Quantum Engineering Workshop

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Virtual & in-person
29 May, 2025
[Registration Link]

For in-person attendance at Caltech contact:
Dr. Farbod Khoshnoud farbodk@caltech.edu

Supported by CAST, Caltech, Cal Poly Pomona, JAVS, ASME

29 May, 2025, A 1-day free hybrid workshop

Pushing the engineering boundaries beyond classical techniques, supported by the CAST Caltech, Journal of Autonomous Vehicles and Systems (JAVS), American Society for Mechanical Engineers (ASME), and College of Engineering, Cal Poly Pomona

8:30 am - 9:00 am (PST)
Opening welcome and introduction
Organizers: Dr. Marco Quadrelli and Dr. Farbod Khoshnoud

Keynote talks:
9:00 AM - 9:30 am
Professor Michael L. Roukes, Caltech
"Nanosystems-enabled single molecule analysis in the quantum regime"

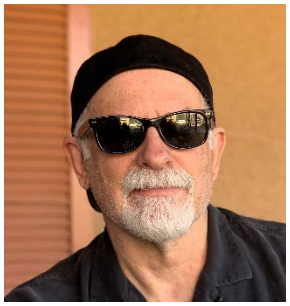
9:30 am - 10:30am
Professor Jens Palsberg, UCLA
"Can AI help quantum computing succeed?"

11:00 am - 11:30 am
Professor David Awschalom, University of Chicago
"The Quantum Revolution: Emerging Technologies at the Atomic scale"

11:30 am - 12:00 pm
Dr. Michael R. Norman, ANL
"What is a Quantum Spin Liquid and how is it related to Quantum Computing?"

12:00 pm - 1:30 pm **Break**

1:30 pm - 2:00 pm
Dr. Slava G. Turyshev, NASA's Jet Propulsion Laboratory
"High-power Lunar Laser Ranging"
2:00 pm - 2:30 pm
Dr. Sheng-Wey Chiow, NASA's Jet Propulsion Laboratory
"Quantum Remote Sensing - Quantum Gravity Gradiometer"
2:30 pm - 3:00 pm
Professor Andrew A. Houck, Princeton University
3:00 pm – 3:30 pm
Break
3:30 pm - 4:00 pm
Professor Ian Petersen, Australian National University
"Linear Quantum Control Engineering"
4:00 pm – 4:30 pm
Professor Heather Lewandowski, University of Colorado, Boulder
"Preparing for the quantum revolution: What is the role of higher education?"
4:30 pm - 5:00 pm
Dr. Maxim Radikovich Shcherbakov, UCI
"Quantum and Nonlinear Nanophotonics Enabled by Extreme Engineering"
5:00 pm – 5:30 pm
Dr. Nicole Yunger Halpern, UM
"Useful autonomous quantum machines"
5:30 pm - 5:45 pm
Q&A, and adjourn



Michael Roukes is the Frank J. Roshek Professor of Physics, Applied Physics, and Bioengineering at the California Institute of Technology. His scientific interests range from applied biotechnology to quantum measurement – with a unifying theme of the development, very-large-scale integration, and application of complex nanosystems to precision measurements in fundamental physics, the life sciences, and medicine. Roukes was the founding Director of Caltech's Kavli Nanoscience Institute (KNI). Thereafter, he co-founded the *Alliance for Nanosystems VLSI* (very-large-scale integration) with scientists and engineers at CEA/LETI in Grenoble. To date, Roukes has been awarded 65 patents in his areas of research and has co-founded three companies. Among his honors, he has held a *Chaire d'Excellence* in nanoscience in Grenoble, France, is a Fellow of the American Physical Society, is a recipient of both the NIH Director's Pioneer Award and the NIH Director's Transformative Research Award, and has been awarded *Chevalier* (Knight) *dans l'Ordre des Palmes Academiques* by the Republic of France.

Nanosystems-enabled single molecule analysis in the quantum regime

Michael Roukes*

Frank J. Roshek Professor
Departments of Physics, Applied Physics, & Bioengineering
California Institute of Technology

Many fundamental biological paradigms that *modulate* macromolecular function – through microscopic mechanisms spanning evolution, species, and molecular diversity – still await discovery. A ubiquitous molecular means nature employs for such modulation is termed *allostery* [1], a concept that emerged over 50 years ago [2,3]. Allostery describes how molecules temporally modulate their function across all domains of biology [4]. An overarching goal of our effort is to open a new avenue to elucidate the ubiquitous and biologically-conserved *microscopic functional motifs* (structures and dynamical mechanisms) employed by allosteric macromolecular complexes.

