



*Ninety-Sixth
Annual Commencement
June 15, 1990*

CALIFORNIA INSTITUTE OF TECHNOLOGY

The Commencement Ceremony

These tribal rites have a very long history. They go back to the ceremony of initiation for new university teachers in mediaeval Europe. It was then customary for students, after an appropriate apprenticeship to learning and the presentation of a thesis as their masterpiece, to be admitted to the Guild of Masters of Arts and granted the license to teach. In the ancient University of Bologna this right was granted by authority of the Pope and in the name of the Holy Trinity. We do not this day claim such high authority.

As in any other guild, whether craft or merchant, the master's status was crucial. In theory at least, it separated the men from the boys, the competent from the incompetent. On the way to his master's degree, a student might collect a bachelor's degree in recognition of the fact that he was half-trained, or partially equipped. The doctor's degree was somewhat different. Originally indistinguishable from the master's, the doctor's gradually emerged by a process of escalation into a supermagisterial role—first of all in the higher faculties of theology, law, and medicine. It will come as no surprise that the lawyers had a particular and early yen for this special distinction.

These gradations and distinctions are reflected in the quaint and colorful niceties of academic dress.

Of particular interest is the cap or mortarboard. In the form of the biretta it was the peculiar sign of the master. Its use has now spread far beyond that highly select group to school girls and choir boys and even to the nursery school. *Sic transit*. . .

The gown, of course, is the basic livery of the scholar, with its clear marks of rank and status—the pointed sleeves of the bachelor, the oblong sleeves of the master, the full sleeves and velvet trimmings of the doctor. The doctors, too, may depart from basic black and break out into many colors—Harvard crimson or Yale blue or the scarlet splash of Oxford.

Color is the very essence of the hood: color in the main body to identify the university; color perhaps in the binding to proclaim the subject of the degree—orange for engineering, gold for science, the baser copper for economics, white for arts and letters, green for medicine, purple for law, scarlet for theology, and so on. Size is a further variable, as the hoods tend to lengthen from the three feet of the bachelor to the four of the doctor. So the birds are known by their plumage.

With this color and symbolism, which is mediaeval though mutated, we stage our brief moment of pageantry, paying homage to that ancient community of scholars in whose shadow we stand, and acknowledging our debt to the university as one of the great institutional constructs of the Middle Ages. While looking back, however, we also celebrate the achievements of this present generation of students and look forward to the future of these our younger colleagues, whom we now welcome to our midst.

David C. Elliot
Professor of History, Emeritus

Academic Procession

Chief Marshal, David B. Wales, Ph.D.

Assistant Marshals

Arden L. Albee, Ph.D.	Christopher E. Brennen, D.Phil.
Judith R. Goodstein, Ph.D.	Robert W. Oliver, Ph.D.
Ward Whaling, Ph.D.	David S. Wood, Ph.D.

Faculty Officers

Steven E. Koonin, Ph.D.	Daniel J. Kevles, Ph.D.
Ward Whaling, Ph.D.	

MARCHING ORDER

CANDIDATES FOR THE DEGREE OF BACHELOR OF SCIENCE

CANDIDATES FOR THE DEGREE OF MASTER OF SCIENCE

CANDIDATES FOR THE DEGREE OF ENGINEER

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OFFICERS

THE FACULTY

THE CHAIRMEN OF DIVISIONS

THE DEANS

THE PROVOST

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE COMMENCEMENT SPEAKER

THE PRESIDENT

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

PRESIDING Ruben F. Mettler, Ph.D.
*Chairman of the Board of Trustees
California Institute of Technology*

ORGAN PRELUDE Leslie J. Deutsch, Ph.D.

PROCESSIONAL . . . The Caltech Wind Ensemble, Brass and Organ
William Bing, M.M., Conductor

INVOCATION Rabbi Gilbert Kollin
Pasadena Jewish Temple and Center

COMMENCEMENT ADDRESS Frank H. T. Rhodes
President, Cornell University

CHORAL SELECTION The Caltech Glee Clubs
Monica J. Hubbard, M.A., Conductor

 "The Old 124th Psalm Tune"
 arr. Gustav Holst

ALMA MATER The Caltech Glee Clubs,
The Caltech Wind Ensemble, Brass and Organ

CONFERRING OF DEGREES Thomas E. Everhart, Ph.D.
*President
California Institute of Technology*

PRESENTATION OF CANDIDATES FOR DEGREES

For the Degree of Bachelor of Science . Christopher E. Brennen, D.Phil.
Dean of Students

For the Degree of Master of Science . . . Gary A. Lorden, Ph.D.
Vice President for Student Affairs

For the Degree of Engineer Dr. Lorden

For the Degree of Doctor of Philosophy . . Arden L. Albee, Ph.D.
Dean of Graduate Studies

Biology Ray D. Owen, Ph.D., Sc.D.
Professor of Biology, Emeritus

Chemistry and Chemical Engineering . . . Fred C. Anson, Ph.D.
Division Chairman

Engineering and Applied Science . . . John H. Seinfeld, Ph.D.
Division Chairman

Geological and Planetary Sciences . . David J. Stevenson, Ph.D.
Division Chairman

Humanities and Social Sciences . . . David M. Grether, Ph.D.
Division Chairman

Physics, Mathematics and Astronomy . . Gerry Neugebauer, Ph.D.
Division Chairman

CONCLUDING REMARKS President Everhart

BENEDICTION Rabbi Kollin

RECESSIONAL . . . The Caltech Wind Ensemble, Brass and Organ

ORGAN POSTLUDE Dr. Deutsch

Candidates for Degrees

BACHELOR OF SCIENCE

- Amin Abid *Lahore, Pakistan* Electrical Engineering
Syed Zubair Ahmad* *Lahore, Pakistan* Electrical Engineering
Paul V. Amadeo* *Wayside, New Jersey* Applied Physics
Kenneth Skilling Andrews *Whitmore Lake, Michigan* Applied Physics
Arthur Ang, Jr.* *Menlo Park, California* Engineering and Applied Science
Dimitrios Antsos* *Thessaloniki, Greece* Electrical Engineering
Manuel Aranda, Jr. *El Paso, Texas* Biology
Syed Aamer Azam* *Karachi, Pakistan* Physics
Mohammad Azeem* *Lahore, Pakistan* Electrical Engineering
Stephen Philip Bard* *Redmond, Washington* Mathematics
Randall Lewis Baron *Coos Bay, Oregon* Physics
Dwight Eugene Berg* *College Park, Maryland* Engineering and Applied Science and Economics
Rick D. Berge *Salt Lake City, Utah* Electrical Engineering
Christofer Bertani *Pasadena, California* Engineering and Applied Science
Munir Frederick Bhatti *Sioux Falls, South Dakota* Physics
Sandip Biswal* *Randallstown, Maryland* Biology
Brian Andrew Brandt* *Hollywood, California* Biology
Timothy T. Broberg *Santa Ana, California* Engineering and Applied Science
Herbert John Burrows* *Glendale, California* Electrical Engineering
Robert Stevens Byers, Jr.* *Orlando, Florida* Engineering and Applied Science
Kleber Alberto Camacho *San Gabriel, California* Engineering and Applied Science
Huy Thanh Cao* *Huntington Beach, California* Mathematics
David Richard Carta *Pasadena, California* Engineering and Applied Science
Kevin Charles Chase* *Natick, Massachusetts* Applied Mathematics and Physics
Andrew W. Chen *Brooklyn, New York* Physics and Applied Mathematics
John Karwin Chen* *Houston, Texas* Electrical Engineering
John Sze-Chi Chen* *Huntsville, Alabama* Engineering and Applied Science and Mathematics
Benjamin G. M. Chew *San Jose, California* Chemistry
Ami Lyra Pradip Choksi *Northridge, California* Biology and Chemistry
Min-Ei Chou *New York, New York* Physics
Vivian Chow* *Hong Kong, Hong Kong* Engineering and Applied Science

Students whose names are followed by an asterisk are being graduated with honor in accordance with a vote of the faculty.

BACHELOR OF SCIENCE — Continued

Dolly Chu* *Covina, California* Engineering and Applied Science
 Steven Glenn Clinard *Alta Loma, California* Electrical Engineering
 Robert Francis Coker *Indianapolis, Indiana* Physics and Astronomy
 William P. Cross* *Kalamazoo, Michigan* Applied Mathematics
 Kevin Richard Curtis* *Lancaster, California* Electrical Engineering
 Joseph William Dadek* *Palmyra, Pennsylvania* Physics and Mathematics
 John Thomas Daly *Huntsville, Alabama* Engineering and Applied Science
 Christopher David Edgington *Bayside, Wisconsin* Engineering and Applied Science
 and Economics
 David Alan Edwards* *Moreno Valley, California* Applied Mathematics
 Glenn Charles Eychaner *Manteca, California* Geology
 Drazen Fabris* *Glendale, California* Engineering and Applied Science
 George Fang *Aurora, Colorado* Electrical Engineering
 Shao-Chieh Fang* *West Covina, California* Engineering and Applied Science
 Carver Clark Farrow, Jr. *St. Thomas, Virgin Islands* Applied Physics
 Jimmy Eng Fendors *Portland, Oregon* Electrical Engineering
 Philip John Fernandez *Santa Clarita, California* Electrical Engineering
 Mark Philip Fey* *Spokane, Washington* Social Science
 Pamela Yuk-Ching Fong *Los Angeles, California* Mathematics
 Robert Allan Fox *Las Vegas, Nevada* Applied Physics
 Charles Chien-Wen Fu *Arcadia, California* Mathematics
 Eric Thomas Fung* *Riverside, California* Biology
 Benjamin Alan Funk *Norman, Oklahoma* Engineering and Applied Science
 Christina Lynn Garden *Amherst, New Hampshire* Applied Physics
 Paul Richard Gentieu* *Andover, New Jersey* Engineering and Applied Science
 Matthew Lee Giger* *Portland, Oregon* Engineering and Applied Science
 Alexander Gilman *Manhattan Beach, California* Chemistry
 Alan Frederik Golightly *Lubbock, Texas* Engineering and Applied Science
 Robert A. Grothe, Jr. *St. Louis, Missouri* Biology
 Kin Ha* *El Monte, California* Applied Physics and Economics
 Jon Hamkins* *Lexington, Kentucky* Electrical Engineering
 Kirk Hargreaves* *Reston, Virginia* Physics
 Gregory Michael Harry *Holland, Pennsylvania* Physics
 Eric Dent Hassenzahl* *Piedmont, California* Engineering and Applied Science
 Jerrold Von Hauck* *Sanford, Florida* Engineering and Applied Science
 Mark Harold Hause *Ypsilanti, Michigan* Engineering and Applied Science
 Amanda Ayres Heaton* *Orlando, Florida* Engineering and Applied Science and
 Mathematics
 Li Wen Ho* *Singapore* Mathematics

