Barış Fidan **Curriculum Vitae**

Professor, PhD, PEng
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Mechanical and Mechatronics Engineering https://www.uwaterloo.ca/cams-lab
Systems Design Engineering (cross app.) +1-519-888-4567 x38023
Electrical and Computer Engineering (cross app.)
University of Waterloo, 200 University Ave. W., Waterloo, ON, Canada N2L 3G1

RESEARCH INTERESTS

NONLINEAR SYSTEMS, SYSTEM IDENTIFICATION, AND ADAPTIVE CONTROL

- Robust Adaptive Control
- Nonlinear Multivariable/Time Varying/Multi-Agent System Control
- Adaptive/Nonlinear Observer/Estimator/Filter Design
- Supervisory Control and Switched Systems

INTELLIGENT AND AUTONOMOUS VEHICLES

- Robust Real-Time Localization and Mapping
- Collaborative Driving and Emergency Maneuvering
- Motion Planning and Control of Autonomous Vehicles and Mobile Robots
- Active Vision Based Planning and Control

COOPERATIVE SYSTEMS AND SENSOR NETWORKS

- Control and Coordination of Autonomous Multi-Agent/Vehicle/Robot Systems
- Optimal and Robust Information Structures for Sensor Networks
- Source Localization and Extremum Seeking
- Cooperative Geolocation: Coverage Problems
- Graph Theoretical Methods

REAL-TIME SYSTEMS AND CONTROL APPLICATIONS

- System ID and Adaptive Control of Robotic and Mechatronic Systems
- Robust Control of Vehicular/Transportation Systems
- Flight Control of High Performance Aircraft and Hypersonic Vehicles
- Modeling and Control of Micro/Nano Electro-Mechanical Systems/Processes

ROBOTICS AND MECHATRONIC SYSTEMS

- Cooperative, Articulated and Reconfigurable Robotic Systems
- Biomedical and Human Assistive Robotics
- Industrial and Service Robotics
- Human-Machine Interaction

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.
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.
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.

B.S. IN MATHEMATICS

Middle East Technical University, Ankara, Turkey, Sep. 1992 – July 1996
Double major program.

RESEARCH

ASSISTANT/ASSOCIATE/FULL PROFESSOR

- Department of Mechanical and Mechatronics Eng., University of Waterloo (UW) 2010–Current
  - Researching on a number of projects within the indicated research interests.
  - PI of NSERC Discovery Program "Adaptive Motion Coordination and Control of Robotic and Vehicular Networks", 2022-2027.
  - PI of NSERC Discovery Program "Cooperative and Adaptive Mechatronic Systems: Identification, Control, and Optimization", 2016-2022.
  - PI of NSERC Discovery Program "Distributed Geometric Coordination of Autonomous Vehicle Networks Moving in Three Dimensions", 2011-2016.
  - PI of CFI/ORF Infrastructure Program "Cooperative Autonomous Vehicle Network Test-Bed" and the associated "Cooperative and Adaptive Mechatronic Systems Lab", 2012 - .
  - PI of Mitacs Project "High Fidelity Modeling, Control and Coordination of Multi-Vehicle Systems for Traversing Cluttered Off-Road Terrains" with GDLS-C, 2021-2024.
  - PI of Mitacs Project "Localization, Monitoring, and Motion Coordination of Autonomous Indoor Service Robots" with Avidbots, 2020-2023.
  - Co-PI of NSERC CRD Project "Extended UAV-based Sensing for Mapping in Support of Ground Vehicles" with GDLS-C, 2018-2021.
  - Co-PI of NSERC CRD/ORF Project "Holistic Vehicle Control" with General Motors, 2017-2021.
  - PI of NSERC Engage Project "Robotic Manipulation for Part Racking Processes in Electroplating Lines" with KEI Inc., 2017-2018
  - Co-PI of NSERC RTI Testbed "Bimanual Assistive Robotic Platform for Neuroscience Research, Synthesized Skill Learning and Robotic Rehabilitation", 2016 - .
  - Co-PI of NSERC CRD Project "Autonomous Driving Strategies for Urban and Highway Environments" with Nuvation Inc, 2013-2017.
  - Co-PI of NSERC CRD/ORF Project "Development of New Technologies for Design and Popularization of Urban Vehicles", with multiple industrial partners, 2014-2017.
  - Co-PI of NSERC CRD Project "Hard Shaping and Accelerated Dressing Technologies for High-Productivity /High-Quality Gear Manufacture" with ODG Inc, 2015-2016.
  - Co-PI of Automotive Partnership Canada Project "Next Generation Electric Vehicles: Development of Key Technologies and Full Vehicle Testing" with General Motors, 2011-2014.
  - PI of NSERC Engage Project "Analysis, Prediction, and Enhancement of CNC Gear Shaping Machine Process Accuracy and Speed Levels" with ODG Inc., 2013.
- Cross appointed at Systems Design Eng., Department 2014–Current
- Cross appointed at Electrical and Computer Eng., Department 2016–Current

