



*Ninety-Third
Annual Commencement
June 12, 1987*

CALIFORNIA INSTITUTE OF TECHNOLOGY

Ninety-Third
Annual
Commencement

FRIDAY MORNING AT TEN O'CLOCK
JUNE TWELFTH, NINETEEN EIGHTY-SEVEN

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 masters, the doctors 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 boys and choir girls 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, Jenijoy La Belle, Ph.D.

Assistant Marshals

Christopher E. Brennen, Ph.D.

Robert W. Oliver, Ph.D.

Gary A. Lorden, Ph.D.

Ward Whaling, Ph.D.

David S. Wood, Ph.D.

Faculty Officers

B. Vincent McKoy, Ph.D.

Eleanor M. Searle, Ph.D., D.M.S.

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 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

ORGAN PRELUDE Leslie J. Deutsch, Ph.D.

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

INVOCATION Rabbi Leonard I. Beerman
Leo Baeck Temple

COMMENCEMENT ADDRESS
"New Wine in Old Bottles: Can We Cope with Our Own Success?"
David A. Hamburg, M.D.
President, Carnegie Corporation

MUSICAL SELECTION The Caltech Glee Clubs
Donald G. Caldwell, D.M.A., Conductor
"Hallelujah" from *Messiah*
George Frederick Handel

CONFERRING OF DEGREES . . Marvin L. Goldberger, Ph.D., D.H.L.
President
California Institute of Technology

PRESENTATION OF CANDIDATES FOR DEGREES

For the Degree of Bachelor of Science . . . Gary A. Lorden, Ph.D.
Dean of Students

For the Degree of Master of Science . . . Stirling L. Huntley, Ph.D.
Associate Dean of Graduate Studies

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

Biology . . . Charles J. Brokaw, Ph.D.
Executive Officer for Biology

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

Engineering and Applied Science . . . Paul C. Jennings, Ph.D.
Division Chairman

Geological and Planetary Sciences . . . Gerald J. Wasserburg, Ph.D.
Division Chairman

Humanities and Social Sciences . . . Louis L. Wilde, Ph.D.
Executive Officer for the Social Sciences

Physics, Mathematics and Astronomy . . . Edward C. Stone, Jr., Ph.D.
Division Chairman

CONCLUDING REMARKS . . . President Goldberger

BENEDICTION . . . Rabbi Beerman

RECESSIONAL . . . The Caltech Wind Ensemble Brass and Organ

ORGAN POSTLUDE . . . Dr. Deutsch

Candidates for Degrees

BACHELOR OF SCIENCE

- Darin Edward Acosta *Arroyo Grande, California* Physics
Thomas Lytell Aldcroft* *Long Beach, California* Physics
Jens Peter Alfke *Los Altos Hills, California* Engineering and Applied Science
Timothy Peter Allen* *Palos Verdes Estates, California* Electrical Engineering
Michael Benjamin Allweiss *West Bloomfield, Michigan* Applied Physics
Michael Nishioka Ando* *Torrance, California* Engineering and Applied Science
Christopher Assad* *Town of Tonawanda, New York* Electrical Engineering
Farid Ghassem Bassiri* *Tehran, Iran* Engineering and Applied Science
John Thomas Beck *Orange, California* Engineering and Applied Science
John Alexander Becker* *Indiana, Pennsylvania* Physics
James Francis Bell III *Coventry, Rhode Island* Geophysics and Engineering and Applied Science
Vineer Bhansali* *Jodhpur, Rajasthan, India* Physics
Maya Binun *Minsk, USSR* Chemical Engineering
Gary Robert Bloomberg *Michigan City, Indiana* Engineering and Applied Science
Anselm Ulrich Matthias Blume *Seymour, Connecticut* Applied Physics and Engineering and Applied Science
Janet Lynn Boley *Arcadia, California* Geophysics
Daniel Shenon Briggs *Mill Valley, California* Physics
Jonathan Eric Brown *Murrieta, California* Electrical Engineering
Randy Brown* *Iowa City, Iowa* Electrical Engineering
Brian Taylor Brunn* *St. Paul, Minnesota* Electrical Engineering
Clea Bures *Victoria, B.C., Canada* Applied Physics
Michael Christopher Burl* *Ovid, Michigan* Electrical Engineering and Applied Mathematics
Brett Charles Bush* *Pacific Palisades, California* Physics
Mark Andrew Carlin* *Carmel, Indiana* Applied Physics
Francisco Javier Castellero Lizán *Panama City, Republic of Panama* Electrical Engineering
Hwai Wen Chang *St. Louis, Missouri* Chemistry and Biology
George J. Chen* *Rancho Palos Verdes, California* Electrical Engineering
Peter L. Cho* *Woodland Hills, California* Physics
Cora Y. Chow *Cypress, California* Electrical Engineering
Ronson Yiu-yuen Chu* *Sacramento, California* Physics

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*

Bret Thomas Clark *Wilton, Connecticut* Electrical Engineering
Olivier Steven Cojot-Goldberg* *Washington, D.C.* Electrical Engineering
Matthew Richard Compton *Ridgecrest, California* Engineering and Applied Science
Christie Ann Cooper *Hudson, Florida* Engineering and Applied Science
David Matthew Crandall *Torrance, California* Applied Physics
William Arthur Craven* *Irvine, California* Physics
Bena Louise Currin* *Daytona Beach, Florida* Engineering and Applied Science
William Douglas Cutrell* *Kermit, Texas* Mathematics and Biology
Michael Francis DeFreitas* *Edgewood, New Mexico* Biology and Chemistry
Vladimir Kenton Degen *Fairbanks, Alaska* Physics
Thanh Diec *Sunnyvale, California* Engineering and Applied Science
Nancy Elizabeth Drehwing *Cazenovia, New York* Engineering and Applied Science
Erik Swenson Ebert *Honolulu, Hawaii* Electrical Engineering
Mark DeWitt Eggleston *Boise, Idaho* Engineering and Applied Science
David Ray Ely *Pasadena, California* Engineering and Applied Science and Social Science
Donna Faye Evans *Houston, Texas* Biology
William Joseph Evans* *Ann Arbor, Michigan* Physics
Dennis Robert Fätland *Tacoma, Washington* Physics
Pamela Caren Feldman* *Los Angeles, California* Electrical Engineering
Vincent Vito Ferrante *Fremont, California* Engineering and Applied Science
Joseph David Francis *Kingsport, Tennessee* Engineering and Applied Science and Literature
Castor Lynn Fu* *Albuquerque, New Mexico* Physics and Electrical Engineering
Allen Gee *Fresno, California* Physics
Jeff Jay Gilham *Mercer Island, Washington* Electrical Engineering
Stephen Mark Gómez *Albuquerque, New Mexico* Biology
Gabrielle Ariadne Gordon* *Beverly Hills, California* Astronomy
Thomas Marshall Gould, Jr.* *Greenlawn, New York* Physics
Bill J. Gray, Jr. *Bowdoinham, Maine* Physics
Glenn Everet Gribble *Tustin, California* Engineering and Applied Science
William Tatsuki Gustafson *Groveland, California* Electrical Engineering
Susannah J. Hannaford* *Brunswick, Maine* Biology
Kathleen Chiyoko Hayashibara* *Carson, California* Chemistry
David George Heath* *Rockland, Maine* Electrical Engineering
Thomas Scott Hemphill *Pasadena, California* Engineering and Applied Science
Kevin Hernandez *Bronx, New York* Applied Physics
Rudolf Josef Hofmeister *Framingham, Massachusetts* Physics
Jarita Charmain Holbrook *Los Angeles, California* Physics