In this talk I will describe ongoing experimental efforts in single-molecule analysis we are pursuing at Caltech, aided by strong interdisciplinary collaboration. They involve coupling individual large proteins or protein complexes to *qubit-interrogated sub-terahertz NEMS* (nanoelectromechanical systems) [5] that, when cooled to mK temperatures, can enable single-quantum spectroscopy of collective, long-range vibrational excitations. A special focus of this work is elucidating the mesoscopic macromolecular mechanisms underlying *dynamical allostery* (the biological modulation of protein function mediated by non-equilibrium vibrational coupling) [6].

*Our principal collaborators include Prof. Amir Safavi-Naeini (*Stanford U.*), Prof. Mark Dykman (*Michigan State U.*), Prof. Rob Phillips (*Caltech*), and their respective research groups.

[1] Rob Phillips, *The Molecular Switch: Signaling and Allostery,* Princeton University Press, 2020.

[2] J. Monod, J. Wyman, J.P. Changeux, *On the nature of allosteric transitions: A plausible model,* Journal of Molecular Biology. **12**: 88–118 (1965).

[3] D.E. Koshland, G. Nemethy D. Filmer, *Comparison of experimental binding data and theoretical models in proteins containing subunits.* Biochemistry. **5** (1): 365–85 (1966).

[4] The special issue of the Journal of Molecular Biology, *Allosteric interactions and biological regulation (Part I)* (Kalodimos and Edelstein 2013) spans an impressive breadth of relevant topics.

[5] J. Xie, M. Shen, Y. Xu, W. Fu, L. Yang, H.X. Tang, *Sub-terahertz electromechanics,* Nature Electronics **6**, 301–306 (2023).

[6] *See, for example:* Q. Cui, M. Karplus, *Allostery and Cooperativity Revisited*, Protein Science **17**, 1295-1307 (2008); N. Tokuriki, D.S. Tawfik, *Protein dynamism and evolvability*, Science **10**, 203-7 (2009); R.H. Austin*, Protein Quantum Dynamics?* in H. Frauenfelder, *The Physics of Proteins*, Springer Science + Business Media (2010), pp. 199-208; A.P. Kornev, *Self-Organization, Entropy, and Allostery*, Biochemical Soc. Trans. **46**, 587-597 (2018).

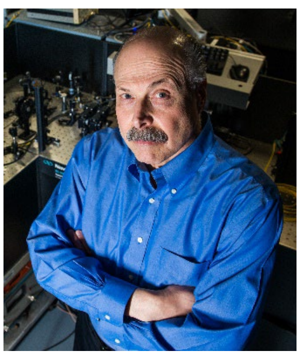
Jens Palsberg is a Professor and former Department Chair of Computer Science at University of California, Los Angeles (UCLA). His research interests span the areas of programming languages, software engineering, and quantum computing. He is the director of the UCLA-Amazon Science Hub for Humanity and Artificial Intelligence, an associate editor of ACM Transactions on Quantum Computing, and a member of the Council of the Association for Computing Machinery (ACM). He is also the co-director of the Center for Quantum Science and Engineering at UCLA, which has more than 30 professors, and he is on the team that started a Masters degree on quantum science and technology at UCLA. In 2012 he received the ACM SIGPLAN Distinguished Service Award, and in 2023 he received the Eon Instrumentation Excellence in Teaching Award at UCLA for his courses on quantum computing.

Title: Can AI help quantum computing succeed?

Speaker: Jens Palsberg, Professor, UCLA Computer Science Department.
https://web.cs.ucla.edu/~palsberg/

Abstract:

Quantum computing is rapidly getting better but still has some way to go before it can make a difference in science and business. Where are we with this, what are the main problems, and how can we use artificial intelligence to help quantum computing succeed?



David Awschalom is the Liew Family Professor and Director of the Quantum Institute in the Pritzker School for Molecular Engineering at the University of Chicago, a Senior Scientist at Argonne National Laboratory, and Director of the Chicago Quantum Exchange. He is also the inaugural director of Q-NEXT, one of the US Department of Energy Quantum Information Science Research Centers. Before arriving in Chicago, he was the Director of the California NanoSystems Institute and Professor of Physics, Electrical and Computer Engineering at the University of California – Santa Barbara. His research focuses on spintronics and quantum engineering, exploring the properties of individual electrons, nuclei, and photons in semiconductors and molecules for quantum information processing. Awschalom received the APS Oliver Buckley Prize and Julius Edgar Lilienfeld Prize, the EPS Europhysics Prize, the MRS David Turnbull Award and Outstanding Investigator Prize, the AAAS Newcomb Cleveland Prize, the International Magnetism Prize from the International Union of Pure and Applied Physics, and an IBM Outstanding Innovation Award. He is a member of the American Academy of Arts & Sciences, the National Academy of Science, the National Academy of Engineering, and the European Academy of Sciences. Dr. Awschalom recently received a US Secretary of Energy Achievement Award.

