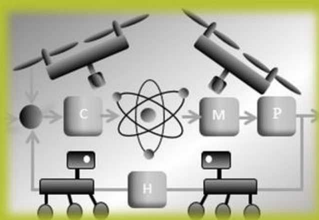
Where: Online/Virtual
When: 26 May, 2021
Space availability is limited
Register here

Info: farbodk@caltech.edu
fkhoshnoud@cpp.edu



Quantum Engineering Workshop

Theory & Practice

26 May, 2021

A 1-day free online workshop

Pushing the engineering boundaries beyond existing techniques

Quantum Engineering Workshop - 26 May 2021

Webinar link: <https://caltech.zoom.us/j/81995523717>

8:30am–8:40am - Opening

Keynote talks:

8:40–9:00
Prof. Morteza Gharib, CAST, *Caltech*
"Introduction to CAST"

9:00–9:30
Dr. Marco Quadrelli, *Jet Propulsion Laboratory*
"JPL Robotics and related applications"

9:30–10:00
Prof. Alan Willner, *University of Southern California*
"Free-Space Quantum Communication Links using Orbital-Angular-Momentum Encoding"

10:00–10:30
Prof. Paul Kwiat, *University of Illinois, Urbana-Champaign*
"Quantum-enhanced and quantum-inspired metrology"

10:30–11:00 **Q&A**

11:00–11:30
Prof. William D. Oliver, *MIT*
"Quantum Engineering of Superconducting Qubits"

11:30-12:00
Prof. Alexander Lvovsky, *Oxford University*
"Optics and machine learning as symbionts"

Invited talks:

12:30-13:00
Dr. Clarice D. Aiello, *UCLA*
"Quantum Sensing/Communications"

13:00–14:00
Prof. Enrique (Kiko) Galvez, *Colgate University*
"Photon quantum mechanics and education"

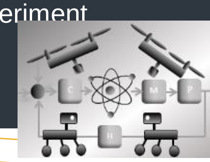
14:00–15:00
Dr. Alan L. Migdall, *National Institute of Standards and Technology*
"multiplexed single photon sources, metrology using photon statistics"

15:00–15:30
Dr. Kathy-Anne Brickman Soderberg, *Air Force Research Laboratory (AFRL) Information Directorate*
"Quantum Information Science at AFRL"

15:30–16:30
Doug Finke, *Quantum Computing Report*
"A Tour Through the Quantum Ecosystem"

16:30–17:00
Remote hands-on photon quantum experiment

17:00–17:30
Q&A



Professor Morteza (Mory) Gharib

Mory Gharib is Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering; Booth-Kresa Leadership Chair, Center for Autonomous Systems and Technologies; Director, Graduate Aerospace Laboratories; Director, Center for Autonomous Systems and Technologies.
He received his B.S. degree in Mechanical Engineering from Tehran University (1975) and his M.S. 1978, in Aerospace and Mechanical Engineering from Syracuse University and his Ph.D.1983, in Aeronautics from Caltech. He joined the faculty of the Applied Mechanics and Engineering Sciences Department at UCSD in 1985. In 1993, he joined Caltech as a professor of Aeronautics. Currently, he is director of Graduate Aerospace Laboratory (GALCIT).

Professor Gharib's current research interests in conventional fluid dynamics and aeronautics include Vortex dynamics, active and passive flow control, nano/micro fluid dynamics, autonomous flight, and underwater systems, as well as advanced flow-imaging diagnostics.
His biomechanics and medical engineering research activities can be categorized in two areas:

1. fluid dynamics of physiological machines such as the human cardiovascular system and ophthalmology as well as aquatic-breathing/propulsion
2. development of medical devices such as heart valves, cardiovascular and human eye health monitoring, and drug delivery systems.

