Date: April 1, 2005

To: William H. Parker
Vice Chancellor for Research
Dean of Graduate Studies

From: Daniel D. Gajski
Henry Samueli "Turing" Endowed Chair
Director, Center for Embedded Computer Systems

Subject: CECS 2004-2005 Annual Report

The Center for Embedded Computer Center (CECS) ended the 2005 fiscal year with many significant accomplishments and a strong and innovative research program. CECS is internationally recognized as an outstanding research center in embedded systems. This year we adapted a new slogan: *CECS – promoting creativity and pursuing discovery!*

The core and domain research programs were conducted by 20 UCI faculty members, 2 UCSD faculty members and 1 UCR faculty member and 129 graduate students. We have three distinguished industrial executives serving on the CECS Research Advisory Board. We treasure and value the research advice, counsel and guidance provided by this distinguished group of industrial executives. We also sponsored 2 CECS Distinguished Lectures which brought an outstanding professor and an industrial researcher to our research center for interaction with our graduate students. We also hosted 11 research visitors from foreign industry and universities who conducted embedded systems research for varying time periods. We successfully added 7 scientific staff members to support our major research projects this fiscal year. We added Tsuneo Kinoshita to the position of Research Relations – Asia and are continuing a search to identify a person for the position of Research Relations – USA.

As recognition of our research capabilities, we were successful in capturing $1,610,165 in contracts and grants, and $797,275 in research donations for a total of $2,407,440. This level of research funding and support signifies the importance of and the recognition achieved by our core and domain research programs.

Four issues of CECS *eNEWS* were published which pictorially highlighted the quarterly research accomplishments of our faculty members, graduate students, and visitors.

We continue to recognize the importance of our web site as a means of attracting talented graduate students and to publicize our core and domain research programs to the industrial and governmental communities. Our web site, www.cecs.uci.edu, was maintained in a timely manner and the site navigation was dramatically improved. Continual pictorial enhancements to our web site has received positive responses from many national and international readers. A new registration option has been well received by many industrial readers who have voluntarily registered for addition to our electronic mailings.

Our core and domain research programs were extremely successful in fiscal year 2004/2005. We will continue striving to build on these research accomplishments in 2006; hoping to have significant and profound societal impact through innovative research and technology transfer

FACULTY MEMBERS

Nader Bagherzadeh - Electrical Engineering and Computer Science, UC Irvine
Lubomir Bic - Information & Computer Science, UC Irvine
Pai H. Chou - Electrical Engineering and Computer Science, UC Irvine
Rainer Doemer – Electrical Engineering and Computer Science, UC Irvine
Nikil D. Dutt - Information & Computer Science, UC Irvine
Daniel D. Gajski - Electrical Engineering and Computer Science, UC Irvine
Jean-Luc Gaudiot - Electrical Engineering and Computer Science, UC Irvine
Tony Givargis - Information & Computer Science, UC Irvine
Rajesh K. Gupta - Computer Science & Engineering, UC San Diego
Ian Harris - Information & Computer Science, UC Irvine
Payam Heydari - Electrical Engineering and Computer Science, UC Irvine
Raymond Klefstad - Electrical Engineering and Computer Science, UC Irvine
Fadi Kurdahi - Electrical Engineering and Computer Science, UC Irvine
Kwei-jay Lin - Electrical Engineering and Computer Science, UC Irvine
J. Michael McCarthy - Mechnaical Engineering, UC Irvine
Alex Nicolau - Information & Computer Science, UC Irvine
Alex Orailoglu - Computer Science & Engineering, UC San Diego
Isaac Scherson - Information & Computer Science, UC Irvine
Tatsuya Suda - Information & Computer Science, UC Irvine
Bruce J. Tromberg - Beckman Laser Institute, UC Irvine
Frank Vahid - Computer Science & Engineering, UC Riverside
Alexander Veidenbaum - Information & Computer Science, UC Irvine

New FACULTY MEMBERS (FY 2004/05)

Elaheh Bozorgadeh - Information & Computer Science, UC Irvine

RESEARCH ADVISORY BOARD MEMBERS

Dr. Gilbert F. Amelio - Senior Partner, Sienna Ventures, Sausalito, California
Dr. Mutsuhiro Arinobu – Vice President, Toshiba, Tokyo, Japan
Dr. Jai H. Hakhu – Vice President, Intel, Santa Clara, California

