

Barış Fidan, PhD

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Curriculum Vitae

National ICT Australia & the Australian National University
Locked Bag 8001, Canberra, ACT-2601, Australia

RESEARCH INTERESTS

AUTONOMOUS MULTI-AGENT DYNAMICAL SYSTEMS AND SENSOR NETWORKS

- Control and Coordination of Autonomous Multi-Agent/Vehicle/Robot Systems
- Information Structures for Multi-Agent Formations and Sensor Networks
- Sensor/Emitter/Agent Localization
- Cooperative Geolocation: Coverage Problems
- Graph Theoretical Methods
- Rigidity, Persistence, and Robustness

NONLINEAR, ADAPTIVE, AND SWITCHED SYSTEMS

- Robust Adaptive Control
- Nonlinear/Switching Control of Multivariable/Time Varying/Multi-Agent Systems
- Triangular Systems and Backstepping Control
- Adaptive/Nonlinear Observer and Filter Design
- Supervisory Control

CONTROL APPLICATIONS

- Flight Control of High Performance Aircraft and Hypersonic Vehicles
- Semiconductor Manufacturing Process Control
- Disk Drive Servo-Systems
- Control of Vehicular/Transportation Systems
- Applications of Adaptive/Switching Control in Communication and Traffic
- Modeling and Control Issues in Micro/Nano Technology

ROBOTICS AND INTELLIGENT SYSTEMS

- Multi-Agent Systems
- Motion Planning and Control of Mobile Robots
- Articulated/Reconfigurable Robots
- Active Vision and Vision Based Control
- Neural Network Based Approaches

EDUCATION

PH.D. IN ELECTRICAL ENGINEERING – SYSTEMS

University of Southern California, Los Angeles, USA

Sep. 1998 – Dec. 2003

Emphasis of studies: Controls. Outside Minor: Aerospace Engineering.

GPA: 4.00/4.00

Ph.D. Dissertation: “*Nonlinear and Adaptive Control of Time Varying and Multivariable Systems: New Designs and Applications*”

Thesis Advisor: Prof. Petros A. Ioannou

M.S. IN ELECTRICAL AND ELECTRONICS ENGINEERING

Bilkent University, Ankara, Turkey,

Sep. 1996 – July 1998

Emphasis of studies: Controls, robotics, and neural networks.

GPA: 3.93/4.00

M.S. Thesis: “*Motion Planning of a Mechanical Snake Using Neural Networks*”

Thesis Advisor: Prof. M. Erol Sezer

B.S. IN ELECTRICAL AND ELECTRONICS ENGINEERING

Middle East Technical University, Ankara, Turkey,

Sep. 1992 – July 1996

Emphasis of senior studies: Controls and computers.

GPA: 3.46/4.00

B.S. IN MATHEMATICS

Middle East Technical University, Ankara, Turkey,

Sep. 1992 – July 1996

Double major program.

GPA: 3.74/4.00

WORK EXPERIENCE - RESEARCH

RESEARCHER (FEB 2005 – JUNE 2007)/ SENIOR RESEARCHER (JULY 2007 - CURRENT)

