ROBERT F. STENGEL

PROFESSOR EMERITUS
DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING
SCHOOL OF ENGINEERING AND APPLIED SCIENCE
PRINCETON UNIVERSITY

D-202, Engineering Quadrangle
Princeton, NJ 08544
(609) 258-5103
E-mail: stengel@princeton.edu
Web: http://www.stengel.mycpanel.princeton.edu

PRINCIPAL INTERESTS

Aerospace Vehicles, Dynamics, Stability, and Control
Robust and Nonlinear Control Theory and Application
Systems Biology
Robotics and Intelligent Systems

SUMMARY OF PROFESSIONAL EXPERIENCE

PRINCETON UNIVERSITY

Professor Emeritus, Mechanical and Aerospace Engineering *(2020-Present)*
Professor, Mechanical and Aerospace Engineering *(1982-2020)*
Associate Dean for Academic Affairs,
School of Engineering and Applied Science *(1994-1997)*
Associate Professor *(1977-1982)*
Director, Program in Robotics and Intelligent Systems *(1988-2018)*
Director, Laboratory for Control and Automation *(1983-2006)*
Director, Flight Research Laboratory *(1977-1983)*

THE ANALYTIC SCIENCES CORPORATION

Section Leader and Member of the Technical Staff *(1973-1977)*

M.I.T. CHARLES STARK DRAPER LABORATORY

Group Head *(1970-1973)*
Member of the Technical Staff *(1968-1973)*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Aerospace Technologist and USAF Officer *(1960-1963)*

EDUCATION

PRINCETON UNIVERSITY
Aerospace and Mechanical Sciences, M.S.E. *(1965)*, M.A. *(1966)*, Ph.D. *(1968)*

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Aeronautics and Astronautics, S.B. *(1960)*

PROFESSIONAL AFFILIATIONS

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
(1976-1992) Senior Member
(1993-Present) Fellow
(2008-Present) Life Fellow

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS
(1960-1973) Member
(1973-1996) Associate Fellow
(1996-Present) Fellow
(2010-Present) Life Fellow

SOCIETY OF AUTOMOTIVE ENGINEERS
(1979-2002) Member, Aerospace Control and Guidance Systems Committee

SIGMA XI
(2005-Present) Member

DETAILS OF EXPERIENCE

PRINCETON UNIVERSITY

COURSES TAUGHT

Aerospace Guidance and Control *(Undergraduate course)*
Aircraft Flight Dynamics *(Undergraduate, graduate courses)*
Automatic Control of Aerospace Vehicles *(Graduate course)*
From the Earth to the Moon *(Freshman seminar)*
Optimal Control and Estimation *(Graduate course)*
Robotics and Intelligent Systems *(Undergraduate course)*
Space Flight Engineering *(Undergraduate course)*
Space System Design *(Undergraduate course)*

PAST SPONSORED RESEARCH

Aerodynamic Modeling for Upset Recovery Simulation *(FAA)*
Optimal Control of Disease Processes *(Shostack Grant)*
New Methods for Cancer Detection (*National Cancer Institute*)
Optimal Control of Disease Processes (*Alfred P. Sloan Foundation*)
Coordinated Flight of Uninhabited Air Vehicles (*Sanders/BAE Systems*)
Neural Network Training *(USA ARO)*
Advanced Air Traffic Management *(FAA)*
Failure-Tolerant Flight Control Systems *(FAA)*
Intelligent Guidance and Control for Wind Shear Encounter *(NASA)*
Knowledge-Based Systems for Computational Control *(USA ARO)*
Intelligent Guidance for Automotive Vehicles
(USA ARO, FHWA, GM, NSF/EPRI)
Intelligent Reconfigurable Control Systems *(USA ARO)*
Computer-Aided Heuristics for Piloted Flight *(USN NASC)*
Stall/Spin Dynamics and Aerodynamics *(The Schultz Foundation)*
Dynamics and Control of Impact Printer Hammers *(IBM)*
High-Order Flying Qualities Criteria *(USN NADC)*
Command and Stability Augmentation with Control Saturation *(NASA)*
Flying Qualities Criteria for Single-Pilot Instrument Flight *(NASA)*
Control, Guidance, and Navigation for General Aviation Aircraft *(NASA)*
Digital Flight Control using Microprocessor Technology *(USN ONR)*
Flight Tests of Direct Side-Force Control *(ONERA, STI/USAF)*

DEPARTMENTAL ACTIVITIES

Professor-in-Charge for Dynamics and Control *(1984-1994)*
Graduate Studies Committee *(1977-1984, 1987-1988, 1993-2001, 2008)*
Seminar Committee *(1986-1988, 1991-1994, 2000-2008)*
Research Committee *(1989-1991)*
Chairman, Faculty Search Committees *(1983-1987, 1989-1993)*
Faculty Development Committee *(1985-1987)*
Acting Director of Graduate Studies *(1982)*
Committee on Undergraduate Studies *(1980-1985)*
Co-Advisor for Classes of 1983, 2003, 2005, 2008, 2010, 2012, 2014
Freshman Advisor *(1979, 2008-2012)*
Equal Employment Opportunity Officer *(2007-2020)*
Graduate Student Career Mentor *(2011-2020)*
Lecturer Search Committee, 2017
Advisor for:
- 19 Ph.D. theses
- 25 M.S.E. theses, 1 M.E. project
- 100+ B.S.E. theses/senior independent work reports
- 7 A.B. theses (Physics, Astrophysics, Woodrow Wilson School)