RESEARCHER (FEB 2005 – JUNE 2007)/ SENIOR RESEARCHER (JULY 2007 – NOVEMBER 2009)

- NICTA - National ICT Australia and ANU-Australian National University 2005–2009
  - Adjunct in CECS - College of Engineering and Computer Science, ANU.
  - Key investigator (KI) 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".
  - 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".
  - KI in 1-year project "Tracking Driver Drowsiness using Head Movements", with Seeing Machines Inc.
  - Researched 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 cooperative emitter geolocation
    - Characterization, diagnosis and assurance of formation/sensor network health/robustness/quality
    - Graph theoretical tools for acquiring and maintaining formation rigidity.
    - Modeling and control of air-breathing hypersonic flight vehicles
    - Adaptive control of multivariable nonlinear systems
    - Driver drowsiness monitoring based on physiological head stabilization system modeling and ID.
  - Worked on establishing a multidisciplinary complex systems engineering initiative/platform in Canberra for academic/research collaboration on different aspects of complex systems engineering, including vision based multi-vehicle control, power grids, synchronization issues in networked systems.

POSTDOCTORAL RESEARCH ASSOCIATE

- Department of Electrical Eng., USC – University of Southern California 2004
  - Member of CATT – Center for Advanced Transportation Technologies, USC.
  - Designed and analyzed adaptive control schemes for nonlinear, time varying, and multivariable systems.
  - Worked on modeling and flight control of high performance and hypersonic aircraft.
  - Contributor in a research grant proposal on "Modeling, Control, and Simulation of Airbreathing Hypersonic Vehicles," which is later accepted and granted by USA DoD/AFOSR, 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 1998 – 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 & analyzed nonlinear & adaptive controllers for certain time varying and multivariable plants.
  - Designed several real-time feedback control schemes 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 position estimator for hard disk drives, and design 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 were 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 1996 – 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.

ACADEMIC/RESEARCH VISITS

- University of California Santa Barbara, USA, May-June 2006
- TOBB University of Economics and Technology, Turkey, July 2006, Jun 2007, Jun-Jul 2008, Sep-Oct 2009
- University of Southern California, Los Angeles, USA, December 2006, June & November-December 2008
- Universite Catholique de Louvain, Belgium, June 2007, July 2012
- Delft University of Technology, Netherlands, June 2007, August-September 2018
- University of California San Diego, USA, June 2008
- University of Iowa, USA, April 2011
- Chalmers University of Technology, Sweden, September-October 2015
- UNSW Canberra, Australia, September-December 2017
- University of Melbourne, Australia, May 2018
- Monash University, Australia, June 2018
- Gwangju Institute of Science and Technology, Korea, November 2018
- Anadolu, Bilkent, Bogazici, Middle East Technical, Uludag Universities, Turkey (various dates)