BACHELOR OF SCIENCE—Continued

- Christopher Asley Hougen *Del Mar, California* Applied Physics
Nhi Gia Hua* *Los Angeles, California* Chemistry
Nathan Ken Inada *Kalihi, Hawaii* Applied Physics
Chi Fung Ip* *Kendall Park, New Jersey* Engineering and Applied Science
Bharathi Jagadeesh *Columbus, Ohio* Biology
Michael Patrick Jensen *Forest Grove, Oregon* Chemistry
Gerard Joseph Jungman* *Chicago, Illinois* Physics and Mathematics
Trina Kay Juzang *Albuquerque, New Mexico* Chemistry
Mira Todorovich Kanzelberger *Putnam Lake, New York* Chemistry
Craig Albert Keller* *Albuquerque, New Mexico* Physics
Salim Khan* *Abbottabad, Pakistan* Engineering and Applied Science
Nicholas G. Kledzik* *Federal Way, Washington* Electrical Engineering
Liu-Yen Kramer *Pacific Palisades, California* Applied Physics
Michael Raymond Kulbickas *Euclid, Ohio* Electrical Engineering
John Martin Lade *Tacoma, Washington* Electrical Engineering
Benson Cua Lam* *Quezon City, Philippines* Engineering and Applied Science
David John Leahy *Bellevue, Washington* Chemistry
Andy Kin On Lee *Portland, Oregon* Physics
Edwin Yoon Lee *Sonoma, California* Physics
Sonny Chung-Fang Lee* *Wooster, Ohio* Chemistry
Kim Liu* *Latham, New York* Chemistry
Edmund John Llewellyn *Boise, Idaho* Electrical Engineering
David Esley Long* *Raleigh, North Carolina* Engineering and Applied Science
Robert William Lord *Burton, Ohio* Electrical Engineering
Robert Alden Luenberger* *Stanford, California* Electrical Engineering
Rosemary Macedo *Boston, Massachusetts* Independent Studies Program
Bengt Magnusson* *Varberg, Sweden* Physics
Umar Mahmood* *Rockville, Maryland* Chemistry
Raymond Yu Shun Mak *Hong Kong* Engineering and Applied Science
Hanif S. Mamdani* *Vancouver, British Columbia, Canada* Engineering and Applied Science
John Philip Mann* *Liverpool, New York* Physics and Electrical Engineering
Steven G. McAdams *Coeur d'Alene, Idaho* Electrical Engineering
Dawn M. Meekhof *Torrance, California* Physics
Chris Meisl *Thousand Oaks, California* Applied Physics
Joy Lyndon Mendoza* *Reno, Nevada* Chemical Engineering
Leo Merken *Vancouver, B.C., Canada* Engineering and Applied Science
James Christopher Mihos* *Annandale, Virginia* Astronomy
Timothy F. Murphy* *Gardena, California* Electrical Engineering

BACHELOR OF SCIENCE — *Continued*

Chad M. Nelson* *Fremont, California* Chemical Engineering
Matthew Alan Nelson *Pasadena, California* Applied Physics
William Harold Newman* *Mount Vernon, Washington* Biology
Derek Roger Ney* *Chevy Chase, Maryland* Engineering and Applied Science
Khanh Bao Nguyen* *Redondo Beach, California* Electrical Engineering
David John Nice* *Kenosha, Wisconsin* Physics
Kenton Earl Noble *Fairbanks, Alaska* Engineering and Applied Science
Thomas P. Nolan *Worthington, Ohio* Applied Physics
Albert Chong Park *Rockville, Maryland* Applied Physics
David Shawn Parkinson* *Tempe, Arizona* Electrical Engineering
Timothy James Parrott *Valencia, California* Chemistry
Marguerite Helene Payne *Muskegon, Michigan* Chemistry
Mark Robert Peting *Eugene, Oregon* Electrical Engineering
Tuyen Thanh Pham* *Middle Island, New York* Electrical Engineering
Paul Bakholdt Piccirillo *Bethesda, Maryland* Engineering and Applied Science
Douglas M. Priest* *Lakewood, Colorado* Mathematics
Jack Hood Profit* *Covina, California* Electrical Engineering
Thomas William Rathjen* *Torrance, California* Engineering and Applied Science
Michael Wade Rhodehamel* *Anchorage, Alaska* Electrical Engineering
Katrinn M. Rodriguez *West Lafayette, Indiana* Biology
Steven Goddard Roskowski *Grand Junction, Colorado* Engineering and Applied Science
Mark Allen Ross *Norfolk, Nebraska* Applied Physics
Laura Lei Sakamoto *Hilo, Hawaii* Engineering and Applied Science
Stephen James Salser* *Pacific Palisades, California* Biology
Karin Aline Sangster *Prairie Village, Kansas* Physics
John Scott Sarapata *Levittown, Pennsylvania* Physics
Hamid Savoj* *Tehran, Iran* Electrical Engineering
Jo Beth Schlottman* *Santa Barbara, California* Biology
Christopher Thomas Schofield *Saint Helena, California* Engineering and Applied Science
Jonathan Shlomo Shapiro *Cypress, California* Mathematics
Susan Tina Sharfstein* *Sunnyvale, California* Chemical Engineering
Vicki Lynn Shimizu* *Chatsworth, California* Engineering and Applied Science
John W. Simpson* *Taos, New Mexico* Mathematics
Timothy Michael Slagle* *Burnsville, Minnesota* Electrical Engineering
David Eric Smith *Kansas City, Missouri* Physics and Mathematics
Rolf Sondergaard* *Altadena, California* Engineering and Applied Science
Michael Moon-sup Song* *Downey, California* Biology

BACHELOR OF SCIENCE—Continued

- Ethan M. Spiegel* *Van Nuys, California* Applied Physics
Theron William Stanford* *San Marino, California* Mathematics
George James Stecher* *Cincinnati, Ohio* Physics and History
Eric J. Stier* *Juneau, Alaska* Engineering and Applied Science
Derek Straub *Littleton, Colorado* Chemistry
Ravi Subramanian* *Geneva, Switzerland* Electrical Engineering
Brian David Suggs *Arcadia, California* Engineering and Applied Science
Darin Katsumi Takemoto* *Livermore, California* Biology
Ichiro Takeuchi *Kanagawa, Japan* Physics
Christopher Michael Tamanaha* *Honolulu, Hawaii* Physics
Jean Chiu-Yung Tang* *South Pasadena, California* Applied Physics
Ivan Tarle* *Novi Sad, Yugoslavia* Biology
David Hisao Tateyama* *Okinawa, Japan* Electrical Engineering
Joan Marie Tetrault *Schenectady, New York* Biology
Bruce Gregory Tiemann *Schenectady, New York* Chemistry
Andrew Michael Tikofsky* *Milwaukee, Wisconsin* Physics and Applied Mathematics
Raymond A. Trent *La Cañada, California* Engineering and Applied Science
Mark Robert Vagins *Silver Spring, Maryland* Physics
Jeffrey Alan Valenti* *Anaheim, California* Astronomy
Scott Christopher Virgil* *San Marcos, California* Chemistry
Mark Donald Wieczorek *Capistrano Beach, California* Applied Physics
Stephen Noel Winters-Hilt *Tulsa, Oklahoma* Electrical Engineering and Physics
Joseph A. Wirtley *Seven Mile, Ohio* Chemical Engineering
David Alan Wittman *Renton, Washington* Engineering and Applied Science
Gerard Chee Lai Wong* *Hayward, California* Physics
Rosaline H. Wu* *Baltimore, Maryland* Electrical Engineering
Moon-Tai Matthew Yeung* *Hong Kong* Engineering and Applied Science
Edward Molhwa Yin* *Richardson, Texas* Electrical Engineering
Joel Bruce York* *Dallas, Texas* Physics
Kenneth Kenji Yoshimoto *Wailuku, Hawaii* Biology
Edward John Zanelli *Westminster, California* Engineering and Applied Science and Economics
Martin Lee Zimmerman* *Chicago, Illinois* Electrical Engineering
Alex Paul Zorrilla *Houston, Texas* Engineering and Applied Science