UNIVERSITY ACTIVITIES

Adviser, Princeton Robotics Club *(2013-2015)*
Affiliated Faculty, Princeton Neuroscience Institute *(2001-2020)*
Butler College Faculty Fellow *(1993-Present)*
Member, Executive Committee for Program in Transportation, SEAS *(1977-2020)*
Affiliated Faculty, Program in Quantitative and Computational Biology *(2005-2012)*
Participating Faculty, Burroughs-Wellcome Graduate Training Program in Biological Dynamics *(2001-2005)*
Member, Graduate School Centennial Steering Committee *(1997-2001)*
Organizer, Alumni College on *The Human Side of Computing (1997)*
Member (ex officio), Course of Study Committee *(1994-1997)*
Coordinator, University report to Accrediting Board for Engineering and Technology *(1995-1996)*
Graduate College Faculty Fellow *(1984-1994)*
Chairman, Rights and Rules Committee, Council of the Princeton University Community *(1980-1982)*
Member, Committee for Topical Program on Robotics and

Industrial Automation, School of Engineering and Applied Science (SEAS) *(1982-1988)*

Member, Executive Committee for Program in Applications of Computing, SEAS *(1990-2012)*

Member, Executive Committee for Program in Engineering and Management Systems, SEAS *(2000-2012)*

THE ANALYTIC SCIENCES CORPORATION, Reading, MA

Technical direction and management of the following projects:

Environmental Impact of Electric Power Generating Plants *(New England Electric Co.)*

Dynamics and Control of Submarines *(USN ONR)*

Rail Vehicle Dynamics *(DOT)*

Digital Control of VTOL Aircraft *(NASA)*

Aircraft Fuel Conservation *(USAF FDL)*

Human Operator-Vehicle Interactions *(USN ONR)*

Command Augmentation for Maneuvering Aircraft *(USN ONR)*

Stability and Control of Maneuvering Aircraft *(NASA)*

M.I.T. CHARLES STARK DRAPER LABORATORY, Cambridge, MA

Principal designer of Lunar Module manual attitude control logic

Technical management and engineering analysis for the following projects:

Space Shuttle Digital Autopilot and Guidance System *(NASA)*

Project Apollo Digital Autopilot *(NASA)*

Digital-Fly-By-Wire (F-8) Aircraft *(NASA)*

Bedside Biomedical Computer

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION,
Wallops Island, VA

Assistant range safety officer for launch operations of sounding rockets and *Scout* satellite launch vehicle

Engineering analysis of rocket trajectories and wind effects

UNITED STATES AIR FORCE

Active duty, assigned to NASA *(1960-1963)*; inactive reserve *(1963-1970)*
Second Lieutenant *(1960-1963)* ; First Lieutenant *(1963-1967)*;
Captain *(1967-1970)*

SUMMER EMPLOYMENT

NORTH AMERICAN AVIATION, Inglewood, CA *(1959)*

Analysis of air loads on *X-15* research aircraft

U.S. NAVY BUREAU OF AERONAUTICS, Washington, DC *(1958)*

Analyses of carrier landing-approach speeds, in-flight refueling, and air-to-air missile dynamics

CURTISS-WRIGHT CORPORATION, Caldwell, NJ *(1957)*

Airfield maintenance

THESES

The Effect of Variations of Structural Efficiency on the Optimum Proportions of a Two Stage Rocket Vehicle, S.B. thesis, M.I.T., 1960.

Wind Profile Measurement using Lifting Wind Sensors, M.S.E. thesis, Princeton U., 1965.

The Measurement of the Atmospheric Wind Profile, Ph.D. thesis, Princeton U.,1968.

AWARDS

NASA Traineeship *(1964-1968)*
NASA Apollo Achievement Award *(1969)*
M.I.T. Certificate of Commendation *(1969)*
AIAA Certificate for Sustained Contributions to the Advancement of the Arts, Science and Technology of Aeronautics and Astronautics *(1985)*

Fellow, Institute of Electrical and Electronics Engineers *(1993)*
Fellow, American Institute of Aeronautics and Astronautics *(1997)*
FAA Excellence in Aviation Award *(1997)*
Grant, Princeton University 250th Anniversary Fund for Innovation in Undergraduate Education *(1999)*
AIAA Mechanics and Control of Flight Award *(2000)*
American Automatic Control Council John R. Ragazzini Education Award *(2002)*
AIAA G. Edward Pendray Aerospace Literature Award *(2012)*