Dr. Gharib's honors and affiliations include Member, American Academy of Arts and Sciences; Member, National Academy of Engineering; Charter Fellow, National Academy of Inventors; Fellow, American Association for the Advancement of Science; Fellow, American Physical Society; Fellow, American Society of Mechanical Engineering; Fellow, International Academy of Medical and Biological Engineering. He has received the G.I. Taylor Medal from the Society of Engineering Sciences, The Fluid Dynamics Prize from the American Physical Society and five new technology recognition awards from NASA in the fields of advanced laser imaging and nanotechnology. In 2008 he received R&D Magazine's "R&D 100 innovation award" for one of the best inventions of the year for his 3-D imaging camera system. Additionally, Dr. Gharib has published more than 250 papers in refereed journal and has been issued 116 U.S. Patents.

Talk: **Introduction to the "Center for Autonomous Systems and Technologies (CAST)**

The Center for Autonomous Systems and Technologies promotes interdisciplinary research and exchange of ideas in the expanding areas of autonomous systems. It serves as an arena for ideas to translate Into reality and be demonstrated to academic and industrial researchers and the general public through educational outreach.

Dr. Marco B. Quadrelli

Dr. Quadrelli is a principal research technologist and the supervisor of the Robotics Modeling and Simulation Group in the Robotics Section at JPL. He is an expert in modeling for dynamics and control of complex space systems. He has a degree in Mechanical Engineering from Padova (Italy), a Master's Degree in Aeronautics and Astronautics from MIT, and a PhD in Aerospace Engineering from Georgia Tech. He was a visiting scientist at the Harvard-Smithsonian Center for Astrophysics, at the Institute for Paper Science and Technology, and a lecturer at the Caltech Graduate Aeronautical Laboratories. After joining NASA JPL in 1997 he has contributed to a number of flight projects including the Cassini-Huygens Probe, Deep Space One, the Mars Aerobot Test Program, the Mars Exploration Rovers, the Space Interferometry Mission, the Autonomous Rendezvous Experiment, and the Mars Science Laboratory, among others. He has been the Attitude Control lead of the Jupiter Icy Moons Orbiter Project, and the Integrated Modeling Task Manager for the Laser Interferometer Space Antenna. He has led or participated in several independent research and development projects in the areas of computational micromechanics, dynamics and control of tethered space systems, formation flying, inflatable apertures, hypersonic entry, precision landing, flexible multibody dynamics, guidance, navigation and control of spacecraft swarms, terra-mechanics, and precision pointing for optical systems. His current research interests are in the areas of multi-domain, multi-physics, multi-body, multi-scale physics-based modeling, dynamics and control. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics, a NASA Institute of Advanced Concepts Fellow, and a Caltech/Keck Institute for Space Studies Fellow.

Dr. Marco B. Quadrelli's Talk: **Robotic Space Exploration and Possible Areas of Applications of Quantum Engineering**

In this talk, Dr. Quadrelli will present an overview of robotic systems for planetary exploration being developed at JPL, the trends driving the current developments in planetary robotics, some of the technical challenges involved, and some of his personal thoughts on possible applications of quantum-related technologies in this area.