BACHELOR OF SCIENCE—Continued

- Colin Douglas Howell* *Cypress, California* Geophysics
Earl Alexander Hubbell *Chicago, Illinois* Mathematics
Christopher David Hurwitz *Dedham, Massachusetts* Engineering and Applied Science
James Paul Ibbetson* *Dural, Australia* Applied Physics
Tarik Isani *Blacksburg, Virginia* Electrical Engineering
Maneesh Jain* *New Delhi, India* Physics and Electrical Engineering
Adam L. Janin *Larkspur, California* Physics
Anders Robert Johnson* *El Segundo, California* Electrical Engineering
Sean Leonard Johnston *Novi, Michigan* Chemistry and Biology
Michael Christopher Jones* *Irvine, California* Chemical Engineering
Jason Joseph Karceski* *Rockford, Illinois* Electrical Engineering
Matthew John Kidd *Bethesda, Maryland* Physics and Mathematics
Nikolaos Kidonakis* *Thessaloniki, Greece* Physics
Jong Duk Kim *Los Angeles, California* Applied Physics
Clifton Jarod Kiser *Joliet, Illinois* Engineering and Applied Science
Kathleen Elizabeth Kraemer *Highland, California* Astronomy
Yu-Hung Kuo* *San Dimas, California* Biology
David Wayne LaFollette *Indianapolis, Indiana* Electrical Engineering
Amit Lal* *Diamond Bar, California* Electrical Engineering
Victoria Lane *Surfer's Paradise, Australia* Biology
Brendon Michael Lasell* *Greeley, Colorado* Mathematics
Alvin Wei-Yin Law* *Hong Kong, Hong Kong* Engineering and Applied Science
Angela Tsai-Ling Lee* *Kawasaki, Japan* Electrical Engineering
Edward Lee* *Kowloon, Hong Kong* Engineering and Applied Science
Howard Shew Kwong Lee* *San Francisco, California* Applied Physics
Ming Lee* *Upper Darby, Pennsylvania* Engineering and Applied Science
Wilson H. Lee *Cupertino, California* Engineering and Applied Science
Thomas James Lenosky* *Troy, Michigan* Physics
Scott Allen Lewicki *Golden Valley, Minnesota* Physics
Po King Li* *Hong Kong, Hong Kong* Electrical Engineering
Kahn-Ren Lim *Agoura, California* Physics
Elaine Emilee Lindelef *Santa Clarita, California* Engineering and Applied Science
George Yen-Hsi Liu* *Irvine, California* Biology
David Ray Lomax *Los Angeles, California* Engineering and Applied Science
Kate Elizabeth Loomis* *Everett, Washington* Engineering and Applied Science
Jennifer Ann Low* *Upland, California* Biology
Steven J. Ludtke *Glenwood Springs, Colorado* Physics
Alan David Lund *Eau Claire, Wisconsin* Applied Physics

BACHELOR OF SCIENCE — *Continued*

Mark Tien-Hsing Ma *Porterville, California* Engineering and Applied Science
Robert William Maher *Euclid, Ohio* Economics
Frederick Karl Mallon* *Livermore, California* Chemical Engineering
Charlotte Faith Mariko Manly* *Wahiawa, Hawaii* Engineering and Applied Science
Ron Arthur Markey *Anchorage, Alaska* Electrical Engineering
Russell Jack May *Indianapolis, Indiana* Mathematics
Aris Moustakas* *Athens, Greece* Physics
Bhushan Mudbhary *Kathmandu, Nepal* Electrical Engineering
Asim Mughal *Lahore, Pakistan* Electrical Engineering
Robert Leo Murdock *Los Angeles, California* Chemical Engineering
Robert L. Myers *Santa Clarita, California* Geophysics
Philip Warren Nabours* *Tacoma, Washington* Physics
Edward J. Nanale *San Diego, California* Applied Physics
Johnny Ng* *Hong Kong, Hong Kong* Engineering and Applied Science
Viola Chee Ng* *Cypress, California* Electrical Engineering
Minh Thuy Nguyen *Anaheim, California* Biology
Kent Brian Nordstrom *Seal Beach, California* Applied Physics
Joel Norris *Moreno Valley, California* Geology
Martin Joseph O'Brien *Stockton, California* Chemical Engineering
Christopher K. Oei *Garden City, New York* Physics
Andre Garapet Ohanissian *Greenhill Farms, Pennsylvania* Engineering and Applied Science
Satomi Okazaki* *Los Angeles, California* Mathematics
Steven Olafson* *East Islip, New York* Electrical Engineering
Lawrence Dean Oliver* *Union City, California* Engineering and Applied Science
Richard Joseph Oliver* *Spokane, Washington* Electrical Engineering
Adam Perse *Los Angeles, California* Physics and Electrical Engineering
Geoffrey Mark Pilling* *Fullerton, California* Physics and Electrical Engineering
Margolita Mia Pollack *East Lansing, Michigan* Applied Physics
Kevin John Pond *Pleasanton, California* Applied Physics
Annis Marie Porter* *Leesburg, Virginia* Electrical Engineering
Adityo Prakash* *Calcutta, India* Physics and Mathematics
Gordon Douglas Pioreschi *Omaha, Nebraska* Engineering and Applied Science
David Walter Proctor *Walnut Creek, California* Engineering and Applied Science
Faress Habibur Rahman *Karachi, Pakistan* Engineering and Applied Science
Gregory Randal Ralph *Hobart, Indiana* Electrical Engineering
Chandra Shekar Raman* *Whittier, California* Electrical Engineering
Edward Ratner* *Golden Valley, Minnesota* Physics
Richard Robert Reid *Christ Church, Barbados* Electrical Engineering
Scott Norman Richman *Newport Beach, California* Applied Mathematics

BACHELOR OF SCIENCE—Continued

- David William Risher* *Huntington Beach, California* Engineering and Applied Science
- Frederick Gurney Roeber *Spokane, Washington* Physics
- Theodore William Rogers *San Pedro, California* Engineering and Applied Science
- Steven Jay Rosenberg* *Shaker Heights, Ohio* Mathematics
- Michael Phillip Salisbury* *Newport Beach, California* Physics and Engineering and Applied Science
- Marcus Alex Santos *Jakarta, Indonesia* Engineering and Applied Science
- Zulfiqar Sayeed* *Dhaka, Bangladesh* Electrical Engineering
- Douglas Eric Schafer *Red Oak, Texas* Electrical Engineering
- Carmen Kay Shepard *Park Rapids, Minnesota* Mathematics
- Karen Mary Siegrist *Frederick, Maryland* Applied Physics
- Derek Vaughn Slye *Carmel, California* Engineering and Applied Science
- Michael Maurice Smyth* *Tacoma, Washington* Physics
- Craig Anthony Sosin* *Lincoln, Nebraska* Physics
- Samuel Nathan Southard, Jr. *San Francisco, California* Engineering and Applied Science
- Meera Srinivasan* *El Paso, Texas* Electrical Engineering
- David M. Stevens* *Laclede, Idaho* Engineering and Applied Science
- Pei-hsiu Suen *Manila, Philippines* Electrical Engineering
- Blake Thomas Sullivan *Santa Clarita, California* Engineering and Applied Science
- Catherine Elise Swift *Honolulu, Hawaii* Geology
- James Donald Taylor *Concord, California* Electrical Engineering
- Ross TenEyck *Cottage Grove, Oregon* Engineering and Applied Science
- Glenn Paul Tesler* *North Hollywood, California* Mathematics and Physics
- Milton Evan Tinkoff *New Bedford, Massachusetts* Engineering and Applied Science
- Leopold E. Travis* *San Francisco, California* Mathematics
- Thomas Joseph Tromey* *Cincinnati, Ohio* Mathematics
- Chandra Lenore Tucker *Santa Barbara, California* Biology
- Marc Louis Turner *Golden, Colorado* Engineering and Applied Science
- Kevin Henry Van Bladel *Boynton Beach, Florida* Physics
- Adam Joby Weissman *Federal Way, Washington* Physics
- John Edward Werner *Albuquerque, New Mexico* Geology
- Kenneth Bruce Wheeler *Los Angeles, California* Electrical Engineering
- Patricia Katryn Wiese *Tacoma, Washington* Geology
- Robert Sylvester Williamson, III* *Hacienda Heights, California* Physics
- Scot Andrew Wolfe *Chandler, Arizona* Chemistry and Biology
- Douglas Man Tat Wong *Glendale, California* Electrical Engineering
- Ki Ching Wong* *Hong Kong, Hong Kong* Physics