PATENT

Wind Velocity Probing Device and Method, No. 3,507,150, Apr 1970

OTHER PROFESSIONAL INFORMATION

STATE AND NATIONAL COMMITTEES

Committee on Low-Altitude Wind Shear and Its Hazard to Aviation, National Research Council *(1983)*
Committee on the Trans-Atmospheric Vehicle, USAF Scientific Advisory Board *(1984-1985)*
Working Group on Aerospace Technology, Governor's Commission on Science and Technology, State of New Jersey *(1985-1986)*
Panel on Microelectromechanical Systems Research, National Science Foundation *(1988)*
Vice Chairman, Congressional Aeronautical Advisory Committee, U.S. House of Representatives *(1986-1989)*
Mobility Systems Panel, Committee on Strategic Technologies for the Army, National Research Council *(1989-1991)*
Program Council, New Jersey Space Grant Consortium *(1991-2001)*
Aircraft Science & Technology Department Board of Visitors, Office of Naval Research *(1998)*
Committee for Review of ONR Air and Surface Weaponry Program, National Research Council *(1999-2002)*
Committee for Naval Forces' Capability for Theater Missile Defense, National Research Council *(2000)*
Committee for Aeronautics and Aviation Technologies Workshop, American Society of Mechanical Engineers *(2003)*

LISTINGS

American Men and Women of Science
Dictionary of International Biography
Who's Who in the World
Who's Who in America
Who's Who in the East
Who's Who in American Education
Who's Who in Aviation and Aerospace
Who's Who in Engineering
Who's Who in Science and Engineering
Who's Who in Technology Today

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

Atmospheric Flight Mechanics Technical Committee *(1972-1974)*
Working Group on Aircraft Fuel Conservation *(1974)*
Board of Directors, New England Section *(1976-1977)*
Flight Simulation Technical Committee *(1981-1983)*
Guidance, Navigation, and Control Technical Committee *(1987-1990)*
Working Group on R&D Planning for Civil Aviation in the 21st Century *(1988)*
Working Group on the Role of Technology in Revitalizing U.S. General Aviation *(1989)*
Artificial Intelligence Technical Committee *(1992-1993)*
Working Group on Highly-Reusable Space Transportation *(1996)*
Fellow Peer Review *(2005-2006)*

AMERICAN AUTOMATIC CONTROL COUNCIL

Chairman, AACC Awards Committee *(1989-1991)*
Chairman, AACC Education Award Subcommittee,
(1988-1989, 2002-2003, 2007-2008)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

Associate Editor at Large, *IEEE Transactions on Automatic Control*
(1990-1994)
Aerospace Electronics and Systems Society *(1976-2001)*
Control Systems Society *(1976-Present)*
Robotics and Automation Society *(1985-2005)*
Juror, Best *Transactions on Automatic Control* Paper for 1982-1983

INTERNATIONAL FEDERATION OF AUTOMATIC CONTROL

Member, Air Traffic Control Automation Working Group *(1993-2001)*

CAMBRIDGE UNIVERSITY PRESS

North American Editor, Cambridge Aerospace Series *(1993-1999)*

INSTITUTE OF PHYSICS (UK)

Editorial Board Member, *Journal of Micromechanics and Microengineering (1990-1993)*

INVITED LECTURES

California Institute of Technology
Clemson University
Cornell University
Delft University of Technology
Drexel University
Duke University
George Washington University
Georgia Institute of Technology
Imperial College of Science, Medicine and Technology
Institute for Advanced Study
Massachusetts Institute of Technology
New Jersey Institute of Technology
Ohio State University
Pennsylvania State University
Princeton University
Purdue University
Rutgers University
Stanford University
Texas A&M University
University of Buffalo
University of California, Berkeley
University of California, Irvine
University of California, San Diego
University of California, Santa Barbara
University of Cambridge
University of Maryland
University of Michigan
University of Minnesota
University of Pennsylvania
Yale University
AIAA Wichita Section
AIAA Princeton Section
AIAA Philadelphia Section
General Electric Company
General Motors Corporation
Grumman Aerospace Corporation
MIT Club of Princeton
NASA Langley Research Center
The Old Guard of Princeton

Plenary Lecture, 9th International Symposium on Intelligent Control, Columbus, OH, Aug 1994.

Plenary Lecture, 3rd IEEE NY/NJ Regional Conference, New Brunswick, NJ, Aug 1994.

Tutorial, IFAC International Workshop on Robust Control, Napa, CA, June 1996

From the Earth to the Moon, Princeton Alumni Day Lecture, Feb 2014

Project Apollo: Origins, Missions, and the Legacy, Historical Society of Princeton (3/19), Princeton Public Library (5/19), Boothbay Harbor Public Library (8/19), Old Guard of Princeton (2/20)

Boeing 737 MAX, Princeton MAE (4/19)

CONGRESSIONAL TESTIMONY

Comments on Findings of Congressional Aeronautical Advisory Committee regarding 1989 NASA Authorization, Hearings before the Transportation, Aviation, and Materials Subcommittee of the Committee on Science, Space, and Technology, U.S. House of Representatives, Apr 1988.

Long-Term Research on Air Transportation Technology, Statement before the Technology and Competitiveness Subcommittee of the Committee on Science, Space, and Technology, U.S. House of Representatives, Oct 1991.