TEACHING

ASSISTANT/ASSOCIATE/FULL PROFESSOR

- Department of Mechanical and Mechatronics Eng., University of Waterloo (UW) 2010–Current
  - Courses instructed:
    - MTE 204 – Numerical Methods (F'10, F'11)
    - MTE 360 – Automatic Control Systems (W'11, W'20)
    - ME 360 – Introduction to Control Systems (W'12, W'14, W'15, W'16, W'17, W'19)
    - MTE 481/482 - Mechatronics Engineering Design Project (F'20,W'21)
    - ME 547 – Robot Manipulators (W'12, W'13, W'14, W'15, W'16, F'16, W'20, W'21)
    - ME 780a – System ID and Adaptive Control (W'10, F'11, F'12, F'14, F'16, W'19, F'20)
    - ME 780m- Robust Nonlinear Control (S'15)
    - ME 780n - Networked System Modeling, Identification, and Control (S'17)
  - Invited short course instruction:
    - Adaptive Control (DISC – Dutch Institute for Systems and Control Course, Utrecht, September 2018)

INSTRUCTOR

- CECS - College of Engineering and Computer Science, ANU 2006–2008
  - 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 1998 – 2003
  - 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 1996 – 1998
  - Courses assisted:
    - Digital Electronics (EE 312)
    - Sampled Data Systems (EE 445/548)
    - Feedback Control Systems (EE 447)

THESIS/PROJECT SUPERVISION

PHD THESIS

- C. Yu (ANU & NICTA, 2005-2007, co-supervised with B. Anderson): *Formation Control Based on Graph Rigidity Theory*
- I. Shames (ANU & NICTA, 2007-2010, co-supervised with B. Anderson): *Formation Control and Coordination of Autonomous Agents*
- A. Kannan (U of Sydney & NICTA, 2005-2010, co-supervised with G. Mao and B. Vucetic): *Flip Ambiguity Mitigation for Robust Wireless Sensor Network Localisation*
- Obaid Ur Rehman (U of New South Wales at ADFA, 2008-2011, co-supervised with I. Petersen): *Robust Nonlinear Control System Design for Hypersonic Flight Vehicles*
- I. Bayezit (UW, 2010-2014, co-supervised with J. Huissoon): *Practical Coordination of Multi-Vehicle Systems in Formation*
- I. Fadakar (UW, 2012-2015, co-supervised with J. Huissoon): *Spatial Formation Coordination and Control*
- S. Guler (UW, 2012-2015): *Adaptive Control of Spatial Multi-Vehicle Systems*
- S. Khosravani (UW, 2012-2016, co-supervised with A. Khajepour): *Development of Vehicle Control Systems With Driver in the Loop*
- F.E. Sancar (UW, 2012-2017, co-supervised with J. Huissoon): *Platooning with Autonomous Cars*
- K. Buyukkabasakal (Ege University, 2014-2016, co-supervised with A. Savran): *Adaptive Fault-Tolerant Flight Control*
- M. Jalalmaaab (UW,2014-2017, co-supervised with S. Jeon): *Cooperative Highway Emergency Braking and Obstacle Avoidance*
- H. Jamshidifar (UW, 2014-2018, co-supervised with A. Khajepour): *Integrated Trajectory and Vibration Control of A Kinematically-Constrained Warehousing Robot*

- N. Koksal (UW, 2014-2019): *Adaptive and Optimal Motion Control of Multi-UAV Systems*
- M. Pirani (UW, 2015-2017, co-supervised with A. Khajepour): *Reliable Vehicle State & Parameter Estimation*
- N. Zengin (UW, 2015-2020): *LS Based Adaptive Control and Extremum Seeking with Active Vehicle Safety System Applications*
- M. Faraj (UW, 2016-2018, co-supervised with V. Gaudet): *Game Theoretic Autonomous Vehicle Coordination near Signalized Junctions*
- G. Gungor (UW, 2015-2020, co-supervised with W. Melek): *Adaptive Control of Reconfigurable Robot Manipulator Platforms*
- I. Umay (UW, Sep 2015-2021, co-supervised with W. Melek): *Integrated Task and Motion Planning of Multi-Robot Manipulators*
- A. Korayem (UW, 2018-2021, co-supervised with A. Khajepour): *Parameter and State Estimation for Car-Trailer Systems*
- C. Liu (UW, Sep 2020-Current): *Vision and Inertial Sensing Based Autonomous Vehicle Navigation*
- N. Reginald (UW, Sep 2020-Current, co-supervised with E. Hashemi): *Vision-Based Accurate Indoor Localization*
- M. Ramesh (UW, Sep 2020 -Current, co-supervised with S. Smith): *Adaptive Coverage-Planning of Arbitrary and Uncertain Non-Convex Indoor Regions*
- A. Lovi (UW, Jan 2021-Current, co-supervised with C. Nielsen): *Blending Based Multi-Model Reference Adaptive Control*
- P. Panahandeh (UW, Jan 2021-Current, co-supervised with A. Khajepour), *Path Planning and Tracking for Autonomous Vehicles*
- A.F. Mostafa (UW, Jan 2022-Current, co-supervised with W. Melek): *Adaptive Coordination and Motion Control of Heterogenous Ground/Aerial Vehicle Networks*
- M. Fraga (UW, May 2022-Current, co-supervised with E. Abdel-Rahman): *Inertial Sensors and Sensor Fusion for Robotic Applications*