BACHELOR OF SCIENCE—*Continued*

- Jeannette Woo *Los Angeles, California* Electrical Engineering
David Webster Wood *El Paso, Texas* Biology and Chemical Engineering
Chris Curtis Worrell *Bethesda, Maryland* Engineering and Applied Science
Kiyotake Yamazaki *New York, New York* Physics
Xiaojian Yan* *Beijing, China* Physics
Chih Meng Yang *Los Angeles, California* Applied Physics
Richard Shih-Jung Yeh* *Lodi, California* Engineering and Applied Science and
Economics
Peter Ying *Forest Hills, New York* Applied Mathematics
Harold Robert Zatz* *Maitland, Florida* Engineering and Applied Science and
Chemistry
Xiaolei Zhu* *Beijing, China* Applied Mathematics
Arthur Joseph Zirger *Gainesville, Florida* Electrical Engineering

MASTER OF SCIENCE

- Yoshio Abe (*Materials Science*) B.E., The University of Tokyo 1981.
- Salim Ahmed (*Electrical Engineering*) B.A., Whitman College 1989; B.S., California Institute of Technology 1989.
- Theocharis Apostolatos (*Physics*) B.S., University of Athens 1988.
- Donald J. Banfield (*Planetary Science*) B.S., Cornell University 1987.
- Dwight Eugene Berg (*Social Science*) B.S., California Institute of Technology 1990.
- Christopher Llewellyn Bond (*Aeronautics*) B.S., California Institute of Technology 1989.
- Paul Anthony Bonenfant (*Electrical Engineering*) B.S., California Institute of Technology 1989.
- Olga Borić (*Electrical Engineering*) B.S.E.E., University of Belgrade 1989.
- Daniel Francis Bourget (*Electrical Engineering*) B.S., Worcester Polytechnic Institute 1988.
- Martin John Brenner (*Applied Mechanics*) B.S., University of Illinois at Urbana-Champaign 1979; M.S., University of California, San Diego 1985.
- Frederic Breugnot (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure d'Ingénieur 1990.
- Milivoje Slobodan Brkovic (*Electrical Engineering*) B.S.E.E., University of Belgrade 1982; M.S.E.E., 1988.
- Martin Aaron Bucher (*Physics*) A.B., University of California, Berkeley 1986.
- Emelia A. Burt (*Geophysics*) B.S., University of Maryland 1979; M.S., 1983.
- Bryan Jay Butler (*Planetary Science*) B.S., Utah State University 1988.
- Bedri Cag Cetin (*Electrical Engineering*) B.S., Bosphorus University 1988.
- Sonali Chakrabarti (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Kharagpur 1989.
- Ajay Chandna (*Electrical Engineering*) B.A.Sc., University of Windsor 1989.
- Fen Chen (*Electrical Engineering*) B.S., Tsinghua University 1984.
- Jen-Sue Chen (*Materials Science*) B.S., National Tsing Hua University 1988.
- Tsu-Han Chen (*Electrical Engineering*) B.S., National Taiwan University 1987.
- Vivian Chow (*Computer Science*) B.S., California Institute of Technology 1990.
- Neil Andrew Chriss (*Mathematics*) B.S., The University of Chicago 1989.
- James Alden Consolver (*Planetary Science*) B.A., Wichita State University 1989; B.S., 1989.
- John Anthony Cortese (*Applied Mathematics*) B.S., Worcester Polytechnic Institute 1982; M.S., 1985.
- Eric Bryant Cummings (*Aeronautics*) B.S., The Pennsylvania State University 1989.
- Roderick Theodore Daebelliehn (*Aeronautics*) B.S., Rose-Hulman Institute of Technology 1989.
- Michael Bruce Daniell (*Electrical Engineering*) B.S., University of Florida 1979.
- Herve Demarles (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure d'Ingénieur en Électronique et Électrotechnique 1990.

MASTER OF SCIENCE—Continued

- Richard William Dissly (*Planetary Science*) B.A., Rice University 1988.
- Michael Anthony Dominick (*Aeronautics*) B.S., University of California, Los Angeles 1986.
- Paul Richard Dressel (*Applied Mathematics*) B.S., University of Wisconsin-Eau Claire 1988.
- Aaron David Earley (*Electrical Engineering*) B.E.E., Georgia Institute of Technology 1988; B.S., Morehouse College 1988.
- David J. Edelson (*Astronomy*) A.B., University of California, Berkeley 1988.
- Christopher James Elkins (*Aeronautics*) B.S., Stanford University 1989.
- Lars Jacob Foged (*Electrical Engineering*) Teknikumingeniør, Ingeniørhøjskolen Aarhus Teknikum 1988.
- James Martin Fox (*Biology*) B.S., Georgetown University 1983.
- William John Andrew Fyfe (*Computer Science*) B.Math., University of Waterloo 1985.
- Christina Danielle Gallup (*Geology*) B.A., The University of Chicago 1987.
- Zhengqiang Gao (*Materials Science*) B.S., Tsinghua University 1986.
- Marc Steven Gelormino (*Chemical Engineering*) B.S., University of Rochester 1987.
- Niko George Glumac (*Aeronautics*) B.S.M.E., University of California, Santa Barbara 1989.
- Steven Craig Gortsema (*Aeronautics*) B.S., Hope College 1989.
- Lisa Baugh Grant (*Geology*) B.S., Stanford University 1985; M.S., California Institute of Technology 1989.
- Jeffrey Paul Grundvig (*Electrical Engineering*) B.S., Brigham Young University 1988.
- Martin Werner Grünewald (*Physics*) Vordiplom Physik, Rheinisch-Westfälische Technische Hochschule, Aachen 1984; Vordiplom Informatik, 1985; Diplom-Physiker, 1988.
- Gary Steven Guthart (*Engineering Science*) B.S., University of California, Berkeley 1987.
- Jonathan Bruce Hacker (*Electrical Engineering*) B.A.Sc., University of British Columbia 1986.
- Louis Emanuel Halperin (*Electrical Engineering*) B.S.E., University of Pittsburgh 1985.
- Karen Ann Harvey (*Electrical Engineering*) B.S., Michigan Technological University 1986.
- Imran Hashim (*Applied Physics*) B.S., Cornell University 1989.
- Shailesh Umamaheshwar Hegde (*Computation and Neural Systems*) B.Tech., Indian Institute of Technology, Bombay 1986; M.S., The University of Virginia 1988.
- William Adams Heindl (*Physics*) B.S., Case Western Reserve University 1987.
- Mohammad Aamir Husain (*Electrical Engineering*) B.Sc., Honors, Loughborough University of Technology 1987.

MASTER OF SCIENCE—Continued

- Matthew E. Johnson (*Mechanical Engineering*) B.S., Northwestern University 1989.
- Laura Ellen Jones (*Geophysics*) B.S., University of California, Riverside 1988.
- Milan Marko Jovicic (*Electrical Engineering*) B.S., Belgrade University 1987.
- Kyung Soo Jun (*Civil Engineering*) B.S., Seoul National University 1983; M.S., 1985.
- Patricia Diane Jungers (*Electrical Engineering*) B.S., Harvey Mudd College 1989.
- Kenneth Isamu Kamemoto (*Physics*) B.S., University of Hawaii 1986.
- Erotokritos Charalambous Katsavounidis (*Physics*) B.S., Aristotle University of Thessaloniki 1988.
- David Andrew Kaufman (*Mechanical Engineering*) B.S., Stanford University 1989; B.A., Willamette University 1989.
- Donald William Kendrick (*Mechanical Engineering*) B.A.Sc., The University of British Columbia 1989.
- Soojin Kim (*Chemical Engineering*) B.S., Cornell University 1988.
- David Blair Kirk (*Computer Science*) B.S., Massachusetts Institute of Technology 1982; M.S., 1984.
- Adam Kolodny (*Electrical Engineering*) B.S., Cornell University 1988.
- Ronald C. Kong (*Electrical Engineering*) B.S., California Institute of Technology 1989.
- Axel Wolf Hendrik Kratel (*Physics*) B.S., University of California, Irvine 1988.
- Scott David Krentzman (*Electrical Engineering*) B.S.E.E., Northeastern University 1989.
- Sophia Kyriazopoulou (*Physics*) B.S., Aristotle University of Thessaloniki 1988.
- Bob Kwok-Shing Lee (*Aeronautics*) B.S., University of Illinois at Urbana-Champaign 1989.
- Fu Chuen Lee (*Electrical Engineering*) B.S., California State University, Los Angeles 1989.
- Karen Andrea Lee (*Electrical Engineering*) B.S., California Polytechnic State University 1986.
- Stephen Sylvain Leroy (*Planetary Science*) B.A., Cornell University 1988.
- Wing-Sze Agnes Leung (*Mechanical Engineering*) B.S., University of Wisconsin-Madison 1989.
- Harold Joseph Levy (*Applied Physics*) B.S. (Chemistry), University of California, Irvine 1987; B.S. (Biology), 1987.
- Glenn Mansfield Lewis (*Computer Science*) B.S., California Institute of Technology 1988.
- Hsin-Yu Li (*Electrical Engineering*) B.S., National Chiao-Tung University 1984; M.S., 1986.
- Peter Jon Licari (*Chemical Engineering*) B.S., Tufts University 1987; M.S., 1988.
- Yu-Chun Donald Lie (*Electrical Engineering*) B.S.E.E., National Taiwan University 1987.