VISITING PROFESSOR/SCHOLAR APPOINTMENTS

Delft University of Technology *(1998)*
Duke University *(1998)*
Imperial College of Science, Technology and Medicine *(1998)*
Massachusetts Institute of Technology *(1998)*
Stanford University *(1998)*
University of California, San Diego *(1998)*
University of Cambridge *(1998)*
Institute for Advanced Study *(2005)*

CONSULTING

American Aviation Services Corporation
ARMA Division of United Technologies Corporation
ECON, Incorporated
Educational Testing Services
Fairfield Resources International
Foley & Lardner
General Motors Corporation
Grumman Aerospace Corporation
Hindustan Aerospace, Limited
Kearfott Division of Singer Corporation
Leatherwood, Walker, Todd, & Mann
Osterlenk, Faber, Gerb, and Soffen
Perkins Coie
Pietragallo, Bennett, and Gordon
RCA Astro-Electronics
Reflectone, Incorporated
Research Triangle Institute

Smiley, Olson, Gilman & Pangia
U.S. Navy Test Pilot School
United States Golf Association

TECHNICAL PAPER/BOOK REVIEW FOR:

Acta Astronautica
Aerospace Science and Technology
AIAA *Journal of Aircraft*
AIAA *Journal of Guidance, Control, and Dynamics*
AIAA *Journal of Spacecraft and Rockets*
Annals of the International Society for Dynamic Games
Applied Mathematical Modeling
ASME *Journal of Dynamic Systems, Measurement and Control*
Automatica
BioMedical Engineering Online
BMC Infectious Diseases
Cellular and Molecular Life Sciences
Computer
Control and Intelligent Systems
Dynamics of Continuous, Discrete and Impulsive Systems
Engineering in Medicine and Biology Magazine
Fuzzy Sets & Systems
International Journal of Biomathematics
IEEE Spectrum
IEEE Transactions on Automatic Control
IEEE Transactions on Aerospace and Electronic Systems
IEEE Transactions on Control Systems Technology
IEEE Transactions on Energy Conversion
IEEE Transactions on Systems, Man, and Cybernetics
IEEE Control Systems Magazine
ISA Transactions
John Wiley & Sons, Inc.
Journal of Biological Dynamics
Journal of Mathematical Biology
Journal of Ocean Engineering
Journal of Optimization Theory & Applications
Journal of Theoretical Biology
Journal of the Franklin Institute
Mathematical and Computer Modelling of Dynamical Systems
Mathematical Biosciences

Numerical Methods for Partial Differential Equations
Optimal Control: Applications & Methods
PLOS One
Prentice-Hall, Inc.
Princeton University Press
Transactions on Microelectromechanical Systems

PROPOSAL REVIEW FOR:

National Aeronautics and Space Administration
National Science Foundation
New Jersey Space Grant Consortium
Research Council of Norway
U.S. Army Research Office

ALUMNI ACTIVITIES

Board of Governors, Association of Princeton Graduate Alumni *(1993-1996, 1976-1978)*
Secretary, M.I.T. Class of 1960 *(1975-1980)*
M.I.T. Alumni Fund:
Alumni Fund Council *(1969-1972)*
Regional Chairman, Cambridge, MA *(1969)*
Regional Vice Chairman, Princeton, NJ *(1966)*

PUBLICATIONS of Robert F. Stengel

BOOKS

1. *OPTIMAL CONTROL AND ESTIMATION*, Dover Publications, New York, 1994. (originally published as *STOCHASTIC OPTIMAL CONTROL; Theory and Application*, J. Wiley & Sons, New York, 1986.)

2. *FLIGHT DYNAMICS*, Princeton University Press, Princeton, 2004.

JOURNAL PAPERS AND BOOK CHAPTERS

1. Wind Profile Measurement Using Lifting Sensors, *J. Spacecraft and Rockets*, Vol. 3, No. 3, Mar 1966, pp. 365-373.

2. Flight Performance of a Small, Low Altitude Rocket, *J. Spacecraft and Rockets*, Vol. 3, No. 6, June 1966, pp. 938-939.

3. Comments on "Approximate Theory for Terminal Velocity of a Freely Falling Body," *J. Spacecraft and Rockets*, Vol. 5, No. 3, Mar 1968, p. 367.

4. Comments on "Mesoscale Wave Motions as Revealed by Improved Wind Profile Measurement," *J. Applied Meteorology*, Vol. 7, No. 3, June 1968, pp. 513-515.

5. Manual Attitude Control of the Lunar Module, *J. Spacecraft and Rockets*, Vol. 7, No. 8, Aug 1970, pp. 941-948.

6. Altitude Stability in Supersonic Cruising Flight, *J. Aircraft*, Vol. 7, No. 5, Sept-Oct 1970, pp. 464-473.

7. Optimal Transition from Entry to Cruising Flight, *J. Spacecraft and Rockets*, Vol. 8, No. 11, Nov 1971, pp. 1126-1132.