MASc THESIS

- N. Koksal (UW, 2012-2014): *Decentralized Formation Control on Multi-Quadrotor Systems*
- G. Gungor (UW, 2013-2014): *System Identification and Adaptive Control of Planar Cable Robots*
- I. Umay (UW, 2013-2015): *Adaptive Wireless Biomedical Capsule Localization & Tracking*
- N. Zengin (UW, 2013-2015): *Adaptive Motion Estimation and Control of Intelligent Walkers*
- C. Liu (UW, 2015-2018) : *Mobile Robot Manipulator System Design for Localization and Mapping in Cluttered Environments*
- A. Woo (UW, 2016 – 2018) : *Localization and Mapping for Autonomous Driving*
- D. Gareau (UW, Sep 2017 – Dec 2019, co-supervised w W. Melek) : *Cooperative Autonomous Map Building*
- O. Barrera-Perez (UW, Jan 2018 – Dec 2019, co-supervised with C. Nielsen) : *Path Tracking for Mobile Robot Manipulator Platforms*
- C. B. Cetin (UW, Sep 2018 – May 2020, co-supervised w W. Melek) : *Dual-Arm Robot Manipulator Systems*
- H. Demircioglu (UW, Sep 2018 - Apr 2020): *Hessian Estimation Based Adaptive and Cooperative Extremum Localization*
- O. Adiyatov (UW, Sep 2018- Aug 2022, co-supervised with S. Smith): *Robust Optimal Path Planning and Navigation for Unmanned Ground Vehicles on Uneven Terrains*
- X. Fan (UW, Sep 2020-Aug 2022, co-supervised with S. Jeon): *Deep Learning Based Depth Estimation with Application to Reliable Path Tracking*
- M. Abouzid (UW, Jan 2019-Current): *Rehabilitation Robotics*
- A.H. Hamouda (UW, Sep 2022- Current, co-supervised with S. Smith): *Path Planning and Navigation for Unmanned Offroad Ground Vehicles*

MS/BS/HONORS PROJECT THESIS

- D. van der Walle (Delft University of Technology, Netherlands, research done at ANU, Nov 2006-Nov 2007, co-supervised by B. Anderson): *Control of Rigid Formations for Surveillance*
- A. Sutton (ANU, 2007, co-supervised with D. Shaddock) : *Laser Frequency Stabilisation by Dual Arm Locking for the LISA Gravitational Wave Detector*
- S. Zhai (ANU, July 2007-Nov 2007) : *Single-View Depth-Estimation Based Formation Control*
- N. Cen (ANU, Feb 2008 - July 2008) : *Sonar and Infrared Sensor Based Formation Control of Robot Swarms*

- R. Soukieh (ANU, 2008): *Obstacle Avoidance in Robotic Formation Control Based on Fluid Mechanical Modeling*
- K. Cheng (ANU, 2009): *Sensing and Implementation Issues in Formation Control*
- B. Meere (TU Eindhoven, Netherlands, research done at UW, Feb-July 2022): *Robust Switching Formation Control of Multi-Lane Autonomous Vehicle Platoons*