MASTER OF SCIENCE—*Continued*

- Wen-Shu Liu (*Materials Science*) B.S., National Tsing Hua University 1987.
- Wei-Min Lu (*Electrical Engineering*) B.S., Tsinghua University 1986; M.S., 1989.
- Victor Manuel Lubecke (*Electrical Engineering*) B.S., California State Polytechnic University, Pomona 1986.
- Svetlana Tatić Lučić (*Electrical Engineering*) B.S.E.E., University of Belgrade 1986.
- Yvan De Sousa Maciel (*Aeronautics*) B.Eng., McGill University 1989.
- Sunil Kumar Malhotra (*Applied Mechanics*) B.S.E., The University of Michigan 1989.
- Michael Irving Mandell (*Electrical Engineering*) B.S.E., The University of Michigan 1989.
- Youbin Mao (*Electrical Engineering*) B.S., Fudan University 1988.
- Joseph Carl Matesic, Jr. (*Electrical Engineering*) B.S., State University of New York at Buffalo 1986.
- Raymond George Mayer (*Electrical Engineering*) B.E., Stevens Institute of Technology 1988.
- Rom Garreth McGuffin (*Aeronautics*) B.S., Texas A&M University 1989.
- James Franklin Miller III (*Electrical Engineering*) B.S., United States Military Academy, West Point 1983.
- Anton Mark Monk (*Electrical Engineering*) B.S., University of California, San Diego 1989.
- Kevin Christopher Moore (*Aeronautics*) B.S., Harvey Mudd College 1987.
- John Christopher Morris (*Electrical Engineering*) B.S., California Polytechnic State University 1989.
- Petros Nikolaos Mouchtaris (*Electrical Engineering*) Diploma, National Technical University of Athens 1989.
- John Murphy (*Electrical Engineering*) B.E., University College Dublin 1988.
- Charles Bruce Musgrave (*Materials Science*) B.S., University of California, Berkeley 1988.
- Gopalakrishnan Narayanan (*Electrical Engineering*) B.Eng., Anna University, Madras 1989.
- Robert G. Noltz (*Physics*) B.S. (Engineering Physics), Texas Tech University 1985; B.S. (Computer Science), 1985.
- Frederick Jorgen Nordby III (*Computer Science*) B.S., California Institute of Technology 1988.
- Charles Nabih Noussair (*Social Science*) B.A., University of Pennsylvania 1987.
- Gorm Nykreim (*Physics*) B.S. (Physics), The University of Washington 1988; B.S. (Chemistry), 1988; B.S. (Astronomy), 1988.
- Takao Omata (*Electrical Engineering*) B.E., The University of Tokyo 1979.
- Sung Kwong Or (*Electrical Engineering*) B.S.E.E., University of Texas at Arlington 1989.
- John Thomas Orchard (*Electrical Engineering*) B.S., University of California, Berkeley 1988.

MASTER OF SCIENCE—Continued

- Gabriel Fernández De Bobadilla Osorio (*Electrical Engineering*) Diplomado, Universidad Nacional de Educación a Distancia 1988; Ingeniero Industrial, Universidad Politécnica de Madrid 1988.
- Joel Alexander Pedersen (*Environmental Engineering Science*) B.S., University of California, Irvine 1988.
- Volnei Antonio Pedroni (*Electrical Engineering*) Electronic Engineer, Universidade Federal Do Rio Grande Do Sul 1975.
- N. Sateesh Pillai (*Electrical Engineering*) B.Tech., University of Kerala 1987.
- Vicki Lynn Pipal (*Electrical Engineering*) A.A., North Hennepin Community College 1985; B.E.E., University of Minnesota 1988.
- Philip Jerome Proteau (*Chemistry*) B.S., The University of Washington 1985.
- Helen Xian Qian (*Geophysics*) B.S., University of California, Los Angeles 1988.
- Yong Qiao (*Electrical Engineering*) B.S., Shanghai Jiao Tong University 1986; M.S.E.E., Northrop University 1988.
- Martin Wolfgang Regehr (*Physics*) B.A.Sc., University of Toronto 1988.
- David William Risher (*Mechanical Engineering*) B.S., California Institute of Technology 1990.
- Susan Elizabeth Roden (*Electrical Engineering*) B.S.E.E., Lehigh University 1988.
- Hector Pablo Rotstein (*Electrical Engineering*) Ingeniero Electricista, Universidad Nacional del Sur 1985.
- Karl Josef Rubenacker (*Civil Engineering*) B.E., The Cooper Union 1989.
- Majid Saghafi (*Chemical Engineering*) B.S., University of Houston 1988.
- Masahiro Sayano (*Electrical Engineering*) B.S., California Institute of Technology 1988.
- Peter Schupp (*Physics*) Vordiplom, University of Heidelberg 1988.
- Joel Mark Schwartz (*Planetary Science*) B.A., Cornell University 1986.
- Ali Shakouri (*Electrical Engineering*) Maîtrise de Physique, Université de Paris VII 1989; Ingenieur, École Nationale Supérieure des Télécommunications de Paris 1990.
- Martha Ann Shaw (*Environmental Engineering Science*) B.S., University of Illinois at Urbana-Champaign 1988.
- Finbar Thomas Sheehy (*Electrical Engineering*) B.E., University College Dublin 1986.
- Angela Chao-Hsuan Shih (*Mechanical Engineering*) B.S.A.E., University of California, Los Angeles 1989.
- William Condon Shoemaker (*Aeronautics*) B.S., Stanford University 1989.
- Vinayagamoorthy Sivapragasam Sivarajan (*Electrical Engineering*) B.Sc., University of Peradeniya 1987.
- Sharon Marie Sjostrom (*Mechanical Engineering*) B.S., Colorado State University 1989.
- Jude Thaddeus Socrates (*Mathematics*) B.S., University of the Philippines 1986; M.S., 1988.
- William Russell Softky (*Physics*) B.Sc., Haverford College 1984.
- Anand Keshav Soman (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1989.

MASTER OF SCIENCE—Continued

- Charles William Stirk (*Electrical Engineering*) B.S., College of William and Mary 1985.
- Hideyuki Suzuki (*Materials Science*) B.S., The University of Tokyo 1988.
- Marc Leonard Tillman (*Aeronautics*) B.S.E., The University of Michigan 1989.
- George Timothy Tomaich (*Aeronautics*) B.S.E., The University of Michigan 1989.
- Paul David Tripodi II (*Chemistry*) B.S., The Pennsylvania State University 1987.
- Charles Su-Chang Tsai (*Applied Physics*) B.S., California Institute of Technology 1989.
- Wayne Wen-Tsui Tsou (*Electrical Engineering*) B.S.E.E., The University of Michigan 1989.
- Kevin Eugene Underhill (*Electrical Engineering*) B.S., California Institute of Technology 1989.
- Marcel René van der Goot (*Computer Science*) Doctorandus Rijksuniversiteit Groningen 1987.
- Hongying Wang (*Electrical Engineering*) B.S., University of Science and Technology of China 1989.
- Xi Wang (*Mechanical Engineering*) B.A.E.E., Tsinghua University 1985; M.S., Oregon State University 1989.
- Catherine Margaret Weitz (*Planetary Science*) B.S., Cornell University 1988.
- Mark Weitzman (*Physics*) B.S., Brooklyn College 1976.
- Andrew Bennett Wells (*Mechanical Engineering*) A.B., Dartmouth College 1989.
- Huafeng Wen (*Electrical Engineering*) B.S., University of Science and Technology of China 1988.
- Gregory Thomas Willette (*Applied Physics*) A.B., Harvard College 1988.
- Darrell Alan Winner (*Environmental Engineering Science*) B.S., Carnegie Mellon University 1989.
- Mau Cheong Wong (*Aeronautics*) B.A.E.M., University of Minnesota 1989.
- Liping Yan (*Civil Engineering*) B.Eng., Southwestern Jiaotong University 1983; M.Eng., 1986.
- Chih Meng Yang (*Applied Physics*) B.S., California Institute of Technology 1990.
- Shi-Long Yang (*Engineering Science*) B.S., Hunan Normal University 1981; M.S., Hebei Normal University 1985; Ph.D., Peking University 1988.
- Piljin Yi (*Physics*) B.S., Seoul National University 1987.
- Chen Yuan (*Mechanical Engineering*) B.A., Wesleyan University 1989; B.S., California Institute of Technology 1989.
- Langche Zeng (*Social Science*) B.S., Chengdu University of Science and Technology 1982; M.A., Sichuan Institute of Finance and Economics 1985.

ENGINEER

- Thomas J. Kubr (*Aeronautics*) B.S.E., The University of Michigan 1987.

DOCTOR OF PHILOSOPHY

DIVISION OF BIOLOGY

- Lois Margaret Banta (*Biology*) B.A., The Johns Hopkins University 1983.
Thesis: Vacuolar Protein Sorting in Yeast: Characterization of Mutants and Identification of a Protein Required for Vacuole Biogenesis.
- Roberto Battiti (*Computation and Neural Systems*) Laurea in Fisica, Università degli Studi di Trento 1985.
Thesis: Multiscale Methods, Parallel Computation and Neural Networks for Real-Time Computer Vision.
- Kurt Andrew Brorson (*Molecular Biology*) B.A., The University of Chicago 1984.
Thesis: Analysis of Expression, Structure and Evolution of Non-Classical Class I Major Histocompatibility Complex Genes.
- George John Carman (*Biology*) A.B., Cornell University 1979.
Thesis: Mappings of the Cerebral Cortex.
- Lance Fors (*Biology*) A.B., University of California, Berkeley 1982.
Thesis: Analysis of the Structure, Expression and Evolution of the Shark Myelin Proteins and Genes.
- Peter Hiram Mathers (*Molecular Biology*) B.S., Brown University 1983.
Thesis: Developmental Regulation and Chromosomal Decondensation of the 68C Glue Gene Cluster in *Drosophila melanogaster*.
- Paul R. Mueller (*Biology*) L.S.B.S., The University of Wisconsin-Milwaukee 1982.
Thesis: *In Vivo* Analysis of Interactions Between Trans-Acting Factors and Their Target Genes.
- Thomas John Novak (*Biology*) B.A., Amherst College 1980.
Thesis: Isolation of the Murine Interleukin 2 Gene and Characterization of its Regulatory Architecture.
- Frank Preugschat (*Molecular Biology*) B.Sc., Simon Fraser University 1982.
Thesis: Proteolytic Processing of the Nonstructural Proteins of Dengue 2 Virus.
- Mani Ramaswami (*Biology*) M.S., Indian Institute of Technology, Delhi 1984.
Thesis: Molecular Genetic Studies on Voltage-Gated Ion Channels.
- Joanne Topol (*Biology*) A.B., Brown University 1977; M.S., The University of Michigan 1980.
Thesis: Transcriptional Control of the *Drosophila* Segmentation Gene *fushi tarazu*.