MASTER OF SCIENCE

- Asif Ahmed (*Electrical Engineering*) B.S., Wichita State University 1981.
- Anne Elizabeth Alder (*Physics*) B.A., Westmont College 1985.
- Brooke Paul Anderson (*Applied Physics*) B.S.E., University of Michigan 1985.
- Edward Paul Ascoli (*Chemical Engineering*) S.B., Massachusetts Institute of Technology 1982.
- Balasubramanya T.N. (*Aeronautics*) B.Tech., Indian Institute of Technology, Madras 1986.
- Bassel Fawzi Beidas (*Electrical Engineering*) B.S.E.E., University of Southern California 1986.
- Allison Lyn Bent (*Geophysics*) B.Sc., Dalhousie University 1985.
- Vineer Bhansali (*Physics*) B.S., California Institute of Technology 1987.
- Robert James Bolender (*Mechanical Engineering*) B.S., California Institute of Technology 1986.
- Roger Temor Bonnecaze (*Chemical Engineering*) B.S., Cornell University 1985.
- Bryan Richard Botsch (*Electrical Engineering*) B.S.E.E., Purdue University 1986.
- Jean-Marc Bournazel (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure d'Électronique de L'Ouest 1985.
- James Russell Bress (*Electrical Engineering*) B.S.E.E., The University of North Carolina at Charlotte 1985.
- Timothy X Brown (*Electrical Engineering*) B.S., The Pennsylvania State University 1986.
- John Michael Budzinski (*Aeronautics*) B.S., Rensselaer Polytechnic Institute 1986.
- Steven Morgan Burns (*Computer Science*) B.A., Pomona College 1984.
- Mark Andrew Caylor (*Aeronautics*) S.B., Massachusetts Institute of Technology 1986.
- Shepperd Chao (*Electrical Engineering*) B.S., California Institute of Technology 1980.
- George Joseph Cisko, Jr. (*Applied Mechanics*) B.S., University of Illinois at Urbana-Champaign 1985.
- Doug M. Cohn (*Electrical Engineering*) B.S., University of Maryland, College Park 1983.
- Oliver Michael Collins (*Electrical Engineering*) B.S., California Institute of Technology 1986.
- Charles Henry Conley (*Physics*) S.B., Massachusetts Institute of Technology 1985.
- Michael Joseph Creed (*Chemical Engineering*) B.Ch.E., University of Dayton 1985.
- Eleonora Curlo (*Social Science*) Dottore in Economia Politica, Università Commerciale Luigi Bocconi 1983.
- David Thomas Currier (*Mechanical Engineering*) B.S., University of California, Santa Barbara 1986.
- Frederic Nicolas Deboës (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure d'Ingénieurs En Électrotechnique 1987.

MASTER OF SCIENCE — Continued

- Susan Marie Dejewski (*Electrical Engineering*) B.S., University of Wisconsin-Milwaukee 1986.
- Arthur Charles Densmore (*Electrical Engineering*) B.S., California State Polytechnic University, Pomona 1986.
- Stephen Paul DeWeerth (*Computer Science*) B.A., Wartburg College 1985.
- Lounette Marie Dyer (*Computer Science*) B.S., Western Michigan University 1982.
- John Lawrence Eckstein (*Electrical Engineering*) B.S., Virginia Polytechnic Institute and State University 1985.
- David Solomon Fashena (*Physics*) B.S., State University of New York at Stony Brook 1983.
- Charles Michael Flaig (*Computer Science*) B.S., California Institute of Technology 1986.
- Michael Kent Frohme (*Geophysics*) B.S., Southern Methodist University 1985.
- Andrew Douglas Gaynor (*Geochemistry*) B.A., University of California, San Diego 1984.
- Peyton Stinson Gibner (*Physics*) B.A., Rice University 1983.
- Andrew Douglas Gibson (*Civil Engineering*) B.E., University of Canterbury 1983.
- Peter Franklin Gray (*Social Science*) B.A., Pitzer College 1984.
- Daniel Scott Greenberg (*Electrical Engineering*) B.S., University of Pennsylvania 1986.
- Arie William Grossman (*Planetary Science*) B.A., University of California, Berkeley 1984.
- Yong Guo (*Electrical Engineering*) B.S., Xi'an Jiaotong University 1982.
- Rajiv Gupta (*Computer Science*) B.Tech., Indian Institute of Technology, Kharagpur 1984.
- Kurt W. Haas (*Electrical Engineering*) B.S., Duke University 1986.
- Jay Alan Hammer (*Aeronautics*) B.S., Carnegie-Mellon University 1986.
- Pieter Johannes Hazewindus (*Computer Science*) Ingenieur, Technical University of Eindhoven 1985.
- Mark David Hofstadter (*Planetary Science*) B.S., Stanford University 1984.
- Robin Scott Horrell (*Chemical Engineering*) B.S., University of Colorado 1985.
- David Da-Teh Huang (*Chemical Engineering*) B.S., National Cheng Kung University 1983.
- David Allen Imel (*Physics*) B.S., University of Washington 1985.
- Michael Kevin Jackson (*Applied Physics*) B.Sc., University of Alberta 1985.
- Devendra Kalra (*Computer Science*) B.Tech., Indian Institute of Technology, Delhi 1984.
- Timothy Lawrence Kay (*Computer Science*) Sc.B., Brown University 1983.
- Serge Puzant Keshishian (*Physics*) B.S. (Physics), Massachusetts Institute of Technology 1986; B.S. (Electrical Engineering) 1986.
- Kihong Kim (*Physics*) B.S., Seoul National University 1985.

MASTER OF SCIENCE—Continued

- Jorge Adrian Kittl (*Applied Physics*) Licenciado, Universidad de Buenos Aires 1985.
- Kathleen Ann Kramer (*Electrical Engineering*) B.S., Loyola Marymount University 1986.
- Louis John Kuest III (*Aeronautics*) B.S., Saint Louis University 1985.
- Jean-Marc Langlois (*Applied Physics*) B.Sc., University of Sherbrooke 1983; M.Sc., 1985.
- Arthur Lee (*Chemical Engineering*) S.B., Massachusetts Institute of Technology 1985.
- Lap Yan Lee (*Physics*) B.Sc., The University of British Columbia 1984.
- Martin Gwang Lee (*Electrical Engineering*) B.S.E.E., University of California, Berkeley 1985.
- Victor Leyva (*Applied Physics*) B.S., California Institute of Technology 1986.
- Derek Lee Lisoski (*Aeronautics*) B.Sc., The University of Calgary 1984; M.Sc., 1986.
- Wei Liu (*Geology*) B.S., Changchun Geological Institute 1982.
- Jin Luo (*Computer Science*) B.S., Beijing Institute of Technology 1983.
- Keyue Ma (*Electrical Engineering*) B.S., Zhejiang University 1982; M.S., 1985.
- Jean-Raynald Yves Mace (*Electrical Engineering*) Diplôme d'Ingénieur, École Supérieure D'Ingénieurs En Électrotechnique Et Électronique 1986.
- Miloje Makivić (*Physics*) B.S., University of Belgrade 1983.
- Dragan Maksimović (*Electrical Engineering*) B.S., University of Belgrade 1984.
- Russell Edgar Mau (*Civil Engineering*) B.S., Iowa State University 1985.
- Anne Therese McQueen (*Chemical Engineering*) B.Eng., McGill University 1983.
- Wen Jin Meng (*Applied Physics*) B.S., California Institute of Technology 1982.
- Gregory Dennis Miller (*Aeronautics*) B.S.A.E., University of Southern California 1986.
- Paul Lewis Miller (*Applied Physics*) B.S.E., Princeton University 1985.
- Susan Marie Miner (*Chemical Engineering*) B.Ch.E., University of Dayton 1985.
- James Henry Morehart (*Mechanical Engineering*) B.S., University of Maryland 1986.
- Ann Wildenstein Mori (*Geophysics*) B.S., Rice University 1974; M. of C.E., 1974.
- Albert Norman Moser (*Applied Mechanics*) B.S., Brown University 1986.
- Julianne Ives Moses (*Planetary Science*) A.B., Cornell University 1985.
- Mark Allen Neifeld (*Electrical Engineering*) B.E.E., Georgia Institute of Technology 1985.
- Ronald Keith Neumeyer (*Mechanical Engineering*) B.S., Rose-Hulman Institute of Technology 1986.
- Harold Sekum Ofori (*Electrical Engineering*) B.S., California Institute of Technology 1984.
- Ivan Matthew Onyszchuk (*Electrical Engineering*) B.A., University of Waterloo 1985; M.A., 1986.