ADMINISTRATION and RESEARCHERS

Daniel D. Gajski - Director
Robert P. Larsen - Associate Director
Grace Wu – Operations Manager
Raphael Castaneda - Webmaster
Maral Melkichian - Administrative Assistant
Kathy Nguyen - Administrative Assistant
Andreas Gerstlauer - Project Scientist

Junyu Peng - Project Scientist
Dongwan Shin - Project Scientist
Quoc-Viet Dang – Project Programmer Analyst
Paul Rigor – Project Programmer Analyst
Amy Henckel – Project System Administrator
Tsuneo Kinoshita– Research Relations-Asia

VISITORS

Neil Audsley – University of York, United Kingdom
Kiyoung Choi - Seoul National University, Seoul, South Korea
Tak-Don Han - (EECS visitor – Kane Kim)
Takaaki Imai - Renasas Technology Corporation, Tokyo, Japan
Dirk Jansen – University of Offenburg, Germany
Su-Chong Joo - (EECS Visitor – Kane Kim)
Sunghyun Lee - (Dutt ICS visitor)
Hyunok Oh - Seoul National University, Seoul, South Korea
Wolfgang Rosenstiel - University of Tuebingen, Tuebingen, Germany
Wonyong Sung - Seoul National University, Seoul, South Korea
Whanki Yong - Handong Global University, Gyoung-buk, South Korea

GRADUATE STUDENTS

Samar Abdi
Nikhil Bansai
Sudarshan Banerjee
Nikhil Bansal
Partha Biswas
Pramod Chandraiah
Harish Chandra
Han-su Cho
Siddharth Choudhuri
Juan Colmanares
Radu Cornea
Susan Cotterell
David Cuccia
Paolo D'Alberto
Ambarish De
Frederic Doucet
Haitao Du
Ryota Egashira
Keita Fujii
Mohammaed Ghodrat
Arijit Ghosh
Sheuti Gorappa
Ann Gordon-Ross
Bita Gorji-Ara
Priya Govinda
Aseem Gupta
Jiwon Hahn
Sam Hamilton
Trevor Harmon
Akira Hatanaka
Matthew Heath
Jie Hu
Yan Huang
Javid Huseynov
Ilya Issenin
Hojjat Jafarpour
Vipul Jain
Dorota Jakubowski
Ravindra Jejurikar
Amir Kamalizad
Dongsoo Kang
Jungyap Kang
Arun Kejariwal
Parin Kenia
Minyoung Kim
Sung Jun Kim
Sun Woo Kim
Arwzou Koohi
Ming Kin Lai
Mingjie Lai
Jinhwan Lee
Kyoungwoo Lee

Seongwon Lee
Dexin Li
Hui Liu
Jiming Liu
Jinfeng Liu
Jun Lu
Rafael Lopez
Roman Lysecky
Ryan Mannion
Mahesh Mamidipaka
Shean McMahon
Sean Merritt
Kris Miller
Michael Moore
Andre Nacul
Babak Naffas
Nader Nassif
Shawn Nemetebakshi
Dan Nicolaescu
Afshin Niktash
Keun Sik No
Koji Noguchi
Chengzhi Pan
Lei Pan
Yi Pan
Mark Panahi
Hooman Parizi
Chulsun Park
Jae Park
Sudeep Pasricha
Cristiano Pereira
Peter Petrov
Kien Pham
Richard Plettner
Mukesh Rajan
Krishna Raman
Kiran Ramineni
Wenjing Rao
Mehrdad Reshadi
Won Woo Ro
Nicolae Savoiu
Devyani Sharma
David Sheldon
Chia-Yen Shih
Chulho Shih
Aviral Shrivastava
Farhan Simjee
Ozgur Sinanoglu
Vivek Sinha
Greg Stitt
Yamini Sukumaran
Rasit Topaloglu
Jelena Trajkovic
Duan Tran
Anshuman Tripathi
Richard Utter
Maria-Cruz Villa-Uriol
Daniel Wang
David Wangerin
Min Wu
Qiang Xie
Fei Xin
Affrin Yahaya
Chengmo Yang
Mei Yang
John Yapisek
Ahmad Yazdi
Sheng Yen
Joon You
Long Yun
Weilin Zeng
Chunchui Zhang
Wendy Zhang
Ying Zhang
Yue Zhang
Shuqing Zhao
Aikaterini Zoumi

STUDENT INTERNS

Issenin Ilya – IMEC, Leuven, Belgium
Sudeep Pasricha - Connexant, Newport Beach, California

GRADUATED STUDENTS

Haobo Yu, Ph.D.
Manev Luthra , MS

PROPOSALS SUBMITTED

Eleven proposals submitted to various Federal, Private and Industrial agencies amounting to $1,214,877.