Professor Alan Willner

Prof. Alan Willner received the Ph.D. (1988) in Electrical Engineering from Columbia University, as well as a B.A. (1982) in Physics and an Honorary Degree (Honoris Causa, 2012) from Yeshiva University. Prof. Willner was a Postdoctoral Member of the Technical Staff at AT&T Bell Laboratories and a Member of Technical Staff at Bellcore. He is currently the Steven and Kathryn Sample Chaired Professor in Engineering in the Ming Hsieh Dept. of Electrical Engineering of the Viterbi School of Engineering at the Univ. of Southern California. Prof. Willner has been: a Visiting Professor at Columbia University, the Univ. College London, and the Weizmann Institute of Science; and a Visiting Scholar at Yeshiva University. He is a Member of the U.S. Army Science Board, was a Member of the Defense Sciences Research Council (a 16-member body that provided reports to the DARPA Director and Office Directors), has served on many scientific advisory boards for small companies, and has advised several venture capital firms. Additionally, Prof. Willner was Founder and CTO of Phaethon Communications, a company whose technology was acquired by Teraxion, that created the ClearSpectrum® dispersion compensator product line which is presently deployed in many commercial 40-Gbit/s systems worldwide.Prof. Willner's professional activities have included: Co-Chair of the U.S. National Academies Committee on the Optics and Photonics Study, President of The Optical Society (OSA), President of the IEEE Photonics Society (formerly LEOS), Co-Chair of the Science & Engineering Council of the OSA, Vice-President for Technical Affairs of the IEEE Photonics Society, Photonics Division Chair of OSA, Chair of the IEEE TAB Ethics and Member Conduct Committee, General & Program Co-Chair of the Conference on Lasers and Electro-Optics (CLEO), Program Co-Chair of the OSA Annual Meeting, General Chair of the IEEE LEOS Annual Meeting, Program Chair of Telecommunications Engineering at SPIE's Photonics West, Chair of the Unclassified Technical Program for IEEE MILCOM, Elected Member of the Board of Governors for the IEEE Photonics Society, General Co-Chair of the IEEE Photonics Society Topical Meeting on Broadband Networks, Steering Committee and Technical Committee Member of the Conference on Optical Fiber Communications (OFC), and Member of the US Advisory Committee for Int'l Commission for Optics (activity of the National Academies, IEEE, OSA and SPIE). Prof. Willner was an invited foreign dignitary representing the sciences for the 2009 Nobel Prize Ceremonies in Stockholm.Prof. Willner's editorial positions have included: Editor-in-Chief of the IEEE/OSA Journal of Lightwave Technology (JLT), Editor-in-Chief of OSA Optics Letters, Editor-in-Chief of the IEEE Journal of Selected Topics in Quantum Electronics, Associate Editor of the IEEE Journal of Selected Areas in Communications Series on Optical Networks (now IEEE/OSA JOCN), Guest Editor of JLT and JSAC for the Joint Special Issue on Multiple-Wavelength Technologies & Networks, and Guest Editor of IEEE J. of Quantum Electronics Focus Issue on High-Capacity Optical Transmission Systems.Prof. Willner has >1450 publications, including one book, 10 edited books, ~38 U.S. patents, ~45 keynotes/plenaries, ~23 book chapters, >400 refereed journal papers, and >300 invited papers/presentations. His research is in optical technologies, including: communications, signal processing, networks, and subsystems.

Professor Alan Willner's talk: Free-Space Quantum Communication Links using Orbital-Angular-Momentum Encoding

A photon or beam can carry different amounts of orbital-angular-momentum (OAM) if its phasefront twists in a helical fashion as it propagates, and the amount of OAM corresponds to the number of 2*pi phase shifts that occur in the azimuthal direction. Each OAM state is orthogonal to other states, and such states can be efficiently multiplexed, transmitted, and demultiplexed with little inherent modal crosstalk. Common quantum communication systems encode a qubit on the two orthogonal polarization states. This means an alphabet of 2 and tends to limits data capacity to a single bit per photon. However, since OAM can take on many more orthogonal values than can polarization, the OAM alphabet might provide higher photon efficiency and performance in a quantum system. The number of bits per photon becomes log2N, with N being the number of available OAM-modal states; this is similar to the benefits of N-ary over binary data encoding. In such an encoding system, a possible transmitter would take each single photon and systematically place it on one of N possible OAM states. A possible receiver would capture each photon and then route it to one of N different single-photon detectors. Interestingly, certain approaches that have mitigated impairments for classical channels may also help alleviate problems in quantum channels. For example, adaptive optics can help mitigate turbulence for a quantum channel by providing an inverse modal coupling function at the receiver.