MASTER OF SCIENCE—Continued

- Valerie Patrick (*Chemical Engineering*) B.S., Bucknell University 1984.
- Suzanne Elizabeth Paulson (*Environmental Engineering Science*) B.A., University of Colorado at Boulder 1983; M.S., University of Illinois at Urbana-Champaign 1986.
- Peter Peng (*Mechanical Engineering*) B.E., The Cooper Union School of Engineering 1986.
- Boris Steven Pervan (*Aeronautics*) B.S., University of Notre Dame 1986.
- Toby Shafer Petti (*Chemical Engineering*) B.S., Massachusetts Institute of Technology, 1982; M.S., 1982.
- Hean Lee Poh (*Computer Science*) Diplom-Ingenieur, University of Paderborn 1982.
- Lada Popović (*Electrical Engineering*) B.S., University of Belgrade 1986.
- Stefan Andreas Helmut Poprawa (*Aeronautics*) B.S., University of the Witwatersrand 1985.
- Gil Rivlis (*Physics*) B.Sc., The Hebrew University of Jerusalem 1986.
- David Robinson (*Computer Science*) B.S.E.E., University of Southern California 1984.
- Steven Nicholas Rogak (*Mechanical Engineering*) B.A.Sc., The University of British Columbia 1986.
- Martin Joseph Ruzek (*Geology*) B.S., California Institute of Technology 1981.
- Vinay Padmakar Sathe (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1986.
- Mark Alvin Schlautman (*Environmental Engineering Science*) B.S., The University of Nebraska-Lincoln 1984.
- Richard Carl Schmidt (*Electrical Engineering*) B.S., The Pennsylvania State University 1986.
- Joel Christopher Sercel (*Mechanical Engineering*) B.S., University of Arizona 1984.
- John Michael Snyder (*Computer Science*) B.S., Clarkson University 1984.
- Sara Nadiv Soffer (*Mathematics*) B.Sc., Tel-Aviv University 1984.
- Michael Wray Spencer (*Planetary Science*) B.S., College of William and Mary 1985.
- Stephen James Spicklemire (*Physics*) B.S., Rose-Hulman Institute of Technology 1983.
- Anthony Hugh Stirk (*Chemistry*) B.S., The University of Virginia 1982.
- Martin Charles Storey (*Electrical Engineering*) B.S., Stanford University 1985.
- Hung-Tao Sun (*Electrical Engineering*) B.S., California Institute of Technology 1986.
- Michael John Surace (*Electrical Engineering*) B.S., Loyola Marymount University 1986.
- Guofu Tan (*Social Science*) B.S., Mining College of China 1982; M.S., Huazhong Institute of Technology 1985.
- Michelle Hsiao Tsing Teng (*Environmental Engineering Science*) B.S., Tsinghua University 1985.
- James Edward Terry (*Aeronautics*) B.S., Virginia Polytechnic Institute and State University 1983.

MASTER OF SCIENCE — *Continued*

- Jean Thouin (*Aeronautics*) B.Ing., École Polytechnique de Montréal 1986.
- Bill Wai Ting (*Electrical Engineering*) B.S., Iowa State University 1985.
- Thomas Ralph Tretter (*Electrical Engineering*) B.S., Rose-Hulman Institute of Technology 1986.
- Venkata Giri Venkataramanan (*Electrical Engineering*) B.E., University of Madras 1986.
- Meng-Lin Wang (*Mathematics*) B.S., Soochow University 1984.
- Lynda Ann Wehrmeister (*Mechanical Engineering*) B.S.E., University of Michigan 1985.
- Robert Mason Weikle II (*Electrical Engineering*) B.S., Rice University 1986.
- David Richard Wheeler (*Mechanical Engineering*) B.S., Clarkson University 1986.
- Hei Shing Wong (*Electrical Engineering*) B.Sc., King's College, University of London 1986.
- Yiu-Fai Isaac Wong (*Electrical Engineering*) B.S., California Institute of Technology 1986.
- Cathleen Elaine Woodward (*Physics*) B.S., Texas A&M University 1982.
- Thomas Wilson Workman (*Materials Science*) B.S., California Institute of Technology 1986.
- Yu-shu George Wu (*Applied Physics*) B.S., National Taiwan University 1980.
- Joseph Yang (*Mechanical Engineering*) B.S., California Institute of Technology 1986.
- Tinju Yen (*Physics*) B.S., University of California, Los Angeles 1984.
- Kwang M. Yi (*Electrical Engineering*) B.S., University of California, Berkeley 1981.
- Fotios Zaharoglou (*Electrical Engineering*) Diploma, Aristoteleion University of Thessalonika 1986.
- Tmitri Jonathan Zukowski (*Physics*) B.S., Virginia Polytechnic Institute and State University 1984.

DOCTOR OF PHILOSOPHY

DIVISION OF BIOLOGY

- Ngozi Emmanuel Erundu (*Biology*) B.S., College of Medicine of the University of Lagos, 1976; M.S., B.Sc., 1979.
Thesis: Regional Distribution and Subcellular Associations of Type II Calcium and Calmodulin-Dependent Protein Kinase in Rat Brain.
- Beverley Bond Matthews (*Molecular Biology*) A.B., Cornell University 1979.
Thesis: Structure and Expression of the Actin Gene Family of *Drosophila melanogaster*.
- William Wayne Mattox (*Biology*) B.S., Michigan State University 1980.
Thesis: The Molecular Structure of the *Beadex* and *Heldup-A* Loci of *Drosophila melanogaster*.
- John J. Ngai (*Biology*) B.A., Pomona College 1980.
Thesis: Expression of the Genes Encoding the Cytoskeletal Proteins Vimentin and Protein 4.1.
- Lei Yu (*Biology*) Wuxi College of Light Industry 1979; Academia Sinica 1981.
Thesis: The Nicotinic Acetylcholine Receptor: Gene Expression and Ion Channel Function.

DIVISION OF CHEMISTRY AND CHEMICAL ENGINEERING

- Andrew William Axup (*Chemistry*) B.S., Purdue University 1982.
Thesis: Laser Flash Spectroscopy of Zinc/Ruthenium Myoglobins: An Investigation of Distance and Medium Effects of Photoinduced Long-Range Intraprotein Electron Transfers.
- Barbara J. Burger (*Chemistry*) B.S., University of Rochester 1983.
Thesis: Olefin Insertion and β -Elimination Reactions of Permethylniobocene Olefin Hydride and Permethylscandocene Alkyl Complexes.
- Steven S. Carroll (*Chemistry*) B.S., University of Virginia 1980.
Thesis: The Construction and Kinetic Analysis of Specific Mutants of β -Lactamase.
- Emily Ann Carter (*Chemistry*) B.S., University of California, Berkeley 1982.
Thesis: Finesse in Quantum Chemistry: Accurate Energetics Relevant for Reaction Mechanisms.
- Yie-Hwa Chang (*Chemistry*) B.S., National Taiwan University 1977.
Thesis: Studies of the Roles of Residues 71 and 72 of RTEM-1 Beta-Lactamase and the Structure-Function Relationships between Beta-Lactamases and D,D-Carboxypeptidases by Mutagenesis.
- Huey-jenn Chiang (*Chemistry*) B.S., Tamkang College of Arts and Sciences 1976.
Thesis: Studies of the Thermodynamics of Some Native and Ruthenated Metalloproteins by Spectroelectrochemistry.

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

- Christopher Vincent Chow (*Chemical Engineering*) B.S., University of Illinois at Urbana-Champaign 1980; M.S., California Institute of Technology 1983.
Thesis: The Flow of a Liquid Jet in a Homogeneous Suspension.
- Mark Daniel Cohen (*Chemical Engineering*) B.S., Stanford University 1980.
Thesis: Studies of Concentrated Electrolyte Solutions Using the Electrodynamic Balance.
- David Stewart Dandy (*Chemical Engineering*) B.S., University of California, Davis 1981; M.S., California Institute of Technology 1983.
Thesis: Intermediate Reynolds Number Free-Surface Flows.
- Patrick H. Dussault (*Chemistry*) B.S., University of California, Irvine 1982.
Thesis: Approaches to the Total Synthesis of Aplysiatoxin.
- Sergio Edelstein (*Chemical Engineering*) Ch.Eng., Universidad de Buenos Aires 1980; M.S., Lehigh University 1982.
Thesis: Adsorption of Sulfur Dioxide and Reduction of Sulfate on Alumina and Alkali-Alumina at High Temperatures.
- James Robert Engstrom (*Chemical Engineering*) B.Ch.E., University of Minnesota 1981.
Thesis: The Influence of Surface Structure and Adlayer Composition on the Kinetics and Mechanisms of Gas-Surface Reactions.
- Ron Grosz (*Chemical Engineering*) B.S., Cornell University 1981.
Thesis: Biochemical and Mathematical Modeling of Microaerobic Continuous Ethanol Production by *Saccharomyces Cerevisiae*.
- Malina Manon Hills (*Chemical Engineering*) B.S., Yale University 1981.
Thesis: Characterization of Reaction Intermediates and Adsorbate Interactions on the Ru(001) Surface.
- Rakesh Jain (*Chemistry*) B.Sc., Panjab University 1981; M.Sc., 1982.
Thesis: Direct Observation and Reactions of Organic Biradicals Generated from Novel Bicyclic Azoalkanes.
- John Tyler Keech (*Chemistry*) B.S. (*Physics*), University of California, Irvine 1982; B.S. (*Chemistry*), 1982.
Thesis: High Valent Osmium Complexes Incorporating a Tetradentate Tetraanionic Chelating Ligand; Stabilization Modification Resulting from the Formation of Non-Planar Amides.
- Tai-yong Lee (*Chemical Engineering*) B.S., Seoul National University 1980.
Thesis: Estimation of Petroleum Reservoir Properties.
- Burton A. Leland (*Chemistry*) B.S., Hope College 1981.
Thesis: Photoinduced Electron Transfer: Synthetic Models of the Primary Processes in Photosynthesis.
- Diane Lynn Lynch (*Chemistry*) B.S., Texas A&M University 1979; M.S., 1981.
Thesis: Dynamics of Single and Multiphoton Ionization Processes in Molecules.