When more than one field of study is indicated, the first is the major and the second and others are minors.

DOCTOR OF PHILOSOPHY — *Continued*

DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

- Douglas D. Axe (*Chemical Engineering and Biology*) B.S., University of California, Berkeley 1984.
Thesis: Kinetics of RNA Polymerase β Subunit Synthesis and Acid Endproduct Transport in *Escherichia coli*.
- Claudia Jane Barner (*Chemistry*) B.S., California State University, Northridge 1981; M.A., University of Southern California 1983.
Thesis: Part I: Coordination Chemistry of High-Valent Osmium Polyanionic Chelating Ligand Complexes with Imine, Imido and Nitrido Ligands. Part II: Asymmetric Hydrogenation Using a Resolved Chiral Scandium Hydride Complex.
- Peter John Campo (*Chemical Engineering*) B.S., Rice University 1984.
Thesis: Studies in Robust Control of Systems Subject to Constraints.
- Enrique Geffroy Aguilar (*Chemical Engineering*) B.Sc., Universidad Nacional Autónoma de México 1981.
Thesis: Birefringence of Polymer Solutions in Time-Dependent Flows.
- Raymond Paul Goodrich, Jr. (*Chemistry*) B.S., The Ohio State University 1985.
Thesis: Modification of Membrane Surfaces with Carbohydrates: An Approach for Stabilization During Freezing and Drying.
- John Hampton Griffin (*Chemistry*) B.S., Hope College 1983.
Thesis: Structure-, Stereochemistry-, and Metal-Regulated DNA Binding/Cleaving Molecules.
- Linda C. Griffin (*Chemistry*) A.B., Hope College 1983; B.S., 1983.
Thesis: Oligonucleotide-Directed Cleavage of Single- and Double-Stranded DNA by Double and Triple Helix Formation.
- Christopher J. Guske (*Chemical Engineering*) B.S., University of California, Davis 1983.
Thesis: Metabolic Modeling of Growth and Poly-Beta-Hydroxybutyrate (PHB) Production in *Alcaligenes eutrophus* Hx16.
- James Edward Hanson (*Chemistry*) B.S., Texas Christian University 1984.
Thesis: I. Matrix Isolation of 1,1-Diazenes. II. Distance, Temperature, and Dynamic Solvent Effects on Electron Transfer Reactions.
- W. Reef Hardy (*Chemistry*) B.S., Creighton University 1981.
Thesis: The Characterization and Processing of the Nonstructural Proteins of Sindbis Virus.
- Erica Lyn Harvey (*Chemistry*) B.A., Wellesley College 1985.
Thesis: Photochemical Hydrogen Atom Transfer Reactions of Binuclear Platinum Complexes.
- Michael Joseph Heben (*Chemistry*) B.S., John Carroll University 1984; M.S., Stanford University 1988.
Thesis: Scanning Tunneling Microscopy in Electrochemical Environments.

DOCTOR OF PHILOSOPHY — *Continued*

- David A. Kaisaki (*Chemistry*) B.S., Loyola Marymount University 1984.
Thesis: Part I: 3,4-Diazabenzvalene, the Azoalkane Precursor to Tetrahedrane.
Part II: Magnetic Properties of Polaronic Polymers.
- Hway-Chuan Kang (*Chemical Engineering*) B.S., Yale University 1983.
Thesis: Model Studies of Adsorbate Ordering, Adsorption and Reaction Using Monte Carlo Simulations.
- Chaitan Khosla (*Chemical Engineering and Biology*) B.Tech., Indian Institute of Technology, Bombay 1985.
Thesis: *Vitreoscilla* Hemoglobin: Gene Structure and Regulation, Function, and Applications to Aerobic Bioprocesses.
- Warren Alden Kibbe (*Chemistry*) B.S., Michigan Technological University 1981.
Thesis: A Detailed Analysis of Transcriptional Regulators Affecting the *Saccharomyces cerevisiae* Heat-Shock Gene SSA1.
- John Adam Kramar (*Chemistry*) B.S., Abilene Christian University 1983.
Thesis: Scanning Tunneling Microscopy and Spectroscopy of Molybdenum Disulfide.
- Peter Mark Li (*Chemistry*) B.S., Yale University 1985.
Thesis: The Role of Cu_A in the Cytochrome *c* Oxidase Proton Pump.
- Eliana M. Makhlof (*Chemical Engineering*) B.A., Smith College 1982.
Thesis: Estimation of Absolute Permeability in Multilayered Petroleum Reservoirs with Two- and Three-Phase Flow.
- Donald David Montgomery (*Chemistry*) B.A., Grinnell College 1983.
Thesis: Part I. Influence of Membrane Morphology on Ion-Exchange and Charge Propagation in Composite Polyelectrolyte Electrode Coatings. Part II. Dynamic Surface Tension Measurements of Polarization Relaxation at Mercury Pool Electrodes by the Method of Wilhelmy.
- Charles Buddie Mullins (*Chemical Engineering*) B.S. (Physics), The University of Texas at Austin 1975; M.S. (Mechanical Engineering), 1977; B.S. (Chemical Engineering), the University of Tennessee 1982.
Thesis: Molecular Beam Investigations of Surface Chemical Reactions and Dynamics.
- Ricky Chiu-Yin Ng (*Chemical Engineering*) B.S., University of Houston 1983.
Thesis: Semi-Dilute Polymer Solutions in Strong Flows. Part I: Birefringence and Flow Modification in Extensional Flows. Part II: Chaotic Mixing in Time-Periodic Flows.
- Hung Viet Nguyen (*Chemical Engineering*) B.S., University of Rhode Island 1984.
Thesis: Powder Production in Aerosol Reactors: Particle Structure and Reactor Optimization.
- Steven Louis Novick (*Chemistry*) B.S., University of Central Florida 1985.
Thesis: Chemical Studies of Viral Entry Mechanisms: I. Hydrophobic Protein-Lipid Interactions During Sendai Virus Membrane Fusion. II. Kinetics of Bacteriophage λ DNA Injection.
- David Haynes Semmes (*Chemistry*) B.S., Georgia Institute of Technology 1983.
Thesis: Picosecond Studies of the Vibrational Predissociation of van der Waals Complexes.

DOCTOR OF PHILOSOPHY—Continued

Anthony Skjellum (*Chemical Engineering and Computer Science*) B.S., California Institute of Technology 1984; M.S., 1985.

Thesis: Concurrent Dynamic Simulation: Multicomputer Algorithms Research Applied to Differential-Algebraic Process Systems in Chemical Engineering.

Yongkui Sun (*Chemistry*) B.S., Xiamen University 1982.

Thesis: Kinetic Investigations of Heterogeneously Catalyzed Reactions on the Ru(001) and Pt(110)-(1x2) Surfaces.

Robert J. Sweeney (*Chemistry*) B.S., Worcester Polytechnic Institute 1985.

Thesis: Hydrogen-Atom Transfer Photochemistry of Tetrakis(μ -Pyrophosphito) diplatinate(II).

James E. Toth (*Chemistry*) B.S., Haverford College 1981; M.S., Rutgers University 1984.

Thesis: Electrocatalytic Activity of Transition Metal Substituted Heteropolytungstates.

Christopher J. Webb (*Chemical Engineering*) B.S., University of Arizona 1983.

Thesis: Robust Control Strategies for a Fixed Bed Chemical Reactor.

David Roger Wheeler (*Chemistry*) S.B., Massachusetts Institute of Technology 1985.

Thesis: Mechanism and Applications of the Photochemistry of Bis(η^5 -cyclopentadienyl)titanacyclobutanes.

J. Kenneth Wolfenbarger (*Chemical Engineering*) B.S., Oregon State University 1985.

Thesis: Aerosol Data Inversion: Optimal Solutions and Information Content.

Ernest Byron Wyson (*Chemistry*) B.S., University of Central Florida 1985.

Thesis: Investigations of Group IVA Transition Metal Mediated Carbon-Carbon Bond Forming Reactions.

Fangdong Yin (*Chemical Engineering*) B.S., Peking University 1982; M.S., 1985.

Thesis: Atmospheric Photooxidation of Organosulfur Compounds.

Thomas Edward Zewert (*Chemistry*) B.S., Yale University 1987; M.S., 1987.

Thesis: Electron Transfer in Chemically and Genetically Modified Myoglobins.

DIVISION OF ENGINEERING AND APPLIED SCIENCE

Marie-Agnès Allard (*Civil Engineering and Geophysics*) Diplôme d'Ingénieur, Ecole Spéciale des Travaux publics, du Bâtiment et de l'Industrie 1982; M.S., California Institute of Technology 1983.

Thesis: Soil Stress Field Around Driven Piles.

Gary John Balas (*Aeronautics*) B.S., University of California, Irvine 1982; M.S., 1983.

Thesis: Robust Control of Flexible Structures: Theory and Experiments.