Professor Paul G. Kwiat

Paul G. Kwiat is the Bardeen Chair in Physics, at the University of Illinois, in Urbana-Champaign, and is the inaugural Director of the Illinois Quantum Information Science and Technology Center (IQUIST). A Fellow of the American Physical Society and the Optical Society of America, he has given invited talks at numerous national and international conferences, and has authored over 160 articles on various topics in quantum optics and quantum information, including several review articles. His research focuses on optical implementations of quantum information protocols, particularly using entangled—and hyperentangled—photons from parametric down-conversion. He received the Optical Society of America 2009 R. W. Wood Prize, as the primary inventor of the world's first sources of polarization-entangled photons from down-conversion, which have been used for quantum cryptography, dense-coding, quantum teleportation, quantum metrology, and realizing optical quantum gates. He has also done pioneering work on high-efficiency single-photon detectors, frequency-upconversion-based detection, and high-speed quantum random number generation.

Talk: **Quantum-enhanced and quantum-inspired metrology: Engineering more precise measurements**

It is now well established that the use of entangled quantum states can in some cases lead to sqrt(N) enhancements in the precision of quantum-limited measurements. Here we discuss two examples — based on recycled quantum weak measurements and on frequency non-degenerate two-photon interference — which demonstrate metrological benefits of a different sort, including robustness to systematic noise in one case and noise and loss in the other.

Prof. William D. Oliver

William D. Oliver is jointly appointed Associate Professor of Electrical Engineering and Computer Science and Lincoln Laboratory Fellow at the Massachusetts Institute of Technology. He serves as the Director of the Center for Quantum Engineering and as Associate Director of the Research Laboratory of Electronics. Will’s research interests include the materials growth, fabrication, design, and measurement of superconducting qubits, as well as the development of cryogenic packaging and control electronics.
Will is a Fellow of the American Physical Society, Senior Member of the IEEE, and is appointed to the National Quantum Initiative Advisory Committee. He also serves on the US Committee for Superconducting Electronics and is an IEEE Applied Superconductivity Conference (ASC) Board Member. He received his PhD in Electrical Engineering from the Stanford University in 2003.

Talk: **Quantum Engineering of Superconducting Qubits**

Superconducting qubits are coherent artificial atoms assembled from electrical circuit elements and microwave optical components. Their lithographic scalability, compatibility with microwave control, and operability at nanosecond time scales all converge to make the superconducting qubit a highly attractive candidate for the constituent logical elements of a quantum information processor. Over the past decade, spectacular improvements in the manufacturing and control of these devices have moved the superconducting qubit modality from the realm of scientific curiosity to the threshold of technical reality. In this talk, we present the progress, challenges, and opportunities ahead in the engineering larger scale processors.

Professor Alexander Lvovsky

Alexander Lvovsky is an experimental physicist. He was born and raised in Moscow and did his undergraduate in Physics at the Moscow Institute of Physics and Technology. In 1993, he became a graduate student in Physics at Columbia University in New York City. His thesis research, conducted under the supervision of Dr. Sven R. Hartmann, was in the field of coherent optical transients in atomic gases. After completing his Ph. D. in 1998, he spent a year at the University of California, Berkeley as a postdoctoral fellow in the Department of Physics, and then five years at Universität Konstanz in Germany, first as an Alexander von Humboldt postdoctoral fellow, then as a research group leader in quantum-optical information technology. In 2004 he became Professor in the Department of Physics and Astronomy at the University of Calgary, and from autumn 2018, a professor at the University of Oxford. Alexander has also been a part of the team that created the Russian Quantum Center, and, since 2013, he has been working there as a part-time research group leader. Alexander is a past Canada Research Chair, a lifetime member of the American Physical Society, a Fellow of the Optical Society and a winner of many awards – most notably the International Quantum Communications award, commendation letter from the Prime Minister of Canada and the Emmy Noether research award of the German Science Foundation. His research has been featured by CBC, NBC, Wired, New Scientist, MIT Technology Review, TASS, Daily Mail, and other media.