DOCTOR OF PHILOSOPHY — *Continued*

- Jorge Anibal Mandler (*Chemical Engineering*) B.Sc., Technion-Israel Institute of Technology 1978; M.Sc., 1981.
Thesis: Robust Control System Design for a Fixed-Bed Catalytic Reactor.
- Janet Layne Marshall (*Chemistry*) B.S., The University of North Carolina at Chapel Hill 1981.
Thesis: Spectroscopy and Photochemistry of Pyrazolyl-Bridged Binuclear Iridium(II) Complexes.
- Brian B. Masek (*Chemistry*) B.A., Kearney State College 1980.
Thesis: The Static and Dynamic Conformational Properties of Some (1,5)-Naphthalenophanes.
- James Douglas Meinhart (*Chemistry*) B.S., University of Rochester 1981.
Thesis: Synthesis and Reactivity of Titanocene Methylene Complexes and Bis(Cyclopentadienyl) Titanacyclobutenes.
- David S. Middlemas (*Chemistry*) B.S., University of Utah 1979.
Thesis: Topographical Studies of the Nicotinic Acetylcholine Receptor.
- James J. Neitzel (*Chemistry and Biology*) B.A., Macalester College 1977.
Thesis: The Expression, Stability, and Enzymatic Activity of Specific β -Lactamase Mutants.
- Ching-Long Ni (*Chemistry*) B.S., National Taiwan University 1982.
Thesis: Electrocatalytic Reduction of Dioxide at Chemically Modified Electrodes.
- Kim Claire O'Connor (*Chemical Engineering and Biology*) B.S., Rice University 1982.
Thesis: The Effects of Immobilization on Structure and Substrate Activation of Glutamate Dehydrogenase.
- Jose Nelson Onuchic (*Chemistry*) B.Sc., Universidade de Sao Paulo, Sao Carlos 1980; M.Sc., 1982.
Thesis: New Aspects of the Theory of Electron Transfer Reaction Dynamics.
- Rocco Angelo Paciello (*Chemistry*) S.B., Massachusetts Institute of Technology 1982.
Thesis: Synthesis and Reactivity of Electron-Rich Ruthenium and Iron Half-Sandwich Complexes.
- Geoffrey Tower Peake (*Chemistry*) B.A., Carleton College 1981.
Thesis: Studies of the Donor Properties of New Polyanionic Chelating Ligands through the Synthesis and Characterization of Osmium Complexes.
- Steven William Peretti (*Chemical Engineering and Biology*) B.S., Yale University 1979.
Thesis: Theoretical Modeling and Experimental Investigation of Host-Plasmid Interactions in Recombinant *Escherichia coli*.
- Philip Pjura (*Chemistry*) B.S., Yale University 1978.
Thesis: X-Ray Crystallographic Studies of DNA-Drug and DNA-Protein Interactions.

DOCTOR OF PHILOSOPHY — *Continued*

- Michael Roland Prairie (*Chemical Engineering*) B.S., University of New Mexico 1982; M.S., California Institute of Technology 1984.
Thesis: Steady-State and Transient Methods for Modeling Chemical Reactions on Supported Catalysts.
- Daniel Eduardo Rivera Flores (*Chemical Engineering*) B.S., University of Rochester 1982; M.S., University of Wisconsin-Madison 1984.
Thesis: Modeling Requirements for Process Control.
- Gideon Sageev Grader (*Chemical Engineering*) B.S., University of California, Berkeley 1983.
Thesis: Fourier Transform Infrared Spectroscopy of a Single Aerosol Particle.
- Jerald Bruce Schilling (*Chemistry*) B.S., Andrews University 1981.
Thesis: Experimental and Theoretical Aspects of Hydrocarbon Activation by Transition Metal Ions in the Gas Phase.
- Sigurd Skogestad (*Chemical Engineering*) M.Sc., Norwegian Institute of Technology 1978.
Thesis: Studies on Robust Control of Distillation Columns.
- Michael Bradley Sponsler (*Chemistry*) B.S., Bowling Green State University 1982.
Thesis: Synthesis, EPR Spectroscopy, and Matrix-Isolation Decay Kinetics of Triplet Cyclobutanediyls.
- Brian H. Toby (*Chemistry*) B.A., Rutgers College 1980.
Thesis: Studies of Molecular Bonding, Interactions and Decomposition Reactions on the (001) Surface of Ruthenium.
- Wilman Tsai (*Chemical Engineering*) B.Sc. (*Chemical Engineering*), Syracuse University 1982; B.Sc. (*Environmental Engineering Science*) 1982; M.S. California Institute of Technology 1984.
Thesis: Interactions of Ammonia with Platinum and Ruthenium Surfaces.
- John J. Vajo (*Chemistry*) B.S., Rensselaer Polytechnic Institute 1980.
Thesis: Mechanistic Studies of Heterogeneously Catalyzed Reactions of Ammonia and Acetic Acid on Platinum Surfaces.
- Allan van Asselt (*Chemistry*) B.S., McPherson College 1980.
Thesis: Reactions of Oxygen Containing Ligands in the Coordination of Sphere of Permethylhafnocene and Permethyltantalocene.
- Gregory Alan Voth (*Chemistry*) B.S., University of Kansas 1981.
Thesis: Theoretical Studies of Intramolecular Dynamics and Energy Redistribution.
- Kerry Neil Walzl (*Chemistry*) B.S., University of Delaware 1980.
Thesis: Variable-Angle Electron Energy-Loss Spectroscopy of Polyatomic Molecular Systems.
- Hsin Wang (*Chemistry*) B.S., National Taiwan University 1973; M.S., 1979.
Thesis: Mössbauer and Spectroscopic Studies of Yeast Cytochrome Oxidase.
- Robert Mebane Waymouth (*Chemistry*) B.A. (*Chemistry*), Washington and Lee University 1982; B.S. (*Mathematics*) 1982.
Thesis: Synthesis and Reactivity of Alkylaluminum Adducts of Zirconium Ketene and Ketone Complexes.

DOCTOR OF PHILOSOPHY — *Continued*

Evangelhos Zafiriou (*Chemical Engineering*) Diploma, National Technical University 1983.

Thesis: A Methodology for the Syntheses of Robust Control Systems for Multivariable Sampled-Data Processes.

DIVISION OF ENGINEERING AND APPLIED SCIENCE

Jaywant H. Arakeri (*Aeronautics*) B.Tech., Indian Institute of Technology, Madras 1979; M.E., Indian Institute of Science 1981.

Thesis: Structure Measurements in a Synthetic Turbulent Boundary Layer.

Robert Glenn Arnold (*Environmental Engineering Science and Biology*) B.S.M.E., United States Naval Academy 1969; M.S.E.E., University of North Carolina 1976.

Thesis: The Kinetics and Mechanism of Dissimilative Fe(III) Reduction by *Pseudomonas* sp.200.

William C. Athas, Jr. (*Computer Science*) B.S., University of Utah 1981; M.S., California Institute of Technology 1983.

Thesis: Fine Grain Concurrent Computations.

