Functional Engineered Nano-Architectonics Focus Center (FENA), and Director of Western Institute of Nanoelectronics (WIN) was instrumental in arranging for the delegation to meet with distinguished scholars at UCLA for technical discussion and brainstorming about possibilities of effective collaboration. Mr. Sidney Lu, Senior Officer of Science and Technology Division, Taipei Economic and Cultural Office in Los Angeles hosted a dinner on behalf of Dr. Chi-Hang Joseph Yang, Director of Science and Technology Division of Taipei Economic and Cultural Office in Los Angeles for NCKU delegation and Professor Kang L. Wang and his postdocs and doctoral students. NCKU Delegation made new friends and established new channels of international collaboration with UCLA faculty.

The missions of the EECS delegation included (1) strengthening the roles being played by Professor Kang L. Wang in further development of College of EECS of National Cheng Kung University; (2) familiarizing ourselves with UCLA’s centers of excellence such as CNSI, FENA, WIN, making new friends, and establishing collaboration; (3) recruiting new faculty and degree pursuing foreign students to NCKU, exploring bilateral student and faculty exchanges between NCKU-EECS and UCLA EE and CS departments; and (4) pursuing support by UCLA faculty for NCKU students to study abroad towards advanced degrees at UCLA.

UCLA was founded in 1919 and has since developed into a great university with about 27,000 undergraduates, 12,000 graduates, 4000 teaching faculty, and 360,000 living alumni. Five UCLA faculty members were honored as Nobel laureates: Dr. Louis J. Ignarro, Physiology or Medicine, 1998 for "discoveries concerning nitric oxide as a signaling molecule in the cardiovascular system"; Dr. Paul Boyer, Chemistry, 1997 for "elucidation of the enzymatic mechanism underlying the synthesis of adenosine triphosphate (ATP)"; Dr. Donald Cram, Chemistry, 1987 for "development and use of molecules with structure-specific interactions of high selectivity"; Dr. Julian S. Schwinger, Physics, 1965 for "fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles"; and Dr. Willard F. Libby, Chemistry, 1960. Four UCLA alumni have been awarded the Nobel Prize: Dr. William Sharpe, Dr. Bruce Merrifield, Dr. Glenn Seaborg and Dr. Ralph Bunche.

Department of Electrical Engineering of UCLA has 46 regular faculty members and a number of adjunct and jointly appointed faculty members. Among regular faculty members 23 are IEEE Fellow. It has 12 National Academy members with 4 having been elected in the past three years to the National Academy of Engineering: Professors Frank Chang, Yahya Rahmat-Samii, Deborah Estrin, and Asad Abidi. The NCKU EECS delegation met with NAE member, Prof. Frank Chang. There are three primary research areas in the department:
(1) Circuits and Embedded Systems, (2) Physical and Wave Electronics, and (3) Signals and Systems. These areas cover a broad spectrum of specializations, for example, in communications and telecommunications, control systems, electromagnetics, embedded computing systems, engineering optimization, integrated circuits and systems, nanotechnology, micro-electromechanical systems, photonics and optoelectronics, plasma electronics, signal processing, and solid-state electronics.

Coordinated EE related multidisciplinary research is carried out in 9 research centers: Center for Embedded Sensing Networks (CENS), California NanoSystems Institute (CNSI), Center for Systems, Dynamics, and Control (SyDyC), Functional Engineered Nano-Architectonics Focus Center (FENA), Institute for Digital Research and Education (IDRE), Institute for Pure and Applied Mathematics (IPAM), Institute for Technology Advancement (ITA), Water Technology Research Center (WaTer), and Western Institute of Nanoelectronics (WIN). The NCKU EECS delegation met with directors and/or associate directors of CNSI, FENA, and WIN.

CNSI is a research center that is run jointly by UCLA and UC Santa Barbara. CNSI was established in 2000 with $100 million from the State of California and an additional $250 million in federal research grants and industry funding. Its mission is to encourage university collaboration with industry and enable the rapid commercialization of discoveries in nanosystems.

FENA is a multi-disciplinary center that aims to create and investigate new nano-engineered functional materials and devices, and novel structural and computational architectures for new information processing systems beyond the limits of conventional CMOS technology. FENA is part of the Focus Center Research Program initiated by the Semiconductor Research Corporation in an effort to expand pre-competitive, cooperative, long-range applied microelectronics research at US universities. The center, which was established in 2003, received $13.5 million over the first three years, and as much as $70 million over 10 years. FENA seeks to create and explore the next generation of nanoscale semiconductor technology to the borders of ultimate CMOS and beyond: inventing heterogeneous interfaces of new nanosystems, enabling a combination of biological and molecular functions, and revolutionizing paradigms of information processing and sensing.