SPACE ALLOCATIONS

CECS has space allocation in Information and Computer Science and Engineering Research Facility Building (IERF). It provides office and lab space for 5 faculty members, 53 students, 6 administrative staff, 4 project researcher and 11 visitors (during FY2004/05).

AWARDED CONTRACTS AND GRANTS

Semiconductor Research Corporation	$239,732
UC Micro Intel (2002)	2,317
UC Micro State (2003)	15,163
UC Micro Intel (2003)	17,648
UC Micro State (2003)	10,779
UC Micro Conexant (2003)	30,000
UC Micro State (2004)	19,450
UC Micro Intel (2004)	40,000
UCLA/Semiconductor Research Corporation	229
National Science Foundation/NSG	230,169
National Science Foundation/INRIA, France	31,363
National Science Foundation	125,275
National Science Foundation/DA	23,113
InterDesign Technologies, Japan	797,549
Hitachi Inc., Japan	27,378
Sub Total	$1,610,165

RESEARCH DONATIONS

Motorola, Incorporated	$347,124
SpecC Technology Open Consortium, Japan	6,716
InterDesign Technology, Incorporated, Japan	6,613
Various Donors	249,086
CECS Various Donors	5,149
Sales and Services	12,249
HSSOE Endowed Chair	70,338
Henry T. Nicholas, III Research Fellowships	100,000
Sub Total	$797,275

CONTRACTS, GRANTS AND DONATIONS TOTAL $2,407,440

DISTINGUISHED LECTURES

"Taming Pointers – A Symbolic Approach," by Professor Jianwen Zhu, University of Toronto, Canada, McDonnell Douglas Auditorium, University of California, Irvine, CA, Seminar, August 17, 2004

"Technological Challenges to Computer Architecture Innovation," by Dr. Faye Briggs, Intel Corporation McDonnell Douglas Auditorium, University of California, Irvine, CA, Distinguished Lecture, Dec 9, 2004

Ph.D. PRESENTATIONS

Haobo Yu, December 2004

EVENTS

CECS ISLPED Open House, August 8, 2004
The CECS ISLPED Open House held on August 8, 2004 was a success. Over 55 ISLPED attendees, graduate students, and CECS faculty affiliates were present at this CECS sponsored event.

Keynote Speech, August 31, 2004
Professor Nikil Dutt presented the Keynote Speech at the EUROMICRO Symposium on Digital System Design, Rennes, France.

SEMINARS

"Extreme Makeover of Design Automation**,"** Presented by Professor Daniel Gajski, University of California, Irvine, IEEE Orange County Computer Society, University Club, UC Irvine, October 25, 2004

AWARDS

Henry T. Nicholas, III Research Fellowships, May 15, 2005
The Center for Embedded Computer Systems (CECS) at the University of California, Irvine (UCI) announces that it will award two Henry T. Nicholas, III Research Fellowships for the 2005-2006 academic year.

NSF CAREER Awards, February 7, 2005
Professors Pai H. Chou and Payam Heydari, Department of Electrical Engineering and Computer Science at the Henry Samueli School of Engineering, have been named recipients of the National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award. Each professor received an award of $400,000 covering 5 year duration.