Sassan Bassiri (*Electrical Engineering*) B.S., South Dakota State University 1983; M.S., California Institute of Technology 1984.

Thesis: Electromagnetic Wave Propagation and Radiation in Chiral Media.

Alice Renée Bonnefoi (*Applied Physics*) DEUG A, Université des Sciences et Techniques du Languedoc 1979; Diplôme d'Ingénieur, École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris, 1979; M.S., California Institute of Technology 1983.

Thesis: Electronic Properties and Device Application of GaAs/Al_xGa_{1-x}As Quantum Barrier and Quantum Well Heterostructures.

Mary Elizabeth Brewster (*Applied Mathematics*) B.A., Indiana University at Bloomington 1979; M.A., The University of Texas at Arlington 1983.

Thesis: Asymptotic Analysis of Thin Plates Under Normal Load and Horizontal Edge Thrust.

Paul Brian Burridge (*Civil Engineering and Geophysics*) B.E., University of Auckland 1981; M.S., University of California, Irvine 1982.

Thesis: Failure of Slopes.

Yang-Tse Cheng (*Applied Physics*) B.S., California Institute of Technology 1982; M.S., 1983.

Thesis: Ion-Beam Mixing and the Formation of Amorphous Alloys.

Kar-Ming Cheung (*Electrical Engineering*) B.S.E., University of Michigan 1984; M.S., California Institute of Technology 1985.

Thesis: Error Correction Coding in Data Storage Systems.

Michael V. Chobotov (*Mechanical Engineering*) B.S., California Institute of Technology 1982; M.S., 1983.

Thesis: Gravity Currents with Heat Transfer Effects.

DOCTOR OF PHILOSOPHY — *Continued*

- Young-il Choo (*Computer Science*) B.S., California Institute of Technology 1978; M.S., 1983.
Thesis: Logic from Programming Language Semantics.
- Richard C. Compton (*Electrical Engineering*) B.Sc., The University of Sydney 1982.
Thesis: Analysis of Millimeter and Microwave Integrated Circuits.
- Luca d'Agostino (*Mechanical Engineering*) Laurea in Ingegneria Meccanica, Università degli Studi di Pisa 1978; M.S., California Institute of Technology 1981.
Thesis: Experimental and Theoretical Study on Cavitation Inception and Bubbly Flow Dynamics.
- Russell Lane Dailey (*Electrical Engineering*) B.S., California Institute of Technology 1980; M.S., 1985.
Thesis: Conic Sector Analysis for Digital Control Systems with Structured Uncertainty.
- Yurdaer Nezihi Doğanata (*Electrical Engineering*) B.S., Middle East Technical University 1981; M.S. 1983; M.S. California Institute of Technology 1984.
Thesis: Analysis of Traffic Problems of Integrated Networks.
- James L. Fanson (*Applied Mechanics*) B.S., University of Wisconsin-Madison 1981; M.S., California Institute of Technology 1982.
Thesis: An Experimental Investigation of Vibration Suppression in Large Space Structures Using Positive Position Feedback.
- Imad A. Hannoun (*Civil Engineering and Environmental Engineering Science*) B.E., American University of Beirut 1982; M.S., California Institute of Technology 1983.
Thesis: Turbulent Mixing in Stably-Stratified Fluids Subjected to Zero-Mean Shear.
- Robert Joseph Hauenstein (*Applied Physics*) B.S., John Carroll University 1979; M.S., 1981.
Thesis: Investigations of Single-Crystal Silicide/Silicon Structures.
- John Hyunchul Hong (*Electrical Engineering*) S.B., Massachusetts Institute of Technology 1982; M.S. California Institute of Technology 1983.
Thesis: Optical Computing for Adaptive Signal Processing and Associative Memories.
- Joseph William Humphrey III (*Mechanical Engineering*) B.M.E., Georgia Institute of Technology 1982; M.S., California Institute of Technology 1983.
Thesis: Linear and Nonlinear Acoustics with Nonuniform Entropy in Combustion Chambers.
- Paramsothy Jayakumar (*Civil Engineering*) B.Sc., University of Peradeniya 1982; M.S., California Institute of Technology 1984.
Thesis: Modeling and Identification in Structural Dynamics.
- Belgacem Jerry (*Mechanical Engineering*) Diplôme d'Ingénieur, Ecole Nationale Supérieure d'Arts et Métiers 1979; M.S. (*Mechanical Engineering*), California Institute of Technology 1980; M.S. (*Social Science*) 1982.
Thesis: Experimental Study of Unsteady Hydrodynamic Force Matrices on Whirling Centrifugal Pump Impellers.

DOCTOR OF PHILOSOPHY — *Continued*

- James Russell Kamm (*Applied Mathematics*) Sc.B., Brown University 1981.
Thesis: Shape and Stability of Two-Dimensional Uniform Vorticity Regions.
- Dayalan P. Kasilingam (*Electrical Engineering*) B.A., Trinity College, University of Cambridge 1981; M.S., California Institute of Technology 1982.
Thesis: Topics in Millimeter-Wave Imaging Arrays.
- Harri Kaarlo Kytömaa (*Mechanical Engineering*) B.Sc., Durham University 1979; M.S., California Institute of Technology 1982.
Thesis: Stability of the Structure in Multicomponent Flows.
- Nehemias Lima Lacerda (*Aeronautics*) Aeronautical Engineer, Instituto Tecnológico de Aeronáutica 1978; M.S., California Institute of Technology 1983.
Thesis: On the Start Up of Supersonic Underexpanded Jets.
- Wayne W. Lam (*Electrical Engineering*) B.S., University of Hawaii at Manoa 1981; M.S., California Institute of Technology 1983.
Thesis: Millimeter-Wave Monolithic Schottky Diode-Grid Phase Shifter.
- Michael J. Landman (*Applied Mathematics*) B.Sc., University of Melbourne 1982.
Thesis: New Solutions of an Amplitude Equation Describing Transition in a Laminar Shear Flow.
- Billy Ying Bui Lau (*Electrical Engineering*) B.E., State University of New York at Stony Brook 1979; M.S., California Institute of Technology 1980.
Thesis: Small-Signal Frequency Response Theory for Ideal Dc-to-Dc Converter Systems.
- Ping-Sang Kenneth Leung (*Environmental Engineering Science*) B.S., University of Wisconsin-Green Bay 1981; M.S., California Institute of Technology 1983.
Thesis: Co-Phthalocyanine Catalyzed Autoxidation of Mercaptans.
- Jane Ming-Chin Lin (*Aeronautics*) B.S., Iowa State University of Science and Technology 1980; M.S., California Institute of Technology 1981.
Thesis: Transient Gas Jets into Liquid.
- Christopher Paul Lindsey (*Applied Physics*) B.S., Harvey Mudd College 1975; M.S., California Institute of Technology 1982.
Thesis: High Power Phased Array and Tailored Gain Semiconductor Lasers.
- Dennis Anthony Lyn (*Environmental Engineering Science*) B.A.Sc., University of Toronto 1980; M.A.Sc., 1981.
Thesis: Turbulence and Turbulent Transport in Sediment-Laden Open-Channel Flows.
- Ramaswamy Mahadevan (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Madras 1981; M.S., California Institute of Technology 1982.
Thesis: Problems in Analysis, Control, and Design of Switching Inverters and Rectifiers.
- Michael Anthony Moser (*Applied Mechanics*) Sc.B., Brown University 1981; M.S., California Institute of Technology 1983.
Thesis: The Response of Stick-Slip Systems to Random Seismic Excitation.