WIN is a multi-disciplinary center that is among the world's largest spintronics efforts. It is headquartered at UCLA and led by Electrical Engineering Professor Kang Wang. The institute involves collaborations among teams from UCLA, UC Santa Barbara, UC Berkeley, and Stanford. The program is co-managed by the four participating campuses and semiconductor industry sponsors, with nearly 10 researchers from semiconductor companies working with the students and faculty on all of the university campuses. The institute's mission is to explore and develop advanced research devices, circuits and nanosystems with performance beyond conventional devices, which are based on the current industry standard, complementary metal oxide semiconductors. The Western Institute of Nanoelectronics is being established with starting grants of $18.2 million: an industrial support total of $14.38 million and a matching $3.84 million UC Discovery Grant. The $18.2 million includes $2.38 million from a Nanoelectronics Research Initiative grant funded by six major semiconductor companies — Intel, IBM, Texas Instruments, AMD, Freescale and MICRON. The amount also includes an additional Intel grant of $2 million. The institute also will receive a separate $10 million equipment grant from Intel.

Department of Computer Science was established in 1968 and currently has 60 faculty members including about 40 regular faculty and additional adjunct faculty and faculty with joint appointments. Among them, recently Professor Leonard Kleinrock was awarded the 2008 National Medal of Science Award for “fundamental contributions to the mathematical theory of modern data networks, for the functional specification of packet switching which is the foundation of the Internet Technology, for mentoring generations of students, and for leading the commercialization of technologies that have transformed the world.” Professor Deborah Estrin has
been honored with a 2009 election to the National Academy of Engineering for her "pioneering design and application of heterogeneous wireless sensing systems for environmental monitoring."

The UCLA Computer Science Department is well known for its research in the design and analysis of complex computer systems and networks. Internationally recognized research has been carried out in advanced high-speed networking; artificial intelligence; biocybernetics; computer-aided design and manufacturing; computer arithmetic; computer science theory; computer system architecture and design methodology; distributed computing; economic modeling; parallel processing systems; programming languages and software systems; reliable computing and fault-tolerance; and scientific computing. Coordinated multidisciplinary research is carried out in the following four centers: Center for Embedded Network Sensing (CENS), Center for Autonomous Intelligent Networked Systems (CAINS), and Center for Information & Computation Security (CICS), and Wireless Health Institute (WHI). [From UCLA website.]

The NCKU-EECS delegation consisted of

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**Dr. Wen-Feng HSIEH**  
Chair of Department of Electro-Optical Engineering  
(wfhsieh@mail.nctu.edu.tw)

The delegation met with the following leadership and scholars of UCLA:

**Dr. Kang L. Wang**  
Director of the MARCO Focus Center on Functional Engineered Nano Architectonics (FENA)  
Director of Western Institute of Nanoelectronics (WIN)  
Raytheon Chair in Physical Sciences Professor of Electrical Engineering, UCLA  
wang@ee.ucla.edu
The NCKU EECS delegation paid a visit to Professor Kang L. Wang in his office to start a full-day of lab visits and in-depth discussion on September 21, 2009. Professor Kang L. Wang received the B.S.E.E. from the National Cheng Kung University, Taiwan, in 1964. He earned both the M.S.E.E. and the Ph.D. in electrical engineering from M.I.T., in 1966 and 1970, respectively. Professor Wang is the Principal Investigator and Director of two mega-scale multiple-university and academia-industry-government collaborative research centers, FENA and WIN, with more than $500M research expenditure in recent years. Professor Wang's research focuses on nanoelectronics and optoelectronics, MBE and superlattices, micro-wave and millimeter electronics/optoelectronics, and quantum computing. Prof. Wang was Chair of the department from 1993 to 1996. He is a
Fellow of the IEEE, and a member of the American Physical Society, the Materials Research Society, the Eta Kappa Nu Society, the Sigma Xi Society and the Phi Tau Phi Honor Society.

UCLA is a state university of the State of California. It enjoyed the booming economy in the past decades and developed rapidly into a world class university with annual expenditure exceeding $2B including a College of Medicine and Hospital which ranks the 3rd in US after Johns Hopkins Medical Center and Mayo Medical Center. Just a few years ago, UCLA and other universities in the UC system got huge grants on the order of $100M each from the State quite commonly. For example, the California NanoSystems Institute at UCLA was established based on an initial grant of $100M from the State of California and up to today, more than $150M has been invested in this building even though the planned 10K square feet clean room is not completed yet. The current global economic downturn has impacted the State of California quite severely. This year UCLA got a significant cut in State funded budget by 20% for its operating budget.