- NICTA - National ICT Australia and ANU-Australian National University Feb. 2005–Current
 - Adjunct in CECS - College of Engineering and Computer Science, ANU.
 - Key investigator and deputy project leader in a 3-year NICTA-DSTO (The Australian Defence Science and Technology Organisation) project, “SWARM-2: Coordination, Control, Localization and Health Characterization of Multi-Agent Swarms” (total grant value: Au \$1,239,000).
 - Was key investigator and deputy project leader in a completed 3-year NICTA-DSTO project, “SWARM: Characterization, Diagnosis, and Assurance of Health and Quality of Sensor Formations” (total grant value: Au \$866,000).
 - Was investigator in a completed 1-year NICTA-Seeing Machines Inc. project, “Tracking Driver Drowsiness using Head Movements”.
 - Researching on:
 - Distributed nonlinear and adaptive control of autonomous multi-agent systems
 - Distance/direction based robust localization of sensor networks/emitter arrays
 - Estimator design, geometric problems and optimal coverage in distance/direction(AOA)/range difference(TDOA)/scan based cooperative emitter geolocation
 - Characterization, diagnosis and assurance of formation/sensor network health/robustness/quality
 - Graph theoretical tools for acquiring and maintaining minimal/global/redundant rigidity of formations/sensor networks
 - Modeling and control of air-breathing hypersonic flight vehicles
 - Adaptive control of multivariable nonlinear systems
 - Linear system theoretical modeling and identification of the physiological head stabilization system in humans with application to detection/tracking of driver drowsiness
 - Worked on establishing a multidisciplinary complex systems engineering initiative/platform for collaboration of academics working on different aspects of complex systems engineering in Canberra. Performed initial/background studies on a number of relevant topics (in addition to those listed above) including vision based multi-vehicle control, power grids, synchronization issues in networked systems, etc.
 - Academic/Research Visits:
 - University of California Santa Barbara, USA, May-June 2006
 - TOBB University of Economics and Technology, Turkey, July-August 2006, June 2007, June-July 2008
 - University of Southern California, Los Angeles, USA, December 2006, June & November-December 2008
 - Universite Catholique de Louvain, Belgium, June 2007
 - Delft University of Technology, Netherlands, June 2007
 - University of California San Diego, USA, June 2008

POSTDOCTORAL RESEARCH ASSOCIATE

- Department of Electrical Eng., USC – University of Southern California Jan. 2004 – Jan. 2005
 - Member of CATT – Center for Advanced Transportation Technologies, USC.
 - Designed and analyzed new adaptive control schemes for various classes of nonlinear, time varying, and/or multivariable systems.
 - Worked on modeling and flight control of air-breathing hypersonic vehicles. Developed nonlinear and adaptive controllers for high performance and hypersonic aircraft based on time varying models.
 - Contributor in preparation of a research proposal on “Modeling, Control, and Simulation of Airbreathing Hypersonic Vehicles,” which is later accepted and granted by USA DoD/AFOSR (US\$350,000), noting that the proposal is heavily based on the publications [C8],[C9] (please see the publication list).

RESEARCH ASSISTANT

- Department of Electrical Eng., USC – University of Southern California Sep. 1998 – Dec. 2003
 - Co-developed the Adaptive Control Toolbox (as a commercial software) for MATLAB & Simulink.
 - Co-authored a textbook on Online Parameter Identification and Adaptive Control.
 - Designed and analyzed nonlinear and adaptive controllers for certain classes of time varying and multivariable plants.
 - Designed several real-time feedback controllers for semiconductor etching processes. Wrote the C-codes for implementation of these designs, which were successfully tested in laboratory experiments at the Center for the Intelligent Manufacturing of Semiconductors (CIMOS), USC.
 - Assisted in testing and improvement of a new estimation scheme for hard disk drives, and design and simulation of servo controllers based on this estimator, which are implemented by Acorn Technologies Inc.
 - Assisted in development of control techniques for large segmented telescopes, which are implemented in NASA-SPACE Laboratory of California State University – Los Angeles.
 - Researched on dynamics, modeling, and control of air-breathing hypersonic flight.
- Electrical&Electronics Eng. Department, Bilkent University, Turkey Sep. 1996 – Aug. 1998
 - Developed optimal strategies for path planning of articulated mobile robots. Designed neural network controllers for motion planning of such robots. Formalized an effective neural network training approach in the literature and applied it to the motion planner design.

SUMMER INTERN

- Computer Hardware and Software Group, TUBITAK – the Scientific and Technical Research Council of Turkey, Information Technologies and Electronics Research Institute (Summer 1994)
 - Worked on software/hardware design and testing for several automation systems used in wear industry.