DOCTOR OF PHILOSOPHY — *Continued*

- Ramarathnam Narasimhan (*Applied Mechanics*) B.Tech., Indian Institute of Technology, Madras 1982; M.S., California Institute of Technology 1983.
Thesis: Mode I, Plane Stress Crack Initiation and Growth in Elastic-Plastic Solids: A Finite Element Analysis.
- Timothy J. O'Hern (*Mechanical Engineering*) B.S., University of California, Santa Barbara 1981; M.S., California Institute of Technology 1982.
Thesis: Cavitation Inception Scale Effects: I. Nuclei Distributions in Natural Waters. II. Cavitation Inception in a Turbulent Shear Flow.
- Dimitri Papamoschou (*Aeronautics*) B.S., Syracuse University 1981; M.S., California Institute of Technology 1982.
Thesis: Experimental Investigation of Heterogeneous Compressible Shear Layers.
- Leonidas Paparizos (*Civil Engineering*) Diploma, National Technical University 1982; M.S., California Institute of Technology 1983.
Thesis: Some Observation on the Random Response of Hysteretic Systems.
- George Anthony Rakuljic (*Electrical Engineering*) B.S., University of California, Los Angeles 1982; M.S., California Institute of Technology 1983.
Thesis: Photorefractive Properties and Applications of Barium Titanate and Tungsten Bronze Ferroelectrics.
- Leonid Iakov Rudin (*Computer Science*) M.S., Odessa University 1976; M.S., California Institute of Technology 1981.
Thesis: Images, Numerical Analysis of Singularities and Shock Filters.
- Paul Russell Schatzle (*Aeronautics*) B.S., Texas A&M University 1974; M.S., 1976.
Thesis: An Experimental Study of Fusion of Vortex Rings.
- James Eric Skjelbreia (*Civil Engineering*) B.S., University of Washington 1979.
Thesis: Observations of Breaking Waves on Beaches by Use of Laser Doppler Velocimetry.
- Thomas Henry Sobota (*Mechanical Engineering*) B.S., Polytechnic Institute of New York 1981; M.S., California Institute of Technology 1982.
Thesis: An Experimental and Numerical Investigation of Swirling Flows in a Rectangular Nozzle.
- James David Sterling (*Mechanical Engineering*) B.S., Texas A&M University 1983; M.S., California Institute of Technology 1984.
Thesis: Longitudinal Mode Combustion Instabilities in Air Breathing Engines.
- Stephen James Toner (*Mechanical Engineering*) B.S., California Institute of Technology 1979; M.S., University of California, Los Angeles 1982.
Thesis: Entrainment, Chemistry, and Structure of Fire Plumes.
- Santosh Subramanyam Venkatesh (*Electrical Engineering*) B.Tech., Indian Institute of Technology, Bombay 1981; M.S., California Institute of Technology 1982.
Thesis: Linear Maps with Point Rules: Applications to Pattern Classification and Associative Memory.

DOCTOR OF PHILOSOPHY — *Continued*

Kelvin H. Wagner (*Electrical Engineering*) B.S., California Institute of Technology 1981; M.S., 1982.

Thesis: Time and Space Integrating Acousto-Optic Signal Processing.

John Charles Wawrzynek (*Computer Science*) B.S., State University of New York at Buffalo 1977; M.S., University of Illinois at Urbana-Champaign 1979.

Thesis: VLSI Concurrent Computation for Music Synthesis.

Jin Jwang Wu (*Environmental Engineering Science and Chemical Engineering*) B.S., National Taiwan University 1981; M.S., California Institute of Technology 1983.

Thesis: Powder Synthesis in Aerosol Reactors.

Xian-Li Yeh (*Applied Physics*) B.S., California Institute of Technology 1982; M.S., 1984.

Thesis: Reaction of Hydrogen with Crystalline and Amorphous Alloys—Crystal to Amorphous Transformation Induced by Hydrogen.

Alan T. Zehnder (*Mechanical Engineering and Materials Science*) B.S., University of California, Berkeley 1982; M.S., California Institute of Technology 1983.

Thesis: Dynamic Fracture Initiation and Propagation in Metals: Experimental Results and Techniques.

Zhe Zhang (*Electrical Engineering*) Tsinghua University 1977; Graduate School of the University of Science and Technology of China 1981.

Thesis: Coupled-Inductor Magnetics in Power Electronics.

Juan Antonio Zufiria (*Applied Mathematics*) Ae.Eng., Polytechnic University of Madrid 1982.

Thesis: Part I. Symmetry Breaking of Water Waves. Part II. The Superharmonic Instability of Surface Water Waves.

DIVISION OF GEOLOGICAL AND PLANETARY SCIENCES

Luciana Astiz (*Geophysics*) B.S., Universidad Nacional Autonoma de Mexico 1980; M.S., California Institute of Technology 1982.

Thesis: I. Source Analysis of Large Earthquakes in Mexico. II. Study of Intermediate-Depth Earthquakes and Interplate Seismic Coupling.

Melinda Mary Brugman (*Geology*) B.S., University of Washington 1978; M.S., California Institute of Technology 1984.

Thesis: Water Flow at the Base of a Surging Glacier.

Andrew James Friedson (*Planetary Science and Physics*) B.S., California Institute of Technology 1979; M.S., University of California, Los Angeles 1980.

Thesis: I. Meridional Energy Balance of Uranus. II. Viscosity of Rock-Ice Mixtures. III. The Thermosphere of Titan.

Heidi Beth Houston (*Geophysics*) B.S., University of Washington 1978; M.S., University of Wisconsin, Madison 1979; M.S., California Institute of Technology 1984.

Thesis: Source Characteristics of Large Earthquakes at Short Periods.

DOCTOR OF PHILOSOPHY — *Continued*

Randolph Livingstone Kirk (*Planetary Science and Physics*) B.S., Stanford University 1981; M.S., California Institute of Technology 1984.

Thesis: I. Thermal Evolution of Ganymede and Implications for Surface Features.

II. Magnetohydrodynamic Constraints on Deep Zonal Flow in the Giant Planets.

III. A Fast Finite-Element Algorithm for Two-Dimensional Photoclinometry.

John Nikolai Louie (*Geophysics*) A.B., Occidental College 1982; M.S., California Institute of Technology 1983.

Thesis: Seismic Reflection Experiments Imaging the Physical Nature of Crustal Structures in Southern California.

Janice Regan (*Geophysics*) B.Sc., University of Victoria 1979; M.S., California Institute of Technology 1982.

Thesis: Numerical Studies of Propagation of Lg Waves Across Ocean Continent Boundaries Using the Representation Theorem.

Donald James Rudy (*Planetary Science and Physics*) B.S., Marquette University 1979; M.S., University of Wisconsin-Madison 1981; M.S., California Institute of Technology 1984.

Thesis: Mars: High Resolution VLA Observations at Wavelengths of 2 and 6 cm and Derived Properties.

Christopher O'Neill Sanders (*Geophysics and Geology*) B.S., University of Nevada, Reno 1979; M.S., California Institute of Technology 1983.

Thesis: I: Seismotectonics of the San Jacinto Fault Zone and the Anza Seismic Gap.

II: Imaging the Shallow Crust in Volcanic Areas with Earthquake Shear Waves.

Douglas R. Schmitt (*Geophysics*) B.S., University of Lethbridge 1980; M.S., California Institute of Technology 1984.

Thesis: I. Applications of Double-Exposure Holography to the Measurement of In Situ Stress and the Elastic Moduli of Rock from Boreholes. II. Shock Temperature Measurements in Fused Quartz and Crystalline NaCl to 35 GPa.

David Russell Scott (*Geophysics*) B.A., Trinity College, Cambridge University 1982.

Thesis: Magmons: Solitary Waves Arising in the Buoyant Ascent of Magma by Porous Flow Through a Viscously Deformable Matrix.

John Emilio Vidale (*Geophysics*) B.S. (*Physics*), Yale University 1981; B.A. (*Geology*) 1981.

Thesis: Application of Two-Dimensional Finite-Difference Wave Simulation to Earthquakes, Earth Structure, and Seismic Hazard.

DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

Jose Edgardo L. Campos (*Social Science*) A.B., Ateneo de Manila University 1974; M.S., University of Minnesota 1980; M.S., California Institute of Technology 1985.

Thesis: A Simple Political Economy Model of Price Supports.

Jack Williamson (*Social Science*) A.B., University of California, Santa Cruz 1975.

Thesis: Financial Equilibrium, Voting Procedures, and Coalition Structures in Allocational Mechanisms.