2004 EDAA Outstanding Dissertation Award, January 25, 2005
Dr. Prabhat Mishra won the EDAA outstanding dissertation award for the thesis topic "New Directions in Embedded System Design Automation." His dissertation is titled, "Specification-Driven Validation of Programmable Embedded Systems."

eNEWS LETTERS

Volume 4, Issue 3 - July 2004
· CECS at DAC
· Introducing Prof. Harris
· Mentor Award to Gajski
· "One Day" FPGA Design Methodology

Volume 4, Issue 4 - October 2004
· CECS at ISLPED
· CECS at ICCSS
· SPARK Book Published
· Student Profiles
· NISC Processor

Volume 5, Issue 1 - January 2005
· CECS at ICCAD
· CECS at Cal-(It)²
· Gajski Addresses Local IEEE
· Dutt Named Editor-in-Chief
· Briggs Delivers Lecture
· Kurdahi to IEEE Fellow
· Chou Wins CAREER

Volume 5, Issue 2 - April 2005
· CECS at DATE 05
· CECS at ASP-DAC 2005
· NSF CAREER Award to Heydari
· Dissertation Award to Mishra
· Bozorgzadeh Joins CECS
· Embedded Testing

JOURNALS

IEEE Design & Test of Computers
Chulsung Park, Jinfeng Liu and Pai H. Chou, "B#: A Battery Emulator and Power-Profiling Instrument," March-April 2004, pp 150-159.

IEEE Design & Test of Computers
S. Pasricha, M. Luthra, S. Mohapatra, N. Dutt, N. Venkatasubramanian, "Dynamic Backlight Adaptation for Low-Power Handheld Devices," September-October 2004, pp 398-405.

IEEE Transactions on Circuits and Systems
P. Heydari , "Analysis of the PLL Jitter Due to Power/Ground and Substrate Noise,", 2004.

IEEE Transactions on VLSI
P. Heydari and R. Mohanavelu, "Design of Ultra High-Speed Low-Voltage CMOS CML buffers and Latches," 2004.

ACM Transactions on Design Automation of Electronic Systems
Seda Ogrenci Memik, Ryan Kastner, Elaheh Bozorgzadeh and Majid Sarrafzadeh, "A Scheduling Algorithm for Optimization and Early Planning in High-Level Synthesis," Volume 10, Number 1, January 2005, pp 33-57.

CONFERENCE PROCEEDINGS

International Conference on Hardware/Software Codesign and System Synthesis (CODES+ISSS 2004), Stockholm, Sweden

S. Banerjee and N. Dutt, "Efficient Search Space Exploration for HW-SW Partitioning," CODES+ISSS 2004, Stockholm, Sweden, pp 122-127, September 8-10, 2004

M. Mamidipaka, K. Khouri, N. Dutt, and M. Abadir, "Analytical Models for Leakage Power Estimation of Memory Array Structures," DES+ISSS 2004," Stockholm, Sweden, pp 146-151, September 8-10, 2004

S. Pasricha, N. Dutt, M. Ben-Romdhane, "ast Exploration of Bus-based On-chip Communication Architectures," CODES+ISSS 2004, Stockholm, Sweden, pp 242-247, September 8-10, 2004

F. Rivera, M. Sanchez-Elez, M. Fernandez, R. Hermida, and N. Bagherzadeh, "Efficient Mapping of Hierarchical Trees on Coarse-Grain Reconfigurable Architectures," CODES+ISSS 2004, Stockholm,

Sweden, pp 30-35, September 8-10, 2004

A. Shrivastava, E. Earlie, N. Dutt, and A. Nicolau**, "**Operation Tables for Scheduling in the Presence of Incomplete Bypassing," CODES+ISSS 2004, Stockholm, Sweden, pp 194-199, September 8-10, 2004

Asia South Pacific Design Automation Conference 2005 Shanghai China (ASP-DAC 2005), Shanghai, China

S. Abdi and D. Gajski, "A Formalism for Functionality Preserving System Level Transformations," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 139-144, January 18-21, 2005

Y. Agarwal, C. Schurgers, and R. Gupta, "Dynamic Power Management Using On-Demand Paging for Networked Embedded Systems," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 755-759, January 18-21, 2005

CONFERENCE PROCEEDINGS (Continue)

R. Ayoub and A. Orailoglu, "A Unified Transformational Approach for Reductions in Fault Vulnerability, Power, and Crosstalk Noise and Delay on Processor Buses," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 729-734, January 18-21, 2005

L. Cai, A. Gerstlauer, and D. Gajski, "Multi-Metric and Multi-Entity Characterization of Applications for Early System Design Exploration," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 944-947, January 18-21, 2005

A. Gerstlauer, D. Shin, R. Doemer, and D. Gajski, "System-Level Communication Modeling for Network-on-Chip Synthesis," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 45-48, January 18-21, 2005