The Quantum Revolution: Emerging Technologies at the Atomic scale

David Awschalom, *University of Chicago*

Abstract

Traditional electronics are rapidly approaching the length scale of atoms and molecules. In this regime, a single atom out of place can have outsized negative consequences and so scaling down classical technologies requires ever-more perfect control of materials. Surprisingly, one of the most promising pathways out of this conundrum may emerge from current efforts to embrace these atomic 'defects' to construct devices that enable new information processing, communication, and sensing technologies based on the quantum nature of electrons and atomic nuclei. In addition to their charge, individual defects in semiconductors and molecules possess an electronic spin state that can be employed as a quantum bit. These qubits can be manipulated and read using a simple combination of light and microwaves with a built-in optical interface and retain their quantum properties over millisecond to second timescales. With these

foundations in hand, we discuss emerging opportunities to atomically-engineer qubits for nuclear memories, entangled registers, sensors and networks for science and technology.
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Michael Norman is an Argonne Distinguished Fellow and the Director of the Argonne Quantum Institute. He has been a Fellow of the American Physical Society since 1995 and received the University of Chicago Distinguished Performance Award in 1999. Previously, he was the Director of the Materials Science Division at Argonne and has served in a number of roles over the years including on the Editorial Boards of Physical Review B and Physical Review X. He is a condensed matter physicist by training with 276 publications to date.

What is a Quantum Spin Liquid and how is it related to Quantum Computing?

Michael Norman, Director, Argonne Quantum Institute

A quantum spin liquid is a state of matter characterized by long-range entanglement of spins, a novel form of topological order [1]. The existence of these "liquids" in real materials is a matter of active debate [1]. If they do exist, they could be the basis for topological quantum computing. Moreover, as shown by Kitaev, the toric code (related to the surface code for quantum error correction) is a Z2 spin liquid. The Z2 spin liquid and more exotic versions of spin liquids are currently being simulated on state-of-the-art quantum computers that can give key insights into the nature of anyons and their dynamics.

[1] Broholm, Cava, Kivelson, Nocera, Norman, and Senthil, *Quantum Spin Liquids*, Science **367**, eaay0668 (2020).

Slava G. Turyshev is an astrophysicist at NASA's Jet Propulsion Laboratory (JPL), California Institute of Technology, and a professor in the Department of Physics and Astronomy at the University of California, Los Angeles (UCLA). He earned an M.S. in physics (with honors) and a Ph.D. in quantum field theory from Lomonosov Moscow State University, Russia, in 1987 and 1990, respectively, and a Doctor of Science (D.Sc.) degree in astrophysics from the same university in 2008. Dr. Turyshev's research focuses on gravitational and fundamental physics, relativistic astrophysics, gravitational waves, and planetary science. His expertise encompasses high-precision spacecraft navigation, relativistic celestial mechanics, solar system dynamics, satellite and lunar laser ranging, detection and characterization of near-Earth objects (NEOs), and the development of advanced space technologies. Dr. Turyshev served as the NASA Project Scientist for the CNES/ESA MICROSCOPE mission (2016–2020), which conducted precision tests of the Equivalence Principle. Since 2015, he has been the JPL Principal Investigator for the Advanced Lunar Laser Ranging Facility at the Table Mountain Observatory, designed to enhance tests of general relativity and study the Moon's deep interior. From 2003 to 2012, he was the Principal Investigator for the Pioneer Anomaly investigation, resolving a longstanding puzzle in spacecraft dynamics. Between 2017 and 2022, he led NASA Innovative Advanced Concepts (NIAC) Phases I–III as Principal Investigator, developing mission architectures to utilize the solar gravitational lens (SGL) for high-resolution imaging and spectroscopy of exoplanets. Since 2023, Dr. Turyshev has served as a member of the Executive Committee of NASA's Fundamental Physics Advisory Group (FunPAG), advising on the strategic direction of space-based fundamental physics research. He has authored over 230 peer-reviewed research papers and two books and is an Academician of the International Academy of Astronautics (IAA).

