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## Symposium on Systems, Control, and Networks in Honor of Professor Pravin Varaiya on His 65th Birthday

Chaouki T. Abdallah

The Symposium on Systems, Control, and Networks was held on 5–7 June 2005 in Berkeley, California, in honor of Prof. Pravin Varaiya on the occasion of his 65th birthday. Pravin Varaiya has been on the faculty of the Department of Electrical Engineering and Computer Sciences of the University of California, Berkeley, since he completed his Ph.D. there in 1966. The symposium brought together over 180 people to celebrate Pravin's contributions to research and education. Pravin Varaiya has contributed to many areas of systems and control, as well as to other areas including communication networks, information theory, economics, power systems, and transportation systems. Since it was not possible to do justice to so many topics in a short meeting, the symposium emphasized a few areas of Pravin's recent activity, specifically, hybrid systems, communication networks, and transportation systems.

The symposium was held at the beautiful Claremont Resort and Spa in Berkeley and at Sibley Auditorium in the College of Engineering on the campus of the University of California, Berkeley. On Sunday, 5 June, the scientific meeting and an evening reception were held at the Claremont in rooms overlooking San Francisco Bay. On Monday and Tuesday, 6–7 June, the

scientific meeting took place at Sibley Auditorium. The symposium banquet was a lovely event held at the Claremont on Monday evening.

Symposium attendees included colleagues of Pravin from his very early days at Berkeley in the 1960s to the present day, especially students, faculty colleagues, coworkers, colleagues from industry and government, and some who knew Pravin mainly through his publications. The format consisted of keynote lectures, sessions with several talks (each centering on one of the focus areas of the meeting), and special panels, which may be remembered as a signature of this symposium. There were three panels: one with students and colleagues from the early years of Pravin's career (the 1960s and 1970s), one from the 1980s, and one representing the 1990s through present. In a meeting with no parallel sessions, with 45-minute keynote lectures and 25-minute regular talks, there wasn't room in the program for everyone who was interested in speaking. The panel discussions were envisioned to allow attendees to comment on Pravin's influence on their careers, while injecting some lighter discussions into the meeting. As it turned out, the panels (along with the banquet) were important in helping the symposium recognize not only Pravin's influence as a researcher but also his

influence on the lives and careers of the many he has touched over the years. Also, session chairs, who in general were not also presenters, used the opportunity to make personal remarks on Pravin's influence. The members of the panel of students and colleagues from the 1960s and 1970s are noted in the caption of the Panel 1 photograph. The 1980s panel consisted of Kemal Inan (Sabanci University, Istanbul), Steven Low (Caltech), and Bozenna Pasik-Duncan (Kansas). The panel representing the 1990s through today consisted of Hamed Benouar (California Center for Innovative Transportation), Karl Petty (Berkeley), and Sonia Sachs (IBM Almaden).

The six keynote lectures, covering topics ranging from resource allocation in networks to transportation system intelligence, were given by Demosthenis Teneketzis (Michigan), Mark H.A. Davis (Imperial College), Shankar Sastry (Berkeley), Hani Mahmassani (Maryland), Sanjoy Mitter (MIT), and Edward Lee (Berkeley). Talks were also given by Karl Åström (Lund and Santa Barbara), Ahmad Bahai (National Semiconductor), John Baras (Maryland), Vivek Borkar (Tata Institute), Akash Deshpande (Teja Technologies), Tyrone Duncan (Kansas), Len Forys (Forys Consulting), Michael Gastpar (Berkeley), Andrea Goldsmith (Stanford), Roberto Horowitz (Berkeley), Sri Kumar



Symposium attendees on the Claremont grounds.



Pravin Varaiya asking a question on the first day of the symposium.

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## The Life and Accomplishments of Pravin Varaiya

**P**ravin Varaiya was born on 29 October 1940 in Bombay, India. He earned the B.E. degree in electrical engineering from the University of Bombay in 1960 and completed his graduate studies in electrical engineering and computer science at the University of California (UC), Berkeley, in 1966. He was a member of the Technical Staff of Bell Laboratories (1962–1963), following completion of his M.S. degree. Pravin's M.S. thesis advisor was Otto J.M. Smith, and his Ph.D. research was supervised by Lotti Zadeh.

Pravin joined the faculty of the Department of Electrical Engineering and Computer Sciences at UC Berkeley in 1966. From the beginning, he demonstrated an unusual breadth of interest and ability that extended beyond his original research area of control and optimization to include communication and information theory, stochastic processes, game theory, and circuit and network theory. Pravin made important and lasting contributions, and he quickly moved through the academic ranks, gaining the rank of professor in 1970. He became well known and highly regarded in the field at an early age.

Pravin's interests continued to expand. In the early 1970s, he began research in economics, focusing on issues of urban economics, such as the design of rent control, urban land use, and the economics of home ownership. He also contributed to general economic theory. He was appointed professor of economics at Berkeley in 1975. His teaching and research duties were split between electrical engineering and economics until 1992, when he decided to again focus his full attention on engineering.