8. Strategies for Control of the Space Shuttle Transition, *J. Spacecraft and Rockets*, Vol. 10, No. 1, Jan 1973, pp. 77-84.

9. Some Effects of Bias Errors in Redundant Flight Control Systems, *J. Aircraft,* Vol. 10, No. 3, Mar 1973, pp. 150-156.

10. Optimal Guidance for the Space Shuttle Transition, *J. Spacecraft and Rockets*, Vol. 11, No. 3, Mar 1974, pp. 173-179. Republished in *Historical Celebration* section, *Journal of Spacecraft and Rockets*, Vol. 40, No. 6, Nov-Dec 2003, pp. 966-972.

11. Effect of Combined Roll Rate and Sideslip Angle on Aircraft Flight Stability, *J. Aircraft*, Vol. 12, No. 8, Aug 1975, pp. 683-685.

12. Energy Management for Fuel Conservation in Transport Aircraft, *IEEE Trans. Aerospace and Electronic Systems*, Vol. AES-12, No. 4, July 1976, pp. 464-470 (with F. Marcus).

13. Stability and Control of Maneuvering High-Performance Aircraft, *J. Aircraft*, Vol. 14, No. 8, Aug 1977, pp. 787-794 (with P. Berry).

14. Stability of the Pilot-Aircraft System in Maneuvering Flight, *J. Aircraft*, Vol. 14, No. 10, Oct 1977, pp. 959-965 (with J. Broussard).

15. Digital Controllers for VTOL Aircraft, *IEEE Trans. Aerospace and Electronic Systems*, Vol. AES-14, No. 1, Jan 1978, pp. 54-63 (with J. Broussard and P. Berry).

16. Digital Flight Control Design for a Tandem-Rotor Helicopter, *Automatica*, Vol. 14, No. 4, July 1978, pp. 301-311 (with J. Broussard and P. Berry).

17. Prediction of Pilot-Aircraft Stability Boundaries and Performance Contours, *IEEE Trans. Systems, Man, and Cybernetics*, Vol. SMC-8, No. 5, May 1978, pp. 349-356 (with J. Broussard).

18. Digital Flight Control Research Using Microprocessor Technology, *IEEE Trans. Aerospace and Electronic Systems*, Vol. AES-15, No. 3, May 1979, pp. 397-404.

19. Flight Investigation and Theory of Direct Side-Force Control, *J. Guidance and Control*, Vol. 2, No. 6, Nov-Dec. 1979, pp. 471-478 (with W. B. Binnie).

20. In-Flight Simulation with Pilot-Center of Gravity Offset and Velocity Mismatch, *J. Guidance and Control*, Vol. 2, No. 6, Nov-Dec 1979, pp. 538-540.

21. Some Effects of Parameter Variations on the Lateral-Directional Stability of Aircraft, *J. Guidance and Control*, Vol. 3, No. 2, Mar-Apr 1980, pp. 124-131 (Also translated and republished in the Soviet journal, *Rocket Technology and Cosmonautics*, Vol. 19, No. 2, Feb 1981, pp. 140-149).

22. Flight Tests of a Microprocessor Control System, *J. Guidance and Control*, Vol. 3, No. 6, Nov-Dec 1980, pp. 494-500 (with G. E. Miller). (Also translated and republished in the Soviet journal, *Rocket Technology and Cosmonautics*, Vol. 19, No. 5, May 1981, pp. 121-130).

23. An Introduction to Stochastic Optimal Control Theory, in *Theory and Applications of Optimal Control in Aerospace Systems*, NATO AGARD-AG-251, Paris, July 1981, pp. 3-1 to 3-33.

24. Stalling Characteristics of a General Aviation Aircraft, *J. Aircraft*, Vol. 19, No. 6, June 1982, pp. 425-434 (with W. B. Nixon).

25. Equilibrium Response of Flight Control Systems, *Automatica*, Vol. 18, No. 3, May 1982, pp. 343-348.

26. A Microprocessor-Based Data Acquisition System for Stall/Spin Research, *IEEE Trans. Aerospace and Electronic Systems*, Vol. AES-19, No. 1, Jan 1983, pp. 59-69 (with M. Sri-Jayantha).

27. A Unifying Framework for Longitudinal Flying Qualities Criteria, *J. Guidance, Control, and Dynamics*, Vol. 6, No. 2, Mar-Apr 1983, pp. 84-90 (Also translated and republished in the Soviet journal *Aeronautics/Space Technology*, Vol. 1, No. 12, Dec 1983, pp. 99-107).

28. Distributed Processing and Fiber-Optic Communications in Air Data Measurement, *IEEE Trans. Aerospace and Electronic Systems*, Vol. AES-19, No. 3, May 1983, pp. 467-473 (with K. Farry).

29. Effects of Displacement and Rate Saturation on the Control of Statically Unstable Aircraft, *J. Guidance, Control, and Dynamics*, Vol. 7, No. 2, Mar-Apr 1984, pp. 197-205 (with G. Hanson).