Salaries of state funded faculty and staff, including Professor K.L. Wang, suffer 8-10% reduction by means of unpaid vacations. Of course, distinguished scholars work even harder through “unpaid vacations” to continue their pursuit of excellence and compete for extramural funds to support their outstanding research programs.

Professor Wang noticed that general interest and enrollment in electrical engineering and computer science in US, Europe, and Japan had been declining recently due to the global economic downturn and the apparently significant reduction in new hiring in the EECS sector. The enrollment usually reflects the current job market. Most incoming students, probably even most of the wisest economists, don't have a clue how each sector of the economy will evolve in the coming four years during the college education. For disciplines such as EECS which is closely tied to economy, the fluctuation in EECS student enrollment is huge. In early 1990s when IBM and the defense industry went through a wide spectrum of layoffs, EE enrollment in US went down to about 1/3 of the previous peak enrollment. It recovered since then to a more stable enrollment about two times of the lowest level before economic tsunami hit the world. The CS enrollment went skyrocketing during the dot-com era with students switching from various disciplines to CS. The CS enrollment dived a few years later along with the burst of the dot-com bubble.

Student enrollment in Taiwan also reflects the local economy, which, although being highly tied to global economy, has its uniqueness different from the rest of the world. Even before the economic downturn hit the world, world wide student enrollment in materials science and engineering was alarmingly low. However, materials science and engineering discipline in Taiwan enjoyed the great popularity. Often, only one out of 10-20 applicants is admitted to materials science and engineering departments at NCKU. Similarly, the current enrollment in EE in Taiwan remains as strong as it used to be in past years. Employment for new graduates from EE specifically and EECS from NCKU in general don't seem to be adversely affected by the economy downturn much. The long history of reputation for NCKU students to be the most favorable employees in Taiwan certainly helps. If the global economy recovers soon enough, the enrollment and employment in EECS for NCKU is expected to remain strong. Nevertheless, we have to monitor closely the overall enrollment status in Taiwan, Asia,
and the world and be adaptive though.

Professor Wang also pointed out the global competition for talents and explained about the recent dramatic recruiting actions about Saudi Arabia's offer of $250K/yr salary or higher for recruiting faculty from around the world to KAUST, which was established based on a $20B foundation. A good university requires both well established professors and top talents in students. Considering the low salary paid by NCKU for faculty and the less than desirable overall infrastructure, we need to explore other incentives and attractions in order to recruit top talents to NCKU. At the same time NCKU should invest heavily in incubating domestic top talents and help them develop into world class scholars.

Professor Wang explained to us how California NanoSystems Institute was established based on $100M funding by the State of California, which formed three strong arms of research infrastructure in California, i.e., Bio, Nano, and Information. UCLA was selected to be responsible for nanotechnology. The mission of the CNSI is to provide a interdisciplinary research platform including building, equipment, and supporting staff for research which will lead to innovative economy for the State of California. Among 10 companies having been incubated by CNST so far, one company has developed a “Nano H2O” nanotechnology enabled water purification technology and business and, thus, graduated from the incubation program after it raised $35M investment funds.

At UCLA, 30-40 Chinese junior undergraduate students spend 3-months summer working with professors of UCLA on various projects. A local person is helping organize and match student interest with specialties of UCLA professors to facilitate the summer studies of Chinese students. For summer studies, it costs only about $3600 and travel expenses for each student. After these students complete their undergraduate program, some found it attractive to return to UCLA to work with the professors they have already known for advanced degrees. NCKU delegation will look into this option and find a mechanism to raise fund to partially sponsor NCKU EECS students to take advantage of this summer study program. On the other side of recruiting foreign students to NCKU, Professor Wang agreed that the tuition waiver, free dormitory and free tutoring of Chinese language were attractive for foreign students to earn MS degrees under supervision by co-directors of NCKU and UCLA. After a student completes his/her MS degree, the student can return to UCLA for his/her doctoral degree possibility also under the supervision of the co-advisors in NCKU and UCLA. NCKU EECS delegation will explore all possibilities to implement this option.

Similar to the advantageous proximity between College of EECS and College of Medicine at NCKU, UCLA has one of the best three College of Medicine and Hospital within a walking distance from the College of Engineering. The College of Medicine at UCLA is many times in size larger than that of the College of Engineering of UCLA, though. By all means, collaboration between the medical community and the engineering community has been very active in UCLA.