WORK EXPERIENCE – TEACHING

INSTRUCTOR

- CECS - College of Engineering and Computer Science, ANU Feb. 2006–Current
 - Courses instructed:
 - Parameter Identification and Adaptive Control (1st Semester, 2006)
 - Digital Signal Processing and Control (2nd Semester, 2007)
 - Nonlinear and Adaptive Control (1st Semester, 2008)

TEACHING ASSISTANT / GRADER

- Department of Electrical Eng., University of Southern California Sep. 1998 – May 2000, Jan. 2003 – May 2003
 - Taught discussion lectures, prepared/graded homework assignments and midterm exams, prepared course web pages, and taught regular lectures in the absence of instructor.
 - Courses assisted:
 - Applied Linear Algebra for Engineering (EE 241)
 - Introduction to Linear Systems (EE 301a)
 - Introduction to Probability and Statistics for Electrical Engineering (EE 364)
 - Digital Control Systems (EE 543a)
 - On-Line Parameter Identification and Adaptive Control (EE 599)
- Electrical&Electronics Eng. Department, Bilkent University, Turkey Sep. 1996 – Aug. 1998
 - Prepared/graded homework assignments, laboratory quizzes, and laboratory assignments. Conducted laboratory sessions. Prepared experimental set-ups and laboratory manuals. Tutored in using MATLAB and Simulink.
 - Courses assisted:
 - Digital Electronics (EE 312)
 - Sampled Data Systems (EE 445/548)
 - Feedback Control Systems (EE 447)

WORK EXPERIENCE – SUPERVISION

(The mark * indicates that BF is co-supervisor. If unmarked, BF is principal supervisor.)

PHD THESIS

- Changbin Yu* (ANU & NICTA, 2005-2007): *Cooperative Control and Sensor Network Localization via Graph Rigidity*
- Iman Shames* (ANU & NICTA, 2006-Current): *Motion Control for Persistent Formations of Autonomous Multi-Agent Systems*
- Anushiya Kannan* (U of Sydney & NICTA, 2005-Current): *Distance-Based Localization in Wireless Sensor Networks*
- Obaid Rehman* (U of New South Wales at ADFA, 2008-Current): *Robust Control of Air-breathing Hypersonic Flight Vehicles*

MS/BS/HONORS PROJECT

- Dirk van der Walle* (Delft University of Technology, Netherlands, Nov 2006-Nov 2007): *Control of Rigid Formations for Surveillance*
- Andrew Sutton* (ANU, 2007) : *Laser Frequency Stabilisation by Dual Arm Locking for the LISA Gravitational Wave Detector*
- Shaohao Zhai (ANU, July 2007-Nov 2007) : *Single-View Depth-Estimation Based Formation Control*
- Na Cen (ANU, Feb 2008 - July 2008) : *Sonar and Infrared Sensor Based Formation Control of Robot Swarms*
- Rabie Soukieh (ANU, 2008): *Obstacle Avoidance in Robotic Formation Control Based on Fluid Mechanical Modeling*

SUMMER/VISITING RESEARCH PROJECT

- Srikumar Sandeep (U of Auckland, NZ, Nov 2005-Feb 2006): *Dynamic Control Modeling of Multi-Agent Systems*
- Andrew Sutton (ANU, Nov 2006-Feb 2007): *Optimal Control and Path Planning for Multi-Agent Systems*
- Mehdi M. Amini (ANU, Nov 2008-Jan 2009): *Getting the Big Picture: Spacecraft Formations*
- Pouyan T. Bibalan (ANU, Nov 2008-Jan 2009): *Simultaneous Localization and Mapping: A Geometric Approach*
- Jon Dansie (U of Adelaide, Nov 2008-Jan 2009): *Development of a Hypersonic Flight Vehicle Control Toolset*

OTHER PROFESSIONAL ACTIVITIES

PUBLICATIONS AND TALKS

- One textbook, one edited book, one MATLAB toolbox, more than eighty publications in prestigious refereed journals/books/conferences, and a number of talks at prestigious institutes.

REVIEWED PAPERS FOR

- ASME Journal of Dynamic Systems, Measurement, and Control
- Automatica
- Electronics Letters
- IET–Control Theory & Applications (Former IEE Proceedings–Control Theory & Applications)
- IEEE Transactions on Automatic Control / Control Systems Technology / Intelligent Transportation Systems / Mobile Computing / Robotics / Vehicular Technology
- ISA Transactions
- International Journal of Adaptive Control and Signal Processing
- International Journal of Systems Science
- Physica
- SIAM Journal on Optimization and Control
- Various conferences including American Control Conference, Conference on Decision and Control, European Control Conference, Mediterranean Conference on Control and Automation