S. Pasricha, N. Dutt, and M. Ben-Romdhane, "Automated Throughput-Driven Synthesis of Bus-Based Communication Architectures," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 495-498, January 18-21, 2005

J. Peng, S. Abdi, and D. Gajski, "A Clustering Technique to Optimize hardware/Software Synchronization," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 965-968, January 18-21, 2005

W. Rao, A. Orailoglu, and R. Karri, **"**Fault Tolerant Nanoelectronic Processor Architectures," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 311-316, January 18-21, 2005

J. Seo and N. Dutt, "A Generalized Technique for Energy-Efficient Operating Voltage Set-Up in Dynamic Voltage Scaled Processors," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 836-841, January 18-21, 2005

R. Topaloglu and A. Orailoglu, "Forward Discrete Probability Propagation Method for Device

Performance Characterization Under Process Variations," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 220-223, January 18-21, 2005

S. Verma, K. Ramineni, and I. Harris, "An Efficient Control-Oriented Coverage Metric," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 317-322, January 18-21, 2005

T. Wei, K. Wu, R. Karri, and A. Orailoglu, "Fault Tolerant Quantum Cellular Array (QCA) Design Using Triple Modular Redundancy with Shifted Operands," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 1192-1195, January 18-21, 2005

C. Zhang and F. Kurdahi, "On Combining Iteration Space Tiling with Data Space Tiling for Scratch-Pad Memory Systems," Asia and South Pacific Design Automation Conference (ASP-DAC 2005), Shanghai, China, pp 965-968, January 18-21, 2005

CECS TECHNICAL REPORTS

S. Banerjee, E. Bozorgzadeh and N. Dutt, "HW/SW Partitioning for Architectures with Partial Dynamic Reconfiguration," TR 05-02, March, 2005.

M. Kim, H. Oh, N. Dutt, A. Nicolau, N. Venkatasubramanian, "Probability Based Power Aware Error Resilient Coding," TR 05-01, February, 2005.

M. Reshadi and D. Gajski, "NISC Modeling and Compilation," TR 04-33, December 2004.

A. Gupta and R. Doemer**,** "System Design of Digital Camera Using SpecC," TR 04-32, December 10, 2004.

R. Jejurikar and R. Gupta, "Leakage Aware Dynamic Slack Reclamation in Real-Time," TR 04-31, November 2004.

A. Nacul and T. Givargis, "The Phantom Serializing Compiler," TR 04-30, November 22, 2004.

S. Abdi and D. Gajski, "System Level Verification with Model Algebra," TR 04-29, November 9, 2004.

M. Mamidipaka and N. Dutt, "eCACTI: An Enhanced Power Estimation Model for On-chip Caches," TR 04-28, September 14, 2004.

S. Pasricha, N. Dutt, E. Bozorgzadeh, and M. Ben-Romdhane**,** "Floorplan-aware Bus Architecture Synthesis," TR 04-27, October 2004.

B. Gorjiara and N. Bagherzadeh, "Systematic Power Management of Heterogeneous Real-time Systems by Dynamic Schedule Analysis," TR 04-26, August 2004.

D. Shin, A. Gerstlauer, R. Doemer, D. Gajski, "System-on-Chip Communication Modeling Style Guide," TR 04-25, July 2004.

D. Shin, L. Cai, A. Gerstlauer, R. Doemer, D. Gajski, “System-on-Chip Transaction-Level Modeling Style Guide,” TR 04-24, July 2004.

D. Shin, J. Peng, A. Gerstlauer, R. Doemer, D. Gajski, “System-On-Chip Network Modeling Style Guide,” TR 04-23, July 31, 2004.

J. Peng, A. Gerstlauer, R. Doemer, D. Gajski, “System-On-Chip Architecture Modeling Style Guide,” TR 04-22, July 31, 2004.

TR 04-21 Not available at current time.

S. Pasricha, N. Dutt, and M. Ben-Romdhane, “Automated Synthesis of Bus Architectures for Systems with Throughput Constraints,” TR 04-20, August 2004.

R. Doemer, A. Gerstlauer, D. Shin**,** “Cycle-accurate RTL Modeling with Multi-Cycled and Pipelined Components,” TR 04-19, July 22, 2004.