We had a guided tour of the CNSI facility led by Associate Director of CNSI, Professor Leonard H. Rome, who is a cell biologist and biochemist and an Associate Director of the California NanoSystems Institute and Senior Associate Dean of Research, David Geffen School of Medicine at UCLA. This is the best integrated biomedical and nanotechnology platform I have visited so far. The Institute accommodates not only the best nanotechnology and biomedical equipment but also clinical research laboratories such as animal MRI, cyclotron radiation facilities. Dr. Rome organized a Nanoscience Interdisciplinary Research Team, a collaboration of disciplines including cell biologists, engineers, chemists, and structural biologists who will engineer vaults so that they may one day be used in drug delivery and as components of nano-electrical machines.

Besides the investment of $160M in the building, CNSI will invest $100M in advanced instrumentation and
equipment in the coming few years. CNSI consisted of about 120 faculty members from Colleges of Science, Engineering, and Medicine. The advanced equipment we saw during the tour was all top of the line in the world. For example, a FEM cryo-EM costing $5M was installed and in operation by a full time resident from the vendor of the cryo-EM. Besides services they also perform further instrumentation development. Several joint development projects in equipment and new products between CNSI and industries were also introduced to us. It is a business model which NCKU can learn for future development of such a state-of-the-art research center.

Several EE faculty members of UCLA joined a lunch with us at the UCLA faculty club. These included Professor Kang L. Wang, Professor Jia-Ming Liu, and Professor Frank Chang. Professor Yahong Xie of Materials Science and Engineering also joined us briefly. We enjoyed, during the lunch, a relaxing discussion about education and economy in Taiwan. I proposed to invite these distinguished professors to NCKU to help with further development of our College of EECS. Professor Kang L. Wang and Professor M.C. Frank Chang accepted our preliminary invitation to serve as Adjunct Chair Professors of NCKU EE.

Professor M.C. Frank Chang earned his B.S. degree from National Taiwan University and Ph.D. from National Chao Tung University. He is the Wintek Chair Professor in the Electrical Engineering Department, and the Director of the High Speed Electronics Laboratory, at the University of California, Los Angeles (UCLA). Professor Chang was elected to the National Academy of Engineering in 2008, for the development and commercialization of GaAs power amplifiers and integrated circuits. He is one of few scholars having been elected to the NAE with Ph.D. educated in Taiwan. Throughout his career, his research has been mostly in the development of high-speed semiconductor devices and integrated circuits for RF & mixed-signal communication and sensing system applications.

Professor Frank Chang showed us his recent research on self-cureable millimeter-wave radio operating at frequencies approaching the limit of CMOS circuit well above 100 Hz and close to 200 GHz. The chip was fabricated by TSMC using its 65nm process. This is a highly demanding project in the system level. The chip needs to satisfy not only high performance specification but also the capability of cure by itself in case the performance deviate from original specification. Very high yield in the fabricated test chips is also the key index for the success of this project. Only one out of fifty fabricated test chips is allowed to fail to meet the specifications. It costs Professor Chang more than $100K, including overhead charged by UCLA for TSMC to fabricate his test chips. This budget for this extramurally funded project is more than $1M.

Research in the system level has a lot of room to be improved at NCKU. Partially because most funded projects are for short terms and of a small budget and also because research in the device level is easier for faculty and students to publish papers, efforts in system level research are not popular at NCKU. Performance evaluation of faculty and criteria for graduation by students are too heavily weighted in the number of published journal papers at NCKU and in Taiwan. This has got to be properly adjusted to promote research in the system level. It is systems which provides value added products for economy in Taiwan. It is fortunate that we have the Southern
Taiwan National Chip Implementation Center on NCKU campus and our faculty and students can compete for opportunities to get their test chips fabricated free of charge. This has been our strengths which should be further taken advantage of by us. Collaboration of world class universities with NCKU will also make it possible for our collaborators to get access to this advantageous edge of advanced research.

Professor Jia-Ming Liu received the B.S. in Electrophysics from National Chiao Tung University in 1975. He earned his M.S. and Ph.D. in Applied Physics from Harvard University, in 1979 and 1982, respectively. Professor Liu has over 200 scientific papers, 14 book chapters, 10 U.S. patents, and two books. He is a fellow of the Optical Society of America, the American Physical Society, the IEEE, and the Guggenheim foundation. Professor Liu's research interests are in nonlinear optics, ultrafast optics, semiconductor lasers, photonic devices, optical wave propagation, nonlinear laser dynamics, chaotic communications, chaotic radar, nanophotonic imaging, and biophotonics. Professor Liu has on-going collaboration with Professor S. J. Chang of NCKUEE. By this site-visit and discussion in person, the collaboration will be further promoted. It is our goal to expand the collaboration to include more professors in NCKU and UCLA on other projects of our common interest.