30. Design and Flight Test of a Lateral-Directional Command Augmentation System, *J. Guidance, Control, and Dynamics*, Vol. 7, No. 3, May-June 1984, pp. 361-368 (with D. Atzhorn). (Also translated and republished in the Soviet journal *Aeronautics/Space Technology*, Vol. 3, No. 3, Mar 1985, pp. 47-56).

31. Design and Flight Testing of Digital Direct Side-Force Control Laws, *J. Guidance, Control, and Dynamics*, Vol. 8, No. 2, Mar-Apr 1985, pp. 188-193 (with S. Grunwald).

32. Analysis of Aircraft Control Strategies for Microburst Encounters, *J. Guidance, Control, and Dynamics*, Vol. 8, No. 5, Sept-Oct 1985, pp. 553-559 (with M. Psiaki).

33. Data Acquisition Systems and Methodology for High Angle of Attack Parameter Estimation, *Technical Soaring*, Vol. 9, No. 4, Nov 1985, pp. 85-95 (with M. Sri-Jayantha).

34. Longitudinal Flying Qualities Criteria for Single-Pilot Instrument Flight Operations, *J. Aircraft*, Vol. 23, No. 2, Feb 1986, pp. 111-117 (with A. Bar-Gill).

35. Optimal Flight Paths Through Microburst Wind Profiles, *J. Aircraft*, Vol. 23, No. 8, Aug 1986, pp. 629-635 (with M. Psiaki).

36. Propulsion and Staging Considerations for an Orbital Sortie Vehicle, *Acta Astronautica*, Vol. 15, No. 1, Jan. 1987, pp.29-34.

37. Flight Control Design Using Non-linear Inverse Dynamics, *Automatica*, Vol. 24, No. 4, July 1988, pp. 471-483 (with S. Lane).

38. Determination of Nonlinear Aerodynamic Coefficients Using the Estimation-Before-Modeling Method, *J. Aircraft*, Vol. 25, No. 9, Sept 1988, pp. 796-804 (with M. Sri-Jayantha).

39. Combining Expert System and Analytical Redundancy Concepts for Fault-Tolerant Flight Control, *J. Guidance, Control, and Dynamics*, Vol. 12, No. 1, Jan-Feb 1989, pp. 39-45 (with D. Handelman).

40. Stability Boundaries for Aircraft with Unstable Lateral-Directional Dynamics and Control Saturation, *J. Guidance, Control, and Dynamics*, Vol. 12, No. 1, Jan-Feb 1989, pp. 62-70 (with P. Shrivastava).

41. An Expert System for Wind Shear Avoidance, *Engineering Applications of Artificial Intelligence*, Vol. 2, No. 3, Sept 1989, pp. 190-197 (with D. A. Stratton).

42. Intelligent Guidance for Headway and Lane Control, *Engineering Applications of Artificial Intelligence*, Vol. 2, No. 4, Dec 1989, pp. 307-314 (with A. Niehaus).

43. Perspectives on the Use of Rule-Based Control, in *Artificial Intelligence in Real-Time Control*, M. G. Rodd and G. J. Suski, ed., Pergamon Press, New York, 1989, pp. 27-32 (with D. Handelman).

44. Restructurable Control Using Proportional-Integral Implicit Model Following, *J. Guidance, Control, and Dynamics*, Vol. 13, No. 2, Mar-Apr 1990, pp. 303-309 (with C. Huang).

45. Closed-Loop Digital Control of an Impact Printer Hammer, *J. Dynamic Systems, Measurement and Control*, Vol. 112, No. 1, Mar 1990, pp. 69-75 (with L. Ryan).

46. Quantitative Knowledge Acquisition for Expert Systems, *Engineering Applications of Artificial Intelligence*, Vol. 3, No. 4, Dec 1990, pp. 271-281 (with B. Belkin).

47. Stochastic Robustness of Linear-Time-Invariant Control Systems, *IEEE Trans. Automatic Control*, Vol. 36, No. 1, Jan 1991, pp. 82-87 (with L. R. Ray).

48. Optimal Aircraft Performance During Microburst Encounter, *J. Guidance, Control, and Dynamics*, Vol. 14, No. 2, Mar-Apr 1991, pp. 440-446. (with M. Psiaki).

49. An Expert System for Automated Highway Driving, *IEEE Control Systems Magazine*, Vol. 11, No. 3, Apr 1991, pp. 53-61 (with A. Niehaus).

50. Intelligent Failure-Tolerant Control, *IEEE Control Systems Magazine*, Vol. 11, No. 4, June 1991, pp. 14-23.

51. Systematic Methods for Knowledge Acquisition and Expert System Development, *IEEE Aerospace and Electronic Systems Magazine*, Vol. 6, No. 6, June 1991, pp. 3-11 (with B. Belkin).

52. Application of Stochastic Robustness to Aircraft Control Systems, *J. Guidance, Control, and Dynamics*, Vol. 14, No. 6, Nov-Dec 1991, pp. 1251-1259 (with L. R. Ray).

53. Probabilistic Reasoning for Intelligent Wind Shear Avoidance, *J. Guidance, Control, and Dynamics*, Vol. 15, No. 1, Jan-Feb 1992, pp.247-254 (with D. A. Stratton).