DOCTOR OF PHILOSOPHY — *Continued*

- John Spencer Baskin (*Applied Physics*) B.S., Georgia Institute of Technology 1976; M.S., 1983.
Thesis: Real-Time Observation and Analysis of Coherence and Alignment in Molecular Systems: Isolated Molecules and Chemical Reactions.
- David Jones Brady (*Applied Physics*) B.A., Macalester College 1983.
Thesis: Photorefractive Volume Holography in Artificial Neural Networks.
- Lynda Catherine Brinson (*Applied Mechanics*) B.S., Virginia Polytechnic Institute and State University 1985.
Thesis: Time-Temperature Response of Multi-Phase Viscoelastic Solids Through Numerical Analysis.
- Roberto Alfredo Camassa (*Engineering Science and Applied Mathematics*) Laurea in Fisica, Università degli Studi Milano 1982; M.S., California Institute of Technology 1985.
Thesis: Part I: Forced Generation and Stability of Solitary Waves. Part II: Chaotic Advection in a Rayleigh-Bénard Flow.
- Steven Louis Ceccio (*Mechanical Engineering*) B.S.E., The University of Michigan 1985.
Thesis: Observations of the Dynamics and Acoustics of Travelling Bubble Cavitation.
- Howard ZeHua Chen (*Applied Physics*) B.S., California Institute of Technology 1984.
Thesis: GaAs/Al_xGa_{1-x}As Quantum Well Lasers Grown on GaAs and Si by Molecular Beam Epitaxy.
- Kiat Chua (*Aeronautics*) B.E.Sc., University of Western Ontario 1984; M.S., California Institute of Technology 1985.
Thesis: Vortex Simulation of Separated Flows in Two and Three Dimensions.
- Xiaomin Deng (*Applied Mechanics and Materials Science*) B.S., Beijing Institute of Aeronautics and Astronautics 1982; M.S., California Institute of Technology 1985.
Thesis: Dynamic Crack Propagation in Elastic-Plastic Solids.
- Zinnur Doğanata (*Electrical Engineering*) B.S., Middle East Technical University 1981; M.S., 1984; M.S., California Institute of Technology 1985.
Thesis: General Structural Representations for Multi-Input, Multi-Output Discrete-Time FIR and IIR Lossless Systems.
- Thomas Frank Fric (*Aeronautics*) B.S., Cornell University 1984; M.S., California Institute of Technology 1985.
Thesis: Structure in the Near Field of the Transverse Jet.
- David Benjamin Goldstein (*Aeronautics and Planetary Science*) B.S.E., Princeton University 1984; M.S., California Institute of Technology 1985.
Thesis: Investigations of a Discrete Velocity Gas.
- Catherine Kent Hayes (*Applied Mathematics*) B.S., California Institute of Technology 1985.
Thesis: Diffusion and Stress Driven Flow in Polymers.

DOCTOR OF PHILOSOPHY — *Continued*

- Lynn Mary Hildemann (*Environmental Engineering Science and Chemical Engineering*) B.S., California Institute of Technology 1980; M.S., 1983.
Thesis: A Study of the Origin of Atmospheric Organic Aerosols.
- Zhikun Hou (*Applied Mechanics*) M.S., Tongji University 1982; M.S., California Institute of Technology 1985.
Thesis: Nonstationary Response of Structures and Its Application to Earthquake Engineering.
- Ken Yuh Hsu (*Electrical Engineering*) B.S., National Chiao Tung University 1973; M.S., 1975; M.S., California Institute of Technology 1985.
Thesis: Optical Neural Computing for Associative Memories.
- Kayo Ide (*Aeronautics*) B.Sc., Nagoya University 1984.
Thesis: Regular and Chaotic Motion of Uniform Elliptical Vortices in External Linear Time Dependent Velocity Fields.
- Craig C. Jahnke (*Aeronautics*) B.S.M.E., Milwaukee School of Engineering 1984; M.S., California Institute of Technology 1985.
Thesis: Application of Dynamical Systems Theory to Nonlinear Aircraft Dynamics.
- Hector A. Jensen (*Applied Mechanics*) Ingeniero Civil Matemático, Universidad de Chile 1981.
Thesis: Dynamic Response of Structures with Uncertain Parameters.
- Qing Jiang (*Applied Mechanics*) B.Sc., Huazhong University of Science and Technology 1982; M.Sc., 1984.
Thesis: A Continuum Model for Phase Transformation in Thermoelastic Solids.
- Devendra Kalra (*Computer Science*) B.Tech., Indian Institute of Technology, Delhi 1984.
Thesis: A Unified Framework for Constraint-Based Modeling.
- Davut Kavranoglu (*Electrical Engineering*) B.S., Technical University of Istanbul 1984.
Thesis: Elementary Solutions for the H_∞ -General Distance Problem-Equivalence of H_2 and H_∞ Optimization Problems.
- Gregor Kovačič (*Applied Mathematics*) B.S. (Physics), Univerza 'Edvarda Kardelja' V Ljubljani 1985; B.S. (Mathematics), 1986.
Thesis: Chaos in a Model of the Forced and Damped Sine-Gordon Equation.
- John Lazzaro (*Computer Science*) B.S., University of Pennsylvania 1984; M.S., 1984.
Thesis: Silicon Models of Early Audition.
- Marie-Bernard P. Levine (*Civil Engineering*) Ingénieur du Bâtiment, Ecole Spéciale des Travaux publics, du Bâtiment et de l'Industrie 1981; M.S., California Institute of Technology 1982.
Thesis: Accelerogram Processing Using Reliability Bounds and Optimal Correction Methods.

DOCTOR OF PHILOSOPHY — *Continued*

- Vincent Cheng-Teh Liu (*Electrical Engineering*) B.E., State University of New York at Stony Brook 1984; M.S., California Institute of Technology 1985.
Thesis: One and Two Dimensional Digital Multirate Systems with Applications in Sub-Sampling and Bandlimited Signal Reconstruction.
- Giancarlo Umberto Maria Losi (*Aeronautics*) Laurea in Ingegneria Aeronautica, Politecnico di Torino 1983; M.S., California Institute of Technology 1985.
Thesis: Nonlinear Thermoviscoelastic Behavior of Polymers.
- Anamitra Makur (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Kharagpur 1985.
Thesis: Low Rate Image Coding Using Vector Quantization.
- Robert Iain McLachlan (*Applied Mathematics*) B.Sc., Canterbury University 1984.
Thesis: Separated Viscous Flows via Multigrid.
- David Glenn Mehuys (*Electrical Engineering*) B.A.Sc., University of Toronto 1984; M.S., California Institute of Technology 1985.
Thesis: Linear, Nonlinear, and Tunable Guided Wave Modes for High-Power (GaAl)As Semiconductor Lasers.
- Anne Chantal Marie Morlet (*Applied Mathematics*) Diploma, École Centrale de Lyon 1986; D.E.A., Université Lyon I 1986.
Thesis: Part I. Numerical Experiments for the Computation of Invariant Curves in Dynamical Systems. Part II. Numerical Convergence Results for a One Dimensional Stefan Problem.
- Kit Yin Ng (*Environmental Engineering Science*) B.Sc., University of Hong Kong 1983; M.S., California Institute of Technology 1984.
Thesis: Thermal Plumes from Staged Multiport Diffusers in Uniform Quiescent Environment.
- Shouleh Nikzad (*Applied Physics*) B.S., University of Southern California 1982; M.S., California Institute of Technology 1984.
Thesis: A Study of Ion Beam Sputtering of Compound Materials with Laser Spectroscopy.
- Ivan M. Onyszchuk (*Electrical Engineering*) B.A., University of Waterloo 1985; M.A., 1986.
Thesis: On the Performance of Convolutional Codes.
- Cheol Hoon Park (*Electrical Engineering*) B.S., Seoul National University 1984; M.S., California Institute of Technology 1985.
Thesis: Optical Computing and Higher Order Associative Memories.
- Joel S. Paslaski (*Applied Physics*) B.S., California Institute of Technology 1982; M.S., 1983.
Thesis: High Speed Optoelectronics: Photodiodes, Q-Switched Laser Diode and Photoconductive Sampling.

DOCTOR OF PHILOSOPHY—*Continued*

Francois Pépin (*Aeronautics and Planetary Science*) B.Ing., École Polytechnique de Montreal 1984; M.S., California Institute of Technology 1985.

Thesis: Simulation of the Flow Past an Impulsively Started Cylinder Using a Discrete Vortex Method.

Zorana Popovic (*Electrical Engineering*) B.Sc., University of Belgrade 1985.
Thesis: Grid-Oscillators.

Nabeel Agha Riza (*Electrical Engineering*) B.S., Illinois Institute of Technology 1984; M.S., California Institute of Technology 1985.

Thesis: Novel Acousto-Optic Systems for Spectrum Analysis and Phased Array Radar Signal Processing.

Koichi Sayano (*Applied Physics*) B.S., California Institute of Technology 1985.

Thesis: Photorefractive Properties of Ferroelectric Materials for Optical Phase Conjugation, Two-Beam Coupling, and Holographic Storage.

Rachel E. Shinn-Mendoza (*Applied Mathematics*) B.S., California Polytechnic State University 1985.

Thesis: Shocks and Instabilities in Traffic.

Kumar N. Sivarajan (*Electrical Engineering*) B.S., Indian Institute of Technology, Madras 1987; M.S., California Institute of Technology 1988.

Thesis: Spectrum Efficient Frequency Assignment for Cellular Radio.

Gregory Todd Smedley (*Aeronautics*) B.Sc., University of Alberta 1983; M.S., California Institute of Technology 1984.

Thesis: A Study of Immiscible Liquids, Liquid Behavior at Zero Gravity and Dynamic Contact Lines and Angles.

Roy S. R. Smith (*Electrical Engineering*) B.E., University of Canterbury 1980; M.E., 1981.

Thesis: Model Validation for Uncertain Systems.

Wen-King Su (*Computer Science*) B.S., University of California, Davis 1982; M.S., California Institute of Technology 1984.

Thesis: Reactive-Process Programming and Distributed Discrete-Event Simulation.

Phalkun Tan (*Civil Engineering*) B.Ing., École Polytechnique de Montreal 1980; M.Sc.A., 1982.

Thesis: Numerical Simulations of Two-Dimensional Saturated Granular Media.