The delegation met with Prof. Ali H. Sayed, who visited Taiwan in April earlier this year, in the afternoon. Professor Sayed is currently Professor and Chairman of Electrical Engineering. We presented a bound copy of “Banyan for NCKU EECS” as a gift to Professor Sayed and invited him to visit NCKU when he comes to Taiwan next time. During the visit, several models of faculty and student exchange programs were discussed. Professor Sayed considered Taiwanese students excellent and asked us to send draft copies of MOU's for him to process further.

At UCLA, Professor Sayed established and directs the UCLA Adaptive Systems Laboratory. He was born in Brazil and educated in Lebanon and Brazil. He received the degrees of Engineer and MS in Electrical Engineering from the University of São Paulo, Brazil. He received his PhD in Electrical Engineering from Stanford University in 1992. Prof. Sayed's research interests span several areas including adaptive and statistical signal processing, estimation and filtering theories, distributed adaptive processing, signal processing for communications, signal processing for sensor and wireless networks, MIMO signal processing, linear system theory, interplays between signal processing and control methodologies, and reliable and efficient algorithms for large-scale computations. Dr. Sayed has published over 300 journal and conference publications and 5 books. He served as the Editor-in-Chief of the IEEE Transactions on Signal Processing (2003-2005) and the EURASIP Journal on Advances in Signal Processing (2006-2007). He has also consulted with industry on different aspects of adaptive filter design, echo cancellation, channel equalization, and OFDM communications.

On behalf of the NCKU EECS delegation, I made a presentation introducing NCKU and College of EECS to audience of UCLA faculty, postdocs, and students. Through this presentation, they became familiar with the strengths of NCKU and excellent opportunities at NCKU for them. The audience was also welcome to know that there is a great opportunity for American students to study abroad in one of the best engineering institute, NCKU, in the world.
The delegation met with Professor Jason Cong of Department of Computer Science. Professor Jason Cong received his B.S. degree in computer science from Peking University in 1985, his M.S. and Ph.D. degrees in computer science from the University of Illinois at Urbana-Champaign in 1987 and 1990, respectively. NCKU outstanding alumnus, Professor C.L. Liu (劉炯朗) was his advisor. He also served as the department chair from 2005 to 2008. Professor Cong's research interests include computer-aided design of VLSI circuits and systems, design and synthesis of system-on-a-chip, programmable systems, novel computer architectures, nano-systems, and highly scalable algorithms. He has published over 280 research papers and led over 30 research projects supported by DARPA, NSF, SRC, and a number of industrial sponsors in these areas. He was elected to an IEEE Fellow in 2000 and ACM Fellow in 2008.

Professor Cong told us that there had been on-going international collaborative programs among UCLA, Taiwan (NTU and NTHU), and China (Peking University). UCLA and Peking University formed a joint research center with Professor Cong serving as the responsible person at UCLA. The delegation will select a few areas of specialty for matching UCLA professors with NCKU professors to explore further actions. One of the areas for exploration is the wireless personal care. Professor S.M. Tseng of our delegation will follow up with further development in collaboration in this area.

The delegation also met with Professor Jack Ho of National Taiwan Ocean University at UCLA. Professor Ho is an NCKU EE alumnus. He is spending six months working in the lab of Professor Kang L. Wang. NSC provides financial support for his visit. NCKU delegation enjoyed a dinner hosted by Mr. Sidney Lu, Senior Officer of Science and Technology Division, Taipei Economic and Cultural Office in Los Angeles hosted a dinner on behalf of Dr. Chi-Hang Joseph Yang, Director of Science and Technology Division of Taipei Economic and Cultural Office in Los Angeles for NCKU delegation and Professor Kang L. Wang and his postdocs and doctoral students before heading to the airport for an early morning flight leaving from LA to Taipei on September 22, 2009.

A photo taken during a dinner hosted by Mr. Sidney Lu (the person sitting in the far center with a jacket) of Science and Technology Division, Taipei Economic and Cultural Office in Los Angeles on September 21, 2009. Next to Mr. Lu are (left) Prof. Y. Tzeng and (right) Prof. K.L. Wang.