DIVISION OF PHYSICS, MATHEMATICS AND ASTRONOMY

- Arnold Ian Boothroyd (*Physics*) B.Sc., McGill University 1980.
Thesis: Low Mass Stars with Mass Loss and Low-Luminosity Carbon Star Formation.
- Kwok-wai Cheung (*Physics*) B.Sc., University of Hong Kong 1978; M.Phil., 1981;
M.S., Yale University 1981.
Thesis: An Acousto-Optical Correlation Spectrometer for Radio Astronomy.
- Dean-Yi Chou (*Astronomy*) B.S., National Tsing Hua University 1977; M.S.,
University of California, San Diego 1981.
Thesis: Development and Evolution of Magnetic Fields in Active Regions on the Sun.
- Ming-chung Chu (*Physics*) B.S., California Institute of Technology 1983.
Thesis: Hydrodynamics of Ultra-Relativistic Heavy-Ion Collisions.
- Daniel Mark Coffman (*Physics*) B.S., Yale University 1979; M.S., California
Institute of Technology 1983.
Thesis: The Properties of Semileptonic Decays of Charmed D Mesons.
- Richard Allen Edelson (*Astronomy*) B.A., University of California, Berkeley 1981.
Thesis: Broadband Properties of Active Galactic Nuclei.
- Lee Samuel Finn (*Physics*) B.S., University of California, Los Angeles 1982; M.S.,
California Institute of Technology 1983.
Thesis: Relativistic Stellar Pulsations.
- Jonathan William Flower (*Physics*) B.A., Jesus College, University of Cambridge
1983.
Thesis: Lattice Gauge Theory on a Parallel Computer.
- Shahram Hamidi (*Physics*) B.S., California Institute of Technology 1981.
Thesis: Interactions of Strings Compactified on Orbifolds.
- Peter James Holden (*Mathematics*) B.Sc., Imperial College of Science and
Technology 1981.
Thesis: Extension Theorems for Functions of Vanishing Mean Oscillation.
- Richard M. Kremer (*Physics*) B.S., Harvey Mudd College 1980.
Thesis: $^{12}\text{C}(\alpha, \gamma)^{16}\text{O}$ Reaction of Low Energies.
- Kevin Robert Lind (*Astronomy*) B.A., Rice University 1981.
Thesis: Observations and Gas Dynamics of Extragalactic Radio Jets.
- Graeme Lowe (*Physics*) B.Sc., University of Auckland 1979; M.Sc., 1980.
Thesis: Rotation of Bacterial Flagella at High Frequency.
- Jack Harold Lutz (*Mathematics and Computer Science*) B.G.S., University of Kansas
1976; M.A., 1978; M.S. 1981.
Thesis: Resource-Bounded Category and Measure in Exponential Complexity Classes.
- Markus Meister (*Physics*) Vordiplom, Technische Universität München 1979.
Thesis: Studies on Flagellar Rotation: The Angular Symmetry, the Stall Torque, and
the Proton Consumption of the Bacterial Flagellar Motor.

DOCTOR OF PHILOSOPHY — *Continued*

Dawn Christine Meredith (*Physics*) B.A., St. John's College 1980; M.S. California Institute of Technology 1984.

Thesis: Quantum Chaos: Spectral Fluctuations and Overlap Distributions of the Three Level Lipkin-Meshkov-Glick Model.

Milan B. Mijić (*Physics*) B.S., Belgrade University 1979; M.S., California Institute of Technology 1982.

Thesis: Quantum and Inflationary Cosmology with Higher Derivative Gravity.

Duncan Andrew Morris (*Physics*) B.A.Sc., University of Toronto 1983.

Thesis: The Relativistic String in the Caltech-II Model of Hadronization and Electron-Positron Annihilation.

Daniel Neuhauser (*Physics*) B.Sc., Hebrew University of Jerusalem 1982; M.S., California Institute of Technology 1983.

Thesis: Two Problems in Many Body Physics: I. Photon Production: A Probe of Heavy Ion Collisions. II. Structure of Matter in Strong Magnetic Fields.

Kristiana Odencrantz (*Mathematics*) B.A., University of California, Los Angeles 1982.

Thesis: Effects of a Magnetic Field on the Trace of the Heat Kernel for a Schrödinger Operator with a Potential Well.

Alexios P. Polychronakos (*Physics*) Diploma, National Technical University of Athens 1982; M.S., California Institute of Technology 1983.

Thesis: Anomalous Quantum Numbers and Topological Properties of Field Theories.

Roger William Romani (*Physics*) A.B., Princeton University 1983.

Thesis: Neutron Star Observations as Astrophysical Probes.

George Siopsis (*Physics*) B.Sc., The University of Sussex 1982; M.S., California Institute of Technology 1983.

Thesis: Some Aspects of the Quantization of Theories with a Gauge Invariance.

Paul Ernest Stolorz (*Physics*) B.Sc., University of Tasmania 1979; D.I.C., Imperial College of Science and Technology 1981.

Thesis: Numerical Simulations of Lattice QCD.

David Lee Wark (*Physics*) B.S., Indiana University at Bloomington 1980; M.S., California Institute of Technology 1982.

Thesis: The Beta Spectrum Following Fission from ^{252}Cf .

Brian John Warr (*Physics*) Honours, Worcester College, University of Oxford 1982.

Thesis: Regularisation and Renormalisation of Gauge Theories.

Bradley T. Werner (*Physics and Geology*) B.S., California Institute of Technology 1981; M.S., 1982.

Thesis: A Physical Model of Wind-Blown Sand Transport.

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.

Jaywant H. Arakeri

MABEL BECKMAN PRIZE

Awarded to a woman student upon completion of her junior or senior year in recognition of demonstrated academic and personal excellence, contributions to the Institute community, and outstanding qualities of character and leadership.

1987 Pamela C. Feldman

1986 Jean C. Tang

ERIC TEMPLE BELL UNDERGRADUATE MATHEMATICS RESEARCH PRIZE

Awarded to one or more juniors or seniors for outstanding original research in mathematics.

Jonathan S. Shapiro

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

Prizes and awards are listed only for those students awarded degrees in 1987, and include prizes and awards received by them in previous years.

PRIZES AND AWARDS — *Continued*

any other nonacademic criteria. Listed below are graduating seniors who have been recipients of these prizes.

<i>John Alexander Becker</i>	<i>David Esley Long</i>	<i>Rolf Sondergaard</i>
<i>Vineer Bhansali</i>	<i>Umar Mahmood</i>	<i>George James Stecher</i>
<i>Peter L. Cho</i>	<i>Hanif S. Mamdani</i>	<i>Jean Chiu-Yung Tang</i>
<i>William Joseph Evans</i>	<i>Stephan Pietrusiak</i>	<i>Ivan Tarle</i>
<i>Pamela Caren Feldman</i>	<i>Stephen James Salser</i>	<i>Andrew Michael Tikofsky</i>
<i>Chi Fung Ip</i>	<i>Susan Tina Sharfstein</i>	<i>Scott Christopher Virgil</i>
<i>Gerard Joseph Jungman</i>	<i>John W. Simpson</i>	<i>Joel Bruce York</i>
<i>Sonny Chung-Fang Lee</i>		

THE W. P. CAREY & CO., INC. PRIZE IN APPLIED MATHEMATICS

Awarded to a student receiving a Doctor of Philosophy degree for an outstanding doctoral dissertation in applied mathematics.

Juan Antonio Zufiria

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.

Timothy O'Hern

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.

1986 *Randy D. Brown; Pamela C. Feldman*

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.

Clea T. Bures, Deans' Cup

Chris Meisl, 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.

John Ngai

PRIZES AND AWARDS — *Continued*

HAREN LEE FISHER MEMORIAL AWARD IN JUNIOR PHYSICS

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

Vineer Bhansali

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.

1986 David E. Long

JACK E. FROELICH 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.

1986 Peter Leslie Cho

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.

1986 Susannah Joy Hannaford

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.

Hamid M. Savoj; Rolf Sondergaard

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.

1986 Timothy P. Allen; Joseph Francis

ROBERT L. NOLAND LEADERSHIP SCHOLARSHIP

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

1987 Stephen M. Gómez

PRIZES AND AWARDS — *Continued*

THE ROYAL SOCIETY FOR THE ENCOURAGEMENT OF ARTS MANUFACTURES AND COMMERCE SILVER MEDAL

Awarded to students who are receiving their first degrees from the most important institutions of learning in the United States. Winners are selected on the basis of outstanding academic records and significant participation in student activities.

Gabrielle A. Gordon

HERBERT J. RYSER MEMORIAL SCHOLARSHIPS

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

1986 John Simpson

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 Rosemary Macedo

1986 James F. Bell

SIGMA XI AWARD

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

Scott C. Virgil

THE MORGAN WARD PRIZE

Awarded for the best problems and solutions in mathematics submitted by a freshman or sophomore.

1985 George Chen, David E. Long