Michelle Hsiao Tsing Teng (*Engineering Science*) B.S., Tsinghua University 1985.

Thesis: Forced Emissions of Nonlinear Water Waves in Channels of Arbitrary Shape.

Ravi Shanker Thyagarajan (*Applied Mechanics*) B.Tech., Indian Institute of Technology, Madras 1984; M.S., California Institute of Technology 1985.

Thesis: Modeling and Analysis of Hysteretic Structural Behavior.

Hoanh Xuan Vu (*Applied Physics*) B.S., University of California, Los Angeles 1985.

Thesis: Plasma Collection by an Obstacle.

DOCTOR OF PHILOSOPHY — *Continued*

- Peter David Washabaugh (*Aeronautics*) B.S., The University of Michigan 1983;
M.S., California Institute of Technology 1984.
Thesis: An Experimental Investigation of Mode-I Crack Tip Deformation.
- Kristin Lee Wood (*Mechanical Engineering*) B.S., Colorado State University 1985.
Thesis: A Method for the Representation and Manipulation of Uncertainties in Preliminary Engineering Design.
- Fulin Xiong (*Applied Physics*) B.S., Chengdu College of Geology 1978; M.S., University of California, Los Angeles 1984.
Thesis: Characterization and Application of MeV Ion Implanted Layers in III-V Compound Semiconductors.
- Harold Aaron Zarem (*Applied Physics*) A.B., University of California, Berkeley 1984.
Thesis: Investigations of Quantum Wires, Carrier Diffusion Lengths, and Carrier Lifetimes in GaAs/AlGaAs Heterostructures.
- Mei Zhuang (*Aeronautics*) M.S., Beijing Institute of Aeronautics and Astronautics 1984.
Thesis: An Investigation of the Inviscid Spatial Instability of Compressible Mixing Layers.
- George Allan Zimmerman (*Electrical Engineering*) B.S., Stanford University 1985; M.S., California Institute of Technology 1988.
Thesis: Applications of Frequency Modulation Interference Cancellers to Multiaccess Communications Systems.

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

- William Wyatt Anderson (*Planetary Science and Geophysics*) B.A., David Lipscomb College 1981; M.S., Vanderbilt University 1984; M.S., California Institute of Technology 1988.
Thesis: High Pressure States in Condensed Matter: I. High Pressure Behavior of the Iron-Sulfur System with Applications to the Earth's Core. II. Empirical Equation of State for Organic Compounds at High Pressures.
- Allison Lyn Bent (*Geophysics*) B.Sc., Dalhousie University 1985.
Thesis: Source Characteristics of Recent and Historic Earthquakes in Central and Southern California: Results from Forward Modeling.
- Joel David Blum (*Geochemistry*) B.A., Case Western Reserve University 1981; M.S., University of Alaska, Fairbanks 1982.
Thesis: Geochemistry and Resonance Ionization of Platinum-Group Elements.
- Cheryl A. Brigham (*Geochemistry*) B.S., Purdue University 1983.
Thesis: Isotopic Heterogeneity in Calcium-Aluminum-Rich Meteoritic Inclusions.

DOCTOR OF PHILOSOPHY — *Continued*

- John Huw Davies (*Geophysics*) B.A., University of Cambridge 1983; M.S., California Institute of Technology 1988.
Thesis: Some Problems in Mantle Structure and Dynamics. Part 1: Inversion for the Depth Variation of Spectra of Mantle Compressional and Shear Velocity Heterogeneity. Part 2: Physical Model of Source Region of Subduction Zone Volcanism.
- Arie William Grossman (*Planetary Science and Electrical Engineering*) B.A., University of California, Berkeley 1984.
Thesis: Microwave Imaging of Saturn's Deep Atmosphere and Rings.
- Ólafur Guðmundsson (*Geophysics*) B.Sc., University of Iceland 1980; M.S., University of Washington 1984.
Thesis: Some Problems in Global Tomography: Modeling the Core-Mantle Boundary and Statistical Analysis of Travel-Time Data.
- Louise Victoria LeFevre (*Geophysics*) B.A., State University College at Brockport 1980; M.S., California Institute of Technology 1983.
Thesis: I. Seismotectonics of the Middle America Subduction Zone. II. Lithosphere and Upper Mantle Structure of the Canadian Shield and Eastern North America.
- Wei Liu (*Geology*) B.S., Changchun Geological Institute 1982.
Thesis: Paleomagnetism of Miocene Sedimentary Rocks in the Transverse Ranges: The Implications for Tectonic History.
- Harold William Magistrale (*Geophysics*) B.S., University of California, Santa Cruz 1979.
Thesis: I. The Superstition Hills, California, Earthquakes of 24 November 1987. II. Three-Dimensional Velocity Structure of Southern California.
- Gregory Hale Miller (*Geochemistry and Chemistry*) B.S., Purdue University 1983.
Thesis: The Equation of State and Petrogenesis of Komatiite.
- Robert Lowell Ripperdan (*Geology*) B.S., The University of Iowa 1983; M.S., California Institute of Technology 1985.
Thesis: Magnetostratigraphic Investigations of the Lower Paleozoic System Boundaries, and Associated Paleogeographic Implications.
- Richard J. Stead (*Geophysics*) B.S., Lehigh University 1982; M.S., California Institute of Technology 1983.
Thesis: Finite Differences and a Coupled Analytic Technique with Applications to Explosions and Earthquakes.
- Hua-Wei Zhou (*Geophysics*) B.S., Xi'an Jiao Tong University 1982; M.S., Shanghai Jiao Tong University 1984.
Thesis: Travel Time Tomographic Studies of Seismic Structures Around Subducted Lithospheric Slabs.

DOCTOR OF PHILOSOPHY — *Continued*

DIVISION OF HUMANITIES AND SOCIAL SCIENCES

Kemal Güler (*Social Science*) B.A., Bogazici University 1981; M.S., Baylor University 1983.

Thesis: Pre-Auction Investment and Equivalence of Auctions.

Guofu Tan (*Social Science*) B.S., Mining College of China 1982; M.S., Huazhong Institute of Technology 1985.

Thesis: Optimal Procurement and Contracting with Research and Development.

DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

Mark Adler (*Physics*) B.A., University of Florida 1981; M.S., 1985.

Thesis: The Persistence of Charm in the Relentless Decay of Beauty.

Daniel Abram Ashlock (*Mathematics*) B.S. (Mathematics), University of Kansas 1984; B.S. (Computer Science), 1984.

Thesis: A Theory of Permutation Polynomials Using Compositional Attractors.

Kent Grimmett Budge (*Astronomy*) B.S., Brigham Young University 1985.

Thesis: A Non-LTE Analysis of a Sample of O Stars Selected from Galactic OB Associations.

Blaise J. Canzian (*Astronomy*) B.A., Cornell University 1984.

Thesis: Molecular Gas and Star Formation in the Central Regions of Virgo Spiral Galaxies.

Carlo Carraro (*Physics*) Laurea in Fisica, Università degli Studi di Padova 1984.

Thesis: A Path Integral Monte Carlo Method for the Quasielastic Response.

Chi-Bin Chien (*Physics*) B.A., The Johns Hopkins University 1981; M.S., California Institute of Technology 1984.

Thesis: Voltage-Sensitive Dye Recording from Networks of Cultured Neurons.

Don Frederic DeJongh (*Physics*) B.S., The Ohio State University 1983.

Thesis: Resonant Substructure in $\bar{K}\pi\pi$ Decays of D Mesons.

Olivier R. Espinosa (*Physics*) Licenciado, Universidad Tecnica Federico Santa Maria 1984; M.S., 1985.

Thesis: Non-Conservation of Baryon Number at High Energy in the Standard Model.

Jiyu Feng (*Physics*) B.S., Tsinghua University 1982.

Thesis: Some Aspects of Open String Field Theories.

Brian Kurt Fujikawa (*Physics*) B.S., University of Hawaii-Manoa 1981.

Thesis: A Search for $\bar{\nu}_e$ Appearance from Stopped π^+ and μ^+ Decay at LAMPE.

Claire Xiang-Guang Gu (*Physics*) B.S., Fudan University 1985.

Thesis: Optical Neural Networks Using Volume Holograms.

DOCTOR OF PHILOSOPHY—*Continued*

- Arun K. Gupta (*Physics*) B.Tech., Indian Institute of Technology, Madras 1984.
Thesis: Quantum Aspects of Gravity.
- Philip Charles Haubert (*Physics*) B.S., Michigan State University 1983.
Thesis: Heavy Ion Rutherford Backscattering with a Time of Flight Detector System.
- Michael Eugene Hoenk (*Physics*) B.S. (Physics), The University of Iowa 1984;
B.S. (Mathematics), 1984.
Thesis: Orientation Selective Effects in III-V Heterostructure Systems with Application to Nanostructure Fabrication.
- David Allen Imel (*Physics*) B.S., University of Washington 1985.
Thesis: High Density Noble Gas Detectors and Search for Massive Neutrinos in the β -Decay of ^{33}S .
- George Kafkoulis (*Mathematics*) B.S., University of Athens 1984.
Thesis: Homogeneous Sequences of Cardinals for Ordinal Definable Partition Relations.
- Zhaoping Li (*Physics*) B.S., Fudan University 1984.
Thesis: A Model of the Olfactory Bulb and Beyond.
- Kay Magaard (*Mathematics*) B.S., University of Hawaii-Manoa 1982; Diplom, Rheinische Friedrich-Wilhelms-Universität Bonn 1986.
Thesis: The Maximal Subgroups of the Chevalley Groups $F_4(F)$, Where F is a Finite or Algebraically Closed Field of Characteristic $\neq 2, 3$.
- Michael Coleman Miller (*Physics and Computer Science*) B.S., Hillsdale College 1984.
Thesis: Radiation Transfer in Very Strong Magnetic Fields.
- Steven T. Myers (*Astronomy*) B.S., The University of Iowa 1984.
Thesis: A Search for Anisotropy in the Cosmic Microwave Background on Angular Scales of 1 to 30 Arcminutes.
- Martin John Savage (*Physics*) B.Sc., Auckland University 1984; M.Sc., 1985.
Thesis: Flavor $SU(3)$ Predictions for Charmed Baryon and B-Meson Decays.
- Stephen James Spicklemire (*Physics*) B.S., Rose-Hulman Institute of Technology 1984.
Thesis: Isotopic Fractionation in Sputtering.
- Charles Colville Steidel (*Astronomy*) A.B., Princeton University 1984.
Thesis: Spectroscopic Observations of High Redshift QSOs: Galaxies and the Intergalactic Medium at Early Epochs.
- Sandip Parimal Trivedi (*Physics*) M.S., Indian Institute of Technology, Kanpur 1985.
Thesis: Topics in Quantum Gravity.