Talk: Optics and machine learning are natural symbionts. I will present three examples of how these fields can benefit each other based on our recent experimental work:

- optical neural networks and their all-optical training;
- robotic alignment of optical experiments;
- application of machine learning in linear-optical far-field superresolution imaging.

Dr. Clarice D. Aiello

Dr. Clarice D. Aiello is a quantum engineer interested in how quantum physics informs biology at the nanoscale. She is an expert on nanosensors harnessing room-temperature quantum effects in noisy environments. Aiello received her Ph.D. from MIT in Electrical Engineering and held postdoctoral appointments in Bioengineering at Stanford, and in Chemistry at Berkeley. She joined UCLA in 2019, where she leads the Quantum Biology Tech (QuBiT) Lab.

Talk: **From nanotech to living sensors**

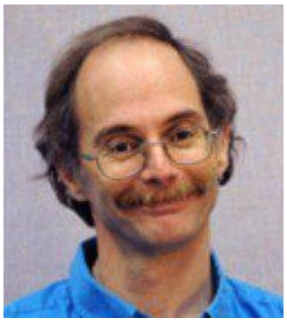
Unraveling the spin physics of biosensing at the nanoscale Substantial in vitro and physiological experimental results suggest that similar coherent spin physics might underlie phenomena as varied as the biosensing of magnetic fields in animal navigation and the magnetosensitivity of metabolic reactions related to oxidative stress in cells. If this is correct, organisms might behave, for a short time, as “living quantum sensors” and might be studied and controlled using quantum sensing techniques developed for technological sensors. I will outline our approach towards performing coherent quantum measurements and control on proteins, cells and organisms in order to understand how they interact with their environment, and how physiology is regulated by such interactions. Can coherent spin physics be established – or refuted! – to account for physiologically relevant biosensing phenomena, and be manipulated to technological and therapeutic advantage?

Professor Enrique J. Galvez -- Short Professional Bio

He obtained a Ph.D. in physics from the University of Notre Dame, Indiana, in 1986. He has been member of the faculty at Colgate University since 1988—currently the Charles A. Dana Professor of Physics and Astronomy. His research interests include atomic and optical physics and physics education. Recent research projects include studies of light in complex scalar and vector modes, and photon entanglement. Educational projects include modernizing the introductory physics curriculum and the development new laboratories to teach about light and quantum mechanics. He is a Fellow of OSA and has received two APS awards.

Talk: **Photon Quantum Mechanics and Education**

Technological advances in the production and detection of single photons has opened new opportunities for teaching the fundamentals of quantum mechanics via hands-on laboratories. The rise of quantum information has only underscored the need for students to confront the counter intuitive aspects of quantum physics and their contrast with classical physics. The future workforce needs to understand these concepts deeply along with the quantum formalism and statistics. Photon laboratories provide a platform for understanding both the fundamental concepts and their application to physical systems.



Dr. Alan Migdall

Dr. Migdall's current interests broadly cover quantum optics with research related to single-photon sources, detectors, processors, and quantum memory for quantum cryptography and quantum computation. Specific efforts involve **correlated two-photon light** (https://www.youtube.com/watch?v=1MaOqvnkBxk), nonlinear optics, parametric downconversion, Raman scattering, microstructure fibers, multi-particle entanglement, **randomness generation** (http://www.nist.gov/itl/csd/ct/nist_beacon.cfm), and classical and quantum metrology.

Migdall leads the Quantum Optics Group of the Quantum Measurement Division at NIST. He is a fellow of the Joint Quantum Institute at the University of Maryland and a fellow of the American Physical Society. He has organized a number of conferences and workshops on single photon detector and source technologies, as well as the applications and metrology of that technology. He founded the Single Photon Workshop, which debuted at NIST in Gaithersburg in 2003 and has continued biannually at metrology and national labs in the US and around the world. He was editor of a book entitled Single Photon Generation and Detection.