POSTDOCTORAL RESEARCH

- M. Jalalmaab (UW, 2017 - 2018)
- M. Khazraee (UW, 2017 - 2018)
- O. AlBuraiki (UW, Jan 2021 – Dec 2022, co-supervised with W. Melek)
- L. Khoshnevisan (UW, Nov 2021 – June 2022)

OTHER PROFESSIONAL ACTIVITIES

PUBLICATIONS AND TALKS

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

REVIEWED PAPERS FOR

- Various prestigious academic journals including ASME Journal of Dynamic Systems Measurement and Control; Automatica, Electronics Letters, IEEE Trans. on Automatic Control / Control Systems Technology / Industrial Electronics / Intelligent Transportation Systems / Mobile Computing / Robotics / Vehicular Technology, IET–Control Theory & Applications, ISA Transactions**,** International Journal of Adaptive Control and Signal Processing**,** International Journal of Systems Science**,** Physica**,** SIAM Journal on Optimization and Control**,** Systems & Control Letters.
- Various conferences including IFAC World Congress, American Control Conference, Conference on Decision and Control , European Control Conference, Mediterranean Conference on Control and Automation

EDITORIAL AND ORGANIZATION BOARD DUTIES

- Associate Editor: *Asian Journal of Control*
- Associate Editor: *IEEE Trans. on Automation Science and Engineering*
- Associate Editor: *IEEE Trans. on Intelligent Transportation Systems*
- Int. program committee member (IPCM): *IEEE-Intelligent Vehicles Symp.* 2007, 2008, 2009, 2010, 2016, 2017, 2018, 2019, 2020, 2021,2022.
- IPCM: *IEEE International Conference on Intelligent Transportation Systems*, 2018.
- IPCM: *IFAC World Congress*, 2020.
- IPCM: *American Control Conference*, 2021, 2022, 2023.
- IPCM: *European Control Conference*, 2023.
- IPCM: *IFAC Int. Workshop on Adaptation and Learning in Control and Signal Processing*, 2013, 2016.
- IPCM: *IFAC Int. Workshop on Adaptation and Learning Control Systems*, 2019,2022.
- IPCM: *IFAC Conference on Intelligent Control and Automation Sciences*, 2019.
- IPCM: *Int. Conf. on Autonomous and Intelligent Systems*, 2011, 2012.
- IPCM: *3rd Int. Conf. on Control and Optimization with Industrial Applications*, 2011.
- IPCM: *Symposium on Advanced Intelligent Systems*, 2011.
- IPCM: *IEEE International Symposium on Mechatronics and its Applications*, 2013
- Invited session organizer: *45th IEEE Conf. on Decision and Control*, San Diego, USA, 2006.
- Workshop organizer: *Annual Multi-Agent and Dynamic Control Systems Workshop*, TOBB University of Economics and Technology, Turkey, 2006, 2007, 2008.

PROFESSIONAL MEMBERSHIP

- Senior Member, AIAA - American Institute of Aeronautics and Astronautics

- Senior Member, IEEE - Institute of Electrical and Electronics Engineers, IEEE Control Systems Society, IEEE Robotics & Automation Society, IEEE Intelligent Transportation Systems Society, IEEE Vehicular Technology Society, IEEE Industrial Electronics Society, *(Past: IEEE Signal Processing Society)*
- Member, Adaptive & Learning Systems TC Member, IFAC–Int. Federation of Automatic Control
- Member, ASME - American Society of Mechanical Engineers
- Member, SIAM - Society for Industrial and Applied Mathematics, SIAM-AG on Control & System Theory
- PEng, Member, PEO - Professional Engineering Ontario

ACHIEVEMENTS & RECOGNITIONS

- IEEE Vehicular Technology Society Distinguished Lecturer, 2019-2020.
- University of New South Wales - Canberra Rector Funded Senior Visiting Fellowship, 2017.
- UW MME Department Teaching Credit Award (based on graduate student supervision merit), 2017.
- Asian Journal of Control 2006-2008 Best Paper Award (for [J10] in the publication list).
- Listed in AcademicKeys Who's Who in Engineering Higher Education.
- 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 2nd stage of Turkish national university entrance exam, ÖYS-1992.
- 5th rank among a million students in the first stage of 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.