54. On the Flight of a Golf Ball in the Vertical Plane, *Dynamics and Control*, Vol. 2, No. 2, Apr 1992, pp. 147-159.

55. Comments on "Effect of Thrust/Speed Dependence on Long-Period Dynamics in Supersonic Flight," *J. Guidance, Control, and Dynamics*, Vol. 15, No. 3, May-June 1992, pp. 795-797.

56. Robustness of Solutions to a Benchmark Control Problem, *J. Guidance, Control, and Dynamics*, Vol. 15, No. 5, Sept-Oct 1992, pp. 1060-1067 (with C. Marrison).

57. Stochastic Prediction Techniques for Wind Shear Hazard Assessment, *J. Guidance, Control, and Dynamics*, Vol. 15, No. 5, Sept-Oct 1992, pp. 1224-1229 (with D. A. Stratton).

58. AUTOCREW: A Paradigm for Intelligent Flight Control, *An Introduction to Intelligent and Autonomous Control*, P. Antsaklis and K. Passino, ed., Kluwer Academic Publishers, Norwell, MA, 1993, pp. 371-400 (with B. Belkin).

59. Stochastic Measures of Performance Robustness in Aircraft Control Systems, *J. Guidance, Control, and Dynamics*, Vol. 15, No. 6, Nov-Dec 1992, pp. 1381-1387 (with L. R. Ray).

60. A Monte Carlo Approach to the Analysis of Control System Robustness, *Automatica*, Vol. 29, No. 1, Jan 1993, pp. 229-236 (with L. R. Ray).

61. Computer-Aided Analysis of Linear Control System Robustness, *Mechatronics*, Vol. 3., No. 1, Jan. 1993, pp. 119-124. (with L. R. Ray).

62. Robust Kalman Filter Design for Predictive Wind Shear Detection, *IEEE Trans. Aerospace and Electronic Systems*, Vol. 29, No. 4, Oct 1993, pp. 1185-1194. (with D. A. Stratton).

63. Target Pitch Angle for the Microburst Escape Maneuver, *J. Aircraft*, Vol. 30, No. 6, Nov-Dec 1993, pp. 826-832. (with S. Mulgund).

64. Optimal Recovery from Microburst Wind Shear, *J. Guidance, Control, and Dynamics*, Vol. 16, No. 6, Nov-Dec 1993, pp. 1010-1017. (with S. Mulgund).

65. Identification of Aerodynamic Coefficients Using Computational Neural Networks, *J. Guidance, Control, and Dynamics*, Vol. 16, No. 6, Nov-Dec 1993, pp. 1018-1025 (with D. Linse).

66. Toward Intelligent Flight Control, *IEEE Trans. Systems, Man, and Cybernetics*, Vol. 23, No. 6, Nov-Dec 1993, pp. 1699-1717.

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47. Aerospace Guidance and Control, in *Using MATLAB in the Classroom*, Prentice Hall, Englewood Cliffs, 1993, pp. 3-26.

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53. Optimal Control of Disease Processes, TR-202-1, Princeton University, Princeton, Aug 2002.

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DC, R. Loewy and E. Dowell, co-chairs, 2003.

55. *Introduction to Aircraft Flight Dynamics: A Virtual Textbook*, http://www.stengel.mycpanel.princeton.edu/AFDVirTex.html, 2013.

56. Lecture Slides for *Space System Design*, http://www.stengel.mycpanel.princeton.edu/MAE342Lectures.html, 2016.

57. Lecture Slides for *Robotics and Intelligent Systems*, http://www.stengel.mycpanel.princeton.edu/MAE345Lectures.html, 2017.

58. *Robotics and Intelligent Systems: A Virtual Textbook*, http://www.stengel.mycpanel.princeton.edu/RISVirText.html, 2017.

59. Lecture Slides for *Optimal Control and Estimation*, http://www.stengel.mycpanel.princeton.edu/MAE546Seminars.html, 2018.

60. Lecture Slides for *Aircraft Flight Dynamics*, http://www.stengel.mycpanel.princeton.edu/MAE331Lectures.html, 2019.

61. Lecture Slides for *From the Earth to the Moon*, http://www.stengel.mycpanel.princeton.edu/FRSSeminarSlides.html, 2019.

GRADUATE STUDENTS Advised by Robert F. Stengel

NAME	THESIS TITLE AND DATE
	COMPLETED PH.D. DEGREES
Aharon Bar-Gill	*Longitudinal Flying Qualities Criteria for Single-Pilot Instrument Flight Operations, 1982*
Muthathamby Sri Jayantha	*Data Acquisition and Aerodynamic Coefficient Estimation at High Angles of Attack, 1983*
Prakash C. Shrivastava	*Stability Regions of Relaxed Static Stability Aircraft Under Control Saturation Constraints, 1986*
Mark L. Psiaki	*Control of Flight Through Microburst Wind Shear Using Deterministic Trajectory Optimization, 1987*
Stephen H. Lane	*Theory and Development of Adaptive Flight Control Systems Using Nonlinear Inverse Dynamics, 1988*
David A. Handelman	*A Rule-Based Paradigm for Intelligent Adaptive Flight Control, 1989*
Chien Y. Huang	*A Methodology for Knowledge-Based Restructurable Control to Accommodate System Failures, 1989*
Laura Ryan Ray	*Stochastic Robustness of Linear Multivariable Control Systems: Towards Comprehensive Robustness Analysis, 1990*
D. Alexander Stratton	*Aircraft Guidance for Wind Shear Avoidance: Decision Making Under Uncertainty, 1992*