Migdall has been part of a number of science outreach efforts including the OSA Eastman/Presidential Speaker program, giving lectures at numerous universities and colleges, as well as local high schools, middle schools, and elementary schools. He has provided research opportunities for graduate, undergraduate, and high school students. In addition, he was the science advisor for a National Academy of Sciences middle school optics curriculum program.

Migdall began his career at NIST with an NRC postdoctoral fellowship in laser cooling and trapping of neutral atoms, was made a fellow of the American Physical Society in 2007, awarded a NIST Bronze medal in 2009 for his efforts in single photon technology, in 2013 and 2015 awarded patents related to single photon technology, and in 2016 was part of the team that was awarded a Commerce Dept. Gold medal for the long-sought goal of achieving a very strong test rejecting local realistic models as possible alternatives to quantum mechanics.

Talk - Part I: **The Quantum Age-Measurements: For all time, For all people**

A. L. Migdall
Joint Quantum Institute, University of Maryland &
National Institute of Standards and Technology, Gaithersburg, MD, USA

Measurement is arguably the basis of all civilization. We are born into this world measuring our environment and trying to understand it and we continue measuring for the rest of our lives. All of our measurements should rely on standards that ideally are accurate, unchanging, and universally defined. While such a solid foundation for our measurement systems has been dream since before the time of the French Revolution, it is only with the dawn of the quantum age that it could be realized. As a result, humankind just recently achieved an advance that goes beyond the level of a once-in-a-lifetime event, it achieved an advance that, hopefully, is just a once-on-a-planet event. I hope to convey the momentousness of what just occurred.

Talk - Part II: **Multiplexing: A path to an ideal single-photon source**

A. L. Migdall
Joint Quantum Institute, University of Maryland &
National Institute of Standards and Technology, Gaithersburg, MD, USA

Single-photon sources, inherently nonclassical in their nature, are quite distinct from the light sources of a century ago.

And since the first efforts at nonclassical sources of light a half century ago, significant progress has been made. Now, sources that produce photons in pairs, allowing for the heralding of a single photon, are the workhorse of a wide array of applications, from tests of fundamental physics to metrology, and even to biological microscopy. Single-photon sources built from processes that generate photons in pairs rely on either spontaneous parametric down-conversion or spontaneous four-wave mixing and can now achieve production rates of millions of heralded single photons per second in controlled states, with tailored spectral properties and near-perfect spatial modes. However, because these nonlinear optical processes are inherently probabilistic, they cannot simultaneously achieve a high probability of producing a photon and a high single-photon fidelity. This inherent tradeoff can be a severe constraint in many applications.

The multiplexing of many of these probabilistic single-photon sources offers a path to overcoming this tradeoff. By having many low-probability-of-generation, but high-fidelity heralded single-photon sources, it is possible to create a system that boosts the probability of successfully generating an output, while retaining high single-photon fidelity. Multiplexing of such sources is achieved through the use of time, space, and/or frequency to parallelize the spontaneous photon creation, then actively switch the photons into a single mode or actively switch the pumping laser based on feedback from heralding detection events.

We review some of the history and recent exponential progress in this exciting field. From a few theoretical proposals around the beginning of this millennia, the field has sharply grown: numerous distinct multiplexing schemes have been proposed, with many experiments realized in just the past few years, a rate which is strongly increasing. It seems likely that through the use of source multiplexing, one can expect that ten-photon states at rates of $\approx 10^3$ /s are within immediate reach, and 50 photons, enough for a conclusive quantum advantage over classical computers, are no longer a pipe dream.