In the 1970s and into the 1980s, Pravin steadily increased his activities in the area of communications, with an emphasis on communication networks. He simultaneously began a research effort in the field of electric power systems, focusing on dynamics and control of nonlinear power system models. Under his direction, teams of research students and visitors contributed to the understanding of numerous issues in these areas. In the 1980s, he began research in discrete-event and hybrid systems as well as in pricing issues for communication network services and electric power. In the late 1980s, he became involved in what was to become a major commitment with the Institute of Transportation Studies at Berkeley and the California Partners for Advanced Transit and Highways (PATH) Program, a multi-university research program dedicated to solving California's transportation problems. Pravin made seminal contributions to the design of intelligent vehicle highway systems, building on his past research in large-scale, multilayer, and hybrid systems. From 1994–1997, he was director of the PATH program.

Pravin Varaiya has published extensively, authoring or coauthoring four books and more than 280 technical papers. His first book, *Notes on Optimization*, was published in 1972. This classic text has had a major impact on many researchers in systems, control, and applications. Although now out of print, the book is available by free download from Pravin's Web site. His book *Stochastic Systems: Estimation, Identification, and Adaptive Control* (with P.R. Kumar) was published by Prentice-Hall in 1986. The

second edition of *High-Performance Communication Networks* (with J. Walrand) was published by Morgan-Kaufmann in 2000. *Structure and Interpretation of Signals and Systems* (with E. Lee) is an undergraduate text published in 2003 by Addison-Wesley.

Pravin's research includes contributions to optimization; optimal control; adaptive control of Markov chains; optimal control of partially observed stochastic systems; differential games; auctions; bandwidth and power trading markets; pricing of quality of service (QoS) and power; stability, control, and bifurcation analysis of nonlinear power system models; proposals for restructuring the electric power industry; supervisory control of discrete-event systems with partial observations; proposals on pricing for internet service providers; the Martingale theory of jump processes; nonlinear filtering applications; capacity of fading channels with side information; capacity and coding of Markov channels; algorithms for scheduling switches in communication networks; optimal control of queuing systems; QoS routing algorithms for wireless networks; scheduling, routing, and data provisioning for sensor networks; decentralized and hierarchical control; analysis, software modeling, and control of hybrid systems; ellipsoidal techniques for reachability analysis of dynamical systems; traffic congestion analysis; leadership in the development and implementation of performance measurement system for traffic measurement and data processing for the state of California; and, in his economics research, contributions to the theories of rent control, the economics of home ownership, the dynamics of the growth of cities, and to general equilibrium theory.

Pravin has served on the boards of directors of several technology companies and has been involved in technology transfer through involvement in startup companies. In addition to his research, teaching, and writing activities, he has maintained a significant level of public service by working for human rights causes around the world. During leaves of absence from Berkeley, he held visiting appointments at the Federal University of Rio de Janeiro (fall 1970) and MIT (January 1974–January 1975).

Pravin Varaiya has been recognized with many awards and distinctions. He has held a Guggenheim Fellowship (1972) and a Miller Research Professorship (July 1978–June 1979). He holds an honorary doctorate from l'Institut National Polytechnique de Toulouse. In 2002, he was awarded the IEEE Field Medal in Control Systems for "outstanding contributions to stochastic and adaptive control and the unification of concepts from control and computer science." At the 44th IEEE Conference on Decision and Control in Seville in December 2005, he received the Bode Prize of the IEEE Control Systems Society and delivered the Bode Lecture. He is a Fellow of the IEEE and a member of the National Academy of Engineering. He is currently Nortel Networks Distinguished Professor in the Department of Electrical Engineering and Computer Sciences at UC Berkeley. He has served on the editorial boards of many journals and is currently on the editorial boards of *Discrete Event Dynamical Systems* and *Transportation Research—C*.

(DARPA), Alexander Kurzhanski (Berkeley and Moscow State University), Luiz Fernando L. Legey (Federal University of Rio de Janeiro), Markos

Papageorgiou (Crete), Bozenna Pasik-Duncan (Kansas), Steve Shladover (Berkeley), Joseph Sifakis (Grenoble), Claire Tomlin (Stanford), John Tsitsiklis

(MIT), Hal Varian (Berkeley), Jean Walrand (Berkeley), and Felix Wu (Hong Kong and Berkeley). The meeting Web site ([http://www.isr.umd.edu/varaiya\\_symposium/](http://www.isr.umd.edu/varaiya_symposium/)) contains the symposium schedule and titles of all of the presentations. There is also a link there to a site containing pictures from the symposium.