Sandeep S. Mulgund	*Longitudinal Aircraft Flight in Wind Shear: Deterministic Trajectory Optimization and Feedback Control Using Nonlinear Inverse Dynamics, 1994*
Dennis J. Linse	*System Identification for Adaptive Nonlinear Flight Control Using Neural Networks, 1994*
Christopher I. Marrison	*The Analysis and Design of Control Laws for Uncertain Systems Using Stochastic Metrics, 1994*
Axel Niehaus	*Optimal Rule-Based Guidance for Autonomous Vehicles, 1995*
Kristina Richardson	*Identification of Aerodynamic Coefficients with a Neural Network, 1999*
Sai Manohar Gopisetty	*Failure Detection and Identification: Application to Flight Control, 2000*
Qian Wang	*Stochastic Robust Control of Nonlinear Systems, 2001*
Silvia Ferrari	*Algebraic and Adaptive Learning in Neural Control Systems, 2002*
John Wangermann	*Principled Negotiation and Distributed Optimization for Advanced Air Traffic Management, 2003*
Nilesh Kulkarni	*Predictive and Reinforcement Learning for Magneto-Hydrodynamic Control of Hypersonic Flows, 2007 (co-advised with Minh Phan, Dartmouth College)*

COMPLETED M.S.E. DEGREES

W. Brian Binnie	*Direct Side Force Control - A Flight Investigation of Handling Qualities During Terminal Area Operations, 1978*
Jean M. Fernand	*Determination of the Stability and Control Derivatives for the Variable-Response Research Aircraft using a Modified Maximum Likelihood Estimator, 1978*
Richard Lucal	*Pilot-Vehicle Interactions as Predicted by an Optimal Control Model, 1979*
James C. Seat	*A Flight Investigation of Digital Control using Microprocessor Technology, 1979*
James M. Steinberger	*In-Flight Simulation of the General Aviation Aircraft Stall, 1979*
David Atzhorn	*Digital Command Augmentation for Lateral-Directional Aircraft Dynamics, 1981*
Gregory D. Hanson	*Command and Stability Augmentation Techniques for Aircraft with Control Saturation, 1981*
Ralph A. Nichols	*Implementation and Evaluation of an OMEGA-Dead Reckoning Hybrid Navigation System, 1981*
John A. Foxgrover	*Design and Flight Test of a Digital Flight Control System for General Aviation Aircraft, 1982*
Claude Fratter	*Determination of the Aerodynamic Coefficients for the Avionics Research Aircraft using the Estimation-Before-Modeling Technique, 1982*

Scott L. Grunwald	*Command Augmentation Incorporating Direct Side Force Control and Microprocessor Technology, 1982*
Francois Dallery	*Failure Detection and Identification for a Reconfigurable Flight Control System, 1983*
William A. Ehrenstrom	*A Lateral-Directional Controller for High-Angle-of-Attack Flight, 1983*
Michael E. Murphy	*In-Flight Longitudinal Handling Qualities Investigation for Complex Flight Control Systems, 1984*
Xavier Silhouette	*Estimation of the Aerodynamic Coefficients and Derivatives of the Navion Aircraft at High Angles of Attack and Sideslip, 1986*
Gary C. Hsieh	*Experimental Study of the Aerodynamics of a Rectangular Wing in Steady-State Spin, 1986*
Kristin Farry	*Distributed Processing and Fiber Optic Communications in Air Data Measurement, 1988*
David B. Glade	*In-Flight Investigation of Longitudinal Flying Qualities Criteria, 1988*
Robert M. Taylor	*Identification of Printer Hammer Dynamics using the Estimation-Before-Modeling Technique, 1988*
Brenda L. Belkin	*Cooperative Rule-Based Systems for Aircraft Navigation and Control, 1989*
Parvadha Suntharalingam	*Applications of Computer-Aided Control System Design to Linear Quadratic Model-Following, 1989*

Daniel Swanson	*State Estimation for a Tethered Satellite System Using the Extended Kalman Filter Algorithm, 1991*
Darin Spilman	*Dynamic Response and Control of a Jet Transport Aircraft to a Single-Axis Wind Vortex, 1993*
Laura Iwan	*Design of a CMAC Neural Network Controller for the Preferential Oxidation Reactor in a Fuel Cell Vehicle's On0board Methanol Fuel Processor, 1997*
Olivier Laplace	*Coordinated Flight of Uninhabited Air Vehicles, 2001*

COMPLETED M.E. DEGREE

Beck Chen	*Indoor Autonomous UAV Helicopter, 2011*