Dr. Kathy-Anne Brickman Soderberg

Dr. Kathy-Anne Brickman Soderberg is a Principal Research Scientist at the Air Force Research Laboratory (AFRL) Information Directorate in Rome, NY. Dr. Soderberg is the primary investigator and group leader for AFRL's Trapped-Ion Quantum Networking group. Dr. Soderberg received a B.S. in physics from the College of William and Mary, a M.S. and Ph.D. in physics from the University of Michigan, and was a postdoctoral researcher at the University of Chicago. Dr. Soderberg has over fifteen years of technical experience in atomic physics and quantum information processing. Her graduate work focused on trapped-ion quantum computing research and included key demonstrations of phonon-mediated entangling gates and proof-of-principle quantum algorithms. Her postdoctoral work focused on novel neutral-atom quantum computing and the difficulties associated with targeted atomic interactions and optical lattice translation and control. Before joining AFRL, Dr. Soderberg was a technical consultant for quantum information sciences.

Talk: **Quantum Information Science at AFRL**

Recent advances in Quantum Information Science (QIS) indicate that future applications of quantum mechanics will lead to disruptive advances in capabilities for the US Air Force. Controlling and exploiting quantum mechanical phenomena will enable inertial sensors and atomic clocks that provide GPS-like positioning and timing accuracy for extended periods of time in degraded environments, communications networks with provable information security, unprecedented sensor resolution, and computers with exponential speedup in processing speed. To ensure that the future Air Force warfighter maintains a technological advantage the AF must implement a QIS strategy that leads to robust and deployable quantum systems. This invited talk will discuss the AFRL QIS strategy that encompasses timing, sensing, communications and networking, and computing along with related capability development.

Doug Finke

Doug Finke is Managing Editor of the Quantum Computing Report which he founded in 2015 so he could apply his wide breadth of experience to help accelerate the proliferation of quantum computing to the general marketplace. He started his career as a mainframe computer design engineer at IBM and subsequently served in a variety of executive roles in marketing, engineering, and operations at Intel, Western Digital, Corning, and several startup companies. Doug holds degrees in computer engineering and management from the University of Illinois and MIT respectively.

Talk: **A Tour Through the Quantum Ecosystem**

The presentation would show all the different industry players and how they can work together to provide a complete solution to an end user. It shows a model for the complete solution stack from User Community down to the chip of what is needed to make quantum computing a reality.

Organizer: Dr. Farbod Khoshnoud
Contact: farbodk@caltech.edu

Farbod Khoshnoud, PhD, PGCE, CEng, M.IMechE, M.ASME, HEA Fellow, is a faculty member in Electromechanical Engineering at California State Polytechnic University, Pomona. His current research areas include Self-powered Dynamic Systems, Nature/Biologically Inspired Dynamic Systems, and Quantum Entanglement and Quantum Cryptography for Multibody Dynamics, Robotics, Controls, and Autonomy applications. He is a visiting associate in the Center for Autonomous Systems and Technologies in the Department of Aerospace Engineering at California Institute of Technology.

He was a research affiliate in the Mobility and Robotic Systems section at NASA Jet Propulsion Laboratory, Caltech in 2019; an Associate Professor of Mechanical Engineering at California State University, USA; a visiting Associate Professor in the Department of Mechanical Engineering at the University of British Columbia (UBC), Vancouver, Canada, in 2017; a Lecturer in the Department of Mechanical Engineering at Brunel University London, UK, 2014-16; a senior lecturer at the University of Hertfordshire, 2011-2014; a visiting scientist and postdoctoral researcher in the Industrial Automation Laboratory, Department of Mechanical Engineering, at UBC, Vancouver, 2007-2012; a visiting researcher at California Institute of Technology, USA, 2009-2011; and a Postdoctoral Research Fellow in the Department of Civil Engineering at UBC, 2005-2007. He received his Ph.D. in Mechanical Engineering from Brunel University in 2005. He has worked in industry as a mechanical engineer for over six years. He is an associate editor of the Journal of Mechatronic Systems and Control (formerly Control and Intelligent Systems); and the editor of the Quantum Engineering special issue of the Journal of Mechatronic Systems and Control.