PROFESSIONAL MEMBERSHIP

- AIAA - American Institute of Aeronautics and Astronautics
- ASME - American Society of Mechanical Engineers
- IEEE - Institute of Electrical and Electronics Engineers, IEEE Control Systems Society, IEEE Robotics & Automation Society, IEEE Signal Processing Society

- SIAM - Society for Industrial and Applied Mathematics, SIAM Activity Group on Control & System Theory

CONFERENCE/WORKSHOP ORGANIZATION

- Int. program committee member: *IEEE-Intelligent Vehicles Symp. 2008*, Eindhoven, Netherlands, June 2008.
- Program committee member: *IEEE-Intelligent Vehicles Symp. 2007*, Istanbul, Turkey, June 2007.
- Invited session organizer: *45th IEEE Conf. on Decision and Control*, San Diego, USA, Dec 2006.
- Workshop organizer: *Annual Multi-Agent and Dynamic Control Systems Workshop*, TOBB University of Economics and Technology, Turkey, 31 July 2006, 6 June 2007, 1 July 2008.

POPULAR MATHEMATICS LECTURES

- Teaching assistant in the summer/winter mathematics schools and the International Mathematics Olympiad training camps held by TUBITAK, 1993-1997.
- Problem seminars on various topics in mathematics (Euclidean plane geometry, map coloring problem, space geometry, etc.) in affiliation with TUBITAK, 1995-1996.

ACHIEVEMENTS & RECOGNITIONS

- Listed in Marquis Who's Who in the World.
- Listed in International Biographical Centre -IBC Leading Scientists of the World 2008.
- Continuous graduate assistantship at the University of Southern California, 1998-2003.
- Continuous graduate assistantship at Bilkent University, Turkey, 1996-1998.
- High Honor List of the Middle East Technical University, Turkey (four semesters), 1992-1996.
- Honor List of the Middle East Technical University, Turkey (four semesters), 1993-1995
- Honorary Scholarship given by Vehbi Koç Foundation, Turkey, 1992-1996.
- 6th rank among half a million students in the second stage of the Turkish national university entrance exam, ÖYS-1992.
- 5th rank among a million students in the first stage of the Turkish national university entrance exam, ÖSS-1992.
- Participated in the International Mathematics Olympiad in Moscow, Russia, 1992.
- First prize in the secondary school level national mathematics competition of TUBITAK, 1989.

RELATED COURSES TAKEN/AUDITED

SYSTEMS, CONTROLS, AND OPTIMIZATION: Linear System Theory, Random Processes, Sampled Data Control Systems, Nonlinear Control Systems, Nonlinear and Adaptive Control, Multivariable Control Systems (Geometric Approaches), Multivariable Control (Robustness Issues and \mathcal{H}_∞ Approaches), Linear Quadratic Control, Process Control, Optimal Control, Engineering Methods in Numerical Analysis (Numerical Search and Optimization Techniques), Stochastic Optimization, Complex Systems*.

ROBOTICS: Robotics and Sensing*, Robot Control using Vision*, Control and Learning in Mobile Robots and Multi-Robot Systems*, Nanorobotics*, Introduction to Neural Networks, Artificial Intelligence*.

SIGNALS AND COMMUNICATION: Digital Signal Processing, Digital Image Processing, Advanced Signal Processing, Adaptive Signal Processing, Communication Systems*, Introduction to Computer Networks*, Broadband Network Architectures*.

AEROSPACE: Flight Mechanics, Flight Vehicle Stability and Control, Spacecraft Attitude Dynamics.

ADVANCED MATHEMATICS: Mathematical Analysis, Differential Geometry, Elementary Topology and Geometry, Graph Theory, Cryptography, Abstract Algebra, Elementary Number Theory, Algebraic Number Theory.

COMPUTERS: Intr. to Logic Design, Intr. to Microprocessors, Data Structures, Operating Systems.

COMPUTER SKILLS

Experienced user and programmer in many standard engineering computing environments (UNIX, LINUX, DOS, Windows; C/C++, PASCAL, Basic, Assembly; MATLAB & Simulink (please see [S1] in the publication list), Mathematica, PSpice; LaTeX, , HTML, Word, Excel, PowerPoint, etc.).

REFERENCES

AVAILABLE UPON REQUEST

* Courses audited. All the other courses are officially taken.