DOCTOR OF PHILOSOPHY — *Continued*

Carlos Enrique Uzcátegui Aylwin (*Mathematics*) Licenciatura, Universidad de Los Andes 1983; M.S., Instituto Venezolano de Investigaciones Científicas, 1985.

Thesis: Smooth Sets for Borel Equivalence Relations and the Covering Property for σ -Ideals of Compact Sets.

David Allan Wasson (*Physics*) B.S., University of Maryland at College Park 1983.
Thesis: Relativistic Mean Field Theory: Methods and Applications.

Andrew James Weir (*Physics*) B.A., Oxford University 1983; M.S., California Institute of Technology 1985.

Thesis: A Measurement of B^0 - \bar{B}^0 Mixing in e^+e^- Annihilation at 29 GeV.

Christine Diana Wilson (*Astronomy*) B.Sc., University of Toronto 1984.

Thesis: Star Formation and the Interstellar Medium in M33.

Dolly Yu-ting Wu (*Physics*) A.B., Columbia University 1983; M.S., California Institute of Technology 1985.

Thesis: Radiative Tau Production and Decay.

Xiao-He Zhang (*Physics*) B.S., Zhejiang University 1982.

Thesis: Multipole Moments in General Relativity and Dynamical Perturbations of Black-Hole Magnetospheres.

Prizes and Awards

FREDERIC W. HINRICHS, JR., MEMORIAL AWARD

Awarded to the senior who, in the opinion of the undergraduate Deans, has made the greatest undergraduate contribution to the welfare of the student body and whose qualities of leadership, character, and responsibility have been outstanding.

Recipient to be announced at Commencement.

THE MILTON AND FRANCIS CLAUSER DOCTORAL PRIZE

Awarded to the Ph.D. candidate whose research is judged to exhibit the greatest degree of originality as evidenced by its potential for opening up new avenues of human thought and endeavor as well as by the ingenuity with which it has been carried out.

Recipient to be announced at Commencement.

THE WILLIAM F. BALLHAUS PRIZE

Awarded to aeronautics students for outstanding doctoral dissertations.

Craig C. Jahnke

FRITZ B. BURNS PRIZE IN GEOLOGY

Awarded to a junior or senior who has demonstrated academic excellence and the greatest promise of future contributions in the fields represented by the Division of Geological and Planetary Sciences.

Colin D. Howell

CALTECH PRIZE SCHOLARSHIPS AND CARNATION SCHOLARSHIPS

Each year Caltech awards these prizes for academic excellence. They are based solely on merit (selection is made on the basis of grades, faculty recommendations, and demonstrated research productivity) with no consideration given to need or any other nonacademic criteria. Listed below are graduating seniors who have been recipients of these prizes.

<i>Syed Z. Ahmad</i>	<i>Maneesh Jain</i>	<i>Aditya Prakash</i>
<i>Sandip Biswal</i>	<i>Anders R. Johnson</i>	<i>Edward Ratner</i>
<i>William P. Cross</i>	<i>Sean L. Johnston</i>	<i>Michael M. Smyth</i>
<i>David A. Edwards</i>	<i>Michael C. Jones</i>	<i>Craig A. Sosin</i>
<i>Charles Chien-Wen Fu</i>	<i>Amit Lal</i>	<i>Glenn P. Tesler</i>
<i>Eric T. Fung</i>	<i>Angela Tsai-Ling Lee</i>	<i>Ki Ching Wong</i>
<i>Amanda A. Heaton</i>	<i>Thomas J. Lenosky</i>	<i>Harold R. Zatz</i>
<i>Li Wen Ho</i>	<i>Kate E. Loomis</i>	<i>Xiaolei Zhu</i>
<i>Colin D. Howell</i>	<i>Aris Moustakas</i>	

Prizes and awards are listed only for those students awarded degrees in 1990, and include prizes and awards received by them in previous years.

PRIZES AND AWARDS — *Continued*

RICHARD BRUCE CHAPMAN MEMORIAL AWARD

Awarded to a graduate student in hydrodynamics who has distinguished himself or herself in research in the Division of Engineering and Applied Science.

Roberto A. Camassa

DONALD S. CLARK MEMORIAL AWARDS

May be awarded to a sophomore and a junior in recognition of service to the campus community and good academic performance. Preference is given to students in the Division of Engineering and Applied Science and to those in Chemical Engineering.

1989 Dwight E. Berg; Kate E. Loomis

DEANS' CUP AND MASTERS' CUP

Two awards, selected by the Deans and Masters respectively, presented to undergraduates whose concern for their fellow students has been demonstrated by persistent efforts to improve the quality of undergraduate life and by effective communication with members of the faculty and administration.

Mark P. Fey, Deans' Cup

David A. Edwards, Masters' Cup

LAWRENCE L. AND AUDREY W. FERGUSON PRIZE

Awarded to the graduating Ph.D. candidate in biology who has produced the outstanding Ph.D. thesis for the past year.

Paul R. Mueller

HAREN LEE FISHER MEMORIAL AWARD IN JUNIOR PHYSICS

Awarded to a junior physics major who demonstrates the greatest promise of future contributions in physics.

1989 Thomas J. Lenosky

HENRY FORD II SCHOLAR AWARD

Awarded either to the engineering student with the best academic record at the end of the third year of undergraduate study, or to the engineering student with the best first-year record in the graduate program.

1989 Maneesh Jain

JACK E. FROEHLICH MEMORIAL AWARD

Awarded to a junior in the upper five percent of his or her class who shows outstanding promise for a creative professional career.

1989 Michael C. Jones; Edward Ratner

PRIZES AND AWARDS—*Continued*

GEORGE W. GREEN MEMORIAL PRIZE

Awarded to the undergraduate student who, in the opinion of the division chairmen, has shown outstanding ability and achievement in creative scholarship.

Aris Moustakas

ARIE J. HAAGEN-SMIT MEMORIAL AWARD

Awarded to a sophomore or junior in biology or chemistry who has shown academic promise and who has made recognized contributions to Caltech.

1989 *Eric T. Fung*

ARTUR MAGER PRIZE IN ENGINEERING

Awarded to a senior in engineering who has shown excellence in scholarship and the promise of an outstanding professional career.

Anders R. Johnson

MARY A. EARL McKINNEY PRIZE IN LITERATURE

The purpose of this prize is to cultivate proficiency in writing. It may be awarded for essays submitted in connection with regular literature classes or awarded on the basis of a special essay contest.

1988 *M. Alex Santoso*

1990 *Chandra L. Tucker*

ROBERT L. NOLAND LEADERSHIP SCHOLARSHIP

Awarded to students who exhibit qualities of outstanding leadership, which are most often expressed as personal actions that have helped other people and that have inspired others to fulfill their capabilities.

1989 *Jerrold V. Hauck*

1990 *Clifton J. Kiser; Richard R. Reid*

THE RODMAN W. PAUL HISTORY PRIZE

Awarded to a graduating senior who has displayed unusual interest in and talent for history.

Eric T. Fung

HERBERT J. RYSER MEMORIAL SCHOLARSHIPS

Awarded to undergraduate students for academic excellence, preferably in mathematics.

1988 *Glenn P. Tesler*

1989 *Li Wen Ho*

PRIZES AND AWARDS—*Continued*

RICHARD P. SCHUSTER MEMORIAL PRIZE

Awarded to one or more juniors or seniors in chemistry or chemical engineering on the basis of financial need and academic promise.

Michael C. Jones

ERNEST E. SECHLER MEMORIAL AWARD IN AERONAUTICS

Awarded to an aeronautics student who has made the most significant contribution to the teaching and research efforts of GALT (Graduate Aeronautical Laboratories of the California Institute of Technology). Preference is given to students working in structural mechanics.

1988 Peter D. Washabaugh

DON SHEPARD AWARD

Awarded to students who would find it difficult, without additional financial help, to engage in extracurricular and cultural activities. The recipients are selected on the basis of their capacity to take advantage of and to profit from these activities rather than on the basis of their scholastic standing.

1987 Dolly Chu

1989 Faress H. Rahman

1990 Angela Tsai-Ling Lee

SIGMA XI AWARD

Awarded to a senior selected for an outstanding piece of original scientific research.

Thomas J. Lenosky

JOHN STAGER STEMPLE MEMORIAL PRIZE IN PHYSICS

Awarded to a graduate student in physics for outstanding progress in research as demonstrated by an excellent performance on the oral Ph.D. candidacy examination.

1987 Stephen J. Spicklemire

1988 Sandip P. Trivedi

CIT ALMA MATER

by Manton Barnes (BS '21 EE)

*In southern California with grace and splendor bound,
Where the lofty mountain peaks look out to lands beyond,
Proudly stands our Alma Mater, glorious to see;
We raise our voices proudly, hailing, hailing thee.
Echoes ringing while we're singing over land and sea,
The halls of fame resound thy name, noble CIT.*