The symposium banquet, emceed by Andrea Goldsmith of Stanford, took place at the Claremont on Monday. Since Pravin has been active in humanitarian causes throughout his career, the banquet provided an opportunity to recognize this interest. The two main talks at the banquet addressed social issues. Nick McKeown of Stanford, who had completed his graduate studies in electrical engineering at Berkeley, gave a talk on the death penalty, titled "When the State Kills." Nick, besides being an electrical engineering professor and an entrepreneur, is active in the effort to abolish the death penalty. Beatriz Manz, a professor of geography and ethnic studies at Berkeley, gave a talk based on her book *Paradise in Ashes*, which describes how the violence and despair of the Guatemalan civil war of the 1980s affected a village near the border with Mexico. Many others took the opportunity to speak in honor of Pravin. A highlight of the banquet was the talk by Jean Paul Jacob of IBM (Emeritus). Jean Paul, who has known Pravin since they were graduate students together in the 1960s, made some humorous remarks, such as a funny reference to Pravin's Volvo, which he has owned since the mid-1960s. He also told the following story: "Pravin has always been an exceptional person. Not only was he born very young, but, I don't know how many of you know it, he did not say a word until he was age two. His first word—long awaited by his family—was 'stochastic.' Unfortunately, his mother did not understand that word, and, therefore, she did nothing about it. This is quite a pity, because when detected at early years, there is a cure for the belief that the world can be modeled by formal stochastic systems."

Eyad Abed presented Pravin with an

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Panel 1: Students and colleagues from the 1960s and 1970s: (from left) Len Forys (Pravin's first Ph.D. student), Tyrone Duncan, René Boel (Gent), and Carlos Humes (Sao Paolo).

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Eugene Wong (left) and Jean Paul Jacob at the symposium banquet.

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Lucien Polak (left), Pravin Varaiya, and Ernie Kuh at the symposium banquet.

advance copy of the Birkhäuser book he edited in conjunction with the symposium, signed by the authors and speakers. The book, *Advances in Control, Communication Networks, and Transportation Systems: In Honor of Pravin Varaiya*, includes most of the talks presented at the symposium. Andrea Goldsmith gave her own remarks about Pravin and read a message from Lotfi Zadeh, Pravin's Ph.D. advisor. Others speaking at the banquet included John Baras (University of Maryland), Hamed Benouar, P.R. Kumar (University of Illinois), Sri Kumar, Jitendra Malik (EECS Chair, U.C. Berkeley), Sanjoy Mitter, Shankar Sastry, and John Wolf (California Department of Transportation). Pravin also said some words at the banquet, giving some interesting reflections on his career, thanking and recognizing individuals who have helped him especially in the early years of his career, and sharing credit with others on some achieve-

ments that were credited to him by speakers in the symposium. Pravin introduced the last act of the banquet, an impromptu Greek musical number by Joseph Sifakis (Grenoble), Andrea Goldsmith, John Baras, and Alex Skabardonis (Civil Engineering, Berkeley).

The symposium more than met the expectations of the organizers. The presentations were of high quality and intellectual content. The reminiscing in the panels made important links with the past and highlighted Pravin Varaiya's contributions to the careers (and lives) of many.

The symposium organization was led by Eyad Abed of the University of Maryland. The Organizing Committee consisted of Eyad Abed, Andrea Goldsmith, Roberto Horowitz, P.R. Kumar, and Shankar Sastry. Besides being the banquet emcee and a symposium speaker, Andrea Goldsmith also played a very important role in local arrangements.

The Outreach Committee, consisting of René Boel, Mustafa Ergen (graduate student, Berkeley), and Sonia Sachs, did an excellent job reaching past students and coworkers of Pravin Varaiya in advance of the symposium. Logistical and financial support was also provided by the Institute for Systems Research of the University of Maryland and the EECS Department of the University of California, Berkeley. Staff members at both institutions who made essential contributions to the success of the symposium include Karen Deal and Rebecca Copeland (Maryland) and Jasna Mrkic and Dana Dee Little (Berkeley).

Financial support provided by Defense Advanced Research Project Agency (DARPA) (Sri Kumar, program manager) and the National Science Foundation (NSF) (Kishan Baheti, program manager) was a major factor in the success of the symposium and is gratefully acknowledged.

## 16th IFAC World Congress: The Largest Automatic Control Conference Ever

### Eyad H. Abed

**P**rague, the capital of the Czech Republic, is a magical city. Founded more than 1,000 years ago, the city still keeps its historical spirit. Known as the city of a hundred spires, Prague shines as one of Europe's most valuable treasures. Prague's Old Town Square is a gem, complete with a still-functioning 15th-century astronomical clock. The famed 14th-century Charles Bridge offers a platform for artists and musicians amid grand statues of saints and a breathtaking view of the Prague Castle. While the city offers numerous galleries and museums, Prague's streets double as an open-air museum of Gothic, Roman, Baroque, Rococo, Renaissance, Art Nouveau, and Cubist styles. The city has attracted artists, scientists, philosophers, writers, and great thinkers around the globe for centuries. Prague was the city of Mozart, Dvorak, Smetana, Kepler, Kafka, Capek (the writer who invented the word "robot"),

and many others.

This summer, the city of Prague was crowded by control engineers, profes-

sors, and students. These visitors came from all over the world to take part in the World Congress of the International



IFAC President's Dinner with the Vltava River and the Charles Bridge in the background. (From right) Abraham Haddad, Eduardo Camacho, Mike Masten, Tamer Basar, and Wook Hyun Kwon.