High-power Lunar Laser Ranging:
Advancing Research in Lunar Geophysics, Gravitational and Fundamental Physics

Slava G. Turyshev, Michael Shao, Inseob Hahn, and Russell Trahan
Jet Propulsion Laboratory, California Institute of Technology
4800 Oak Grove Drive, Pasadena, CA 91109

Recently, we initiated an upgrade to the 1-m telescope at Table Mountain Observatory (TMO) to establish a high-precision lunar laser ranging (LLR) facility. The upgraded system employs a ~1.1 kW continuous-wave laser at 1064 nm, which significantly increases the return photon flux and enables differential LLR measurements by rapidly switching among lunar corner-cube retroreflector (CCR) arrays. This technique effectively cancels common-mode atmospheric and site-related errors, achieving an absolute ranging precision of <1 mm and a differential precision of ~30 μm. Concurrently, we are developing the C2R2 instrument—a dual-CCR system with a calibrated baseline (~50 cm) for deployment on the lunar surface. C2R2's self-calibration maintains sub-mm ranging accuracy and, when integrated with the TMO facility, will enhance the LLR network's capability to constrain lunar interior properties. Specifically, the system will quantitatively determine the lunar core's size, shape, rotation, and turbulence; measure mantle density variations with an accuracy of ±1%; and resolve tidal displacements and free libration modes with an angular precision better than ±0.05°. These high-precision measurements are critical for refining models of interior rigidity, thermal evolution, and energy dissipation, and to improve tests of relativistic gravity by up to an order of magnitude over current methods. The enhanced system is also projected to achieve a strain sensitivity in the μHz gravitational wave band approaching 10^{-16}, thereby providing a complementary method for detecting stochastic gravitational wave signals in this largely unexplored frequency range. We will discuss these technical enhancements, measurement strategies, and the anticipated scientific outcomes.

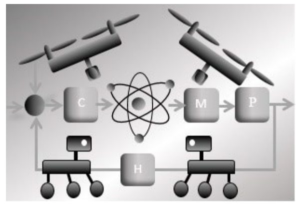
Dr. Chiow is from Quantum Sciences and Technology Group at Jet Propulsion Laboratory. His research focuses on development and application of atom interferometry for microgravity environment. Topics include quantum gravity gradiometer for Earth gravity mapping, atomic seismometer for lunar gravity measurements, atomic accelerometer for planetary science, tests of equivalence principle onboard the international space station, and direct detection of dark energy using atom interferometry in the solar system. He also supports various quantum sensing activities led by NASA.

Title: Quantum Remote Sensing - Quantum Gravity Gradiometer
Authors: Sheng-wey Chiow

Affiliations:
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

Abstract: Atom interferometry exploits the matter-wave nature of atom for precision measurements. Development for space application of atomic sensors is actively pursued worldwide. The areas of applications include Earth sciences, planetary sciences, astrophysics, and fundamental physics. In this talk, an overview of atom interferometry for space will be presented. In particular, quantum gravity gradiometer (QGG) will be discussed in detail as an example of the prospect of quantum remote sensing and the technology challenges.

This research was carried out in part at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration (80NM0018D0004).



Ian R. Petersen was born in Victoria, Australia. He received a Ph.D in Electrical Engineering in 1984 from the University of Rochester. From 1983 to 1985 he was a Postdoctoral Fellow at the Australian National University. From 2017 he has been a Professor at the Australian National University in the School of Engineering. He was the Interim Director of the School of Engineering at the Australian National University from 2018-2019. From 1985 until 2016 he was with UNSW Canberra where he was a Scientia Professor and an Australian Research Council Laureate Fellow in the School of Engineering and Information Technology. He has previously been ARC Executive Director for Mathematics Information and Communications, Acting Deputy Vice-Chancellor Research for UNSW and an Australian Federation Fellow. He has served as an Associate Editor for the IEEE Transactions on Automatic Control, Systems and Control Letters, Automatica, IEEE Transactions on Control Systems Technology and SIAM Journal on Control and Optimization. He also served as an Editor for Automatica. He is a fellow of IFAC, the Asian Control Association, the IEEE and the Australian Academy of Science. His main research interests are in robust control theory, quantum control theory and stochastic control theory.

Title: Linear Quantum Control Engineering

Abstract: This lecture will present a collection of results in the area of linear quantum control engineering. It will discuss models for quantum systems using the Heisenberg pictures of quantum mechanics to describe continuous linear quantum systems. It will discuss closed loop approaches to quantum control involving coherent quantum feedback control in which the controller is also a quantum system. It will discuss quantum LQG control and the quantum Kalman decomposition as well as recent results on quantum risk sensitive control. Examples in the areas of quantum optics and quantum electromechanical systems will be presented.

Heather Lewandowski is a professor of physics and Fellow of JILA at the University of Colorado Boulder. She also serves as the Faculty Director of the CUbit Quantum Initiative focused on Education and Workforce. She leads two research programs, one in experimental molecular physics, and the other in physics education research. Her molecular physics research efforts focus on studying interactions and reactions of cold, chemically important molecules and ions. Her physics education research program studies ways to increase students' proficiency in experimental scientific practices, as well as research in the area of quantum science education and workforce development.

Preparing for the quantum revolution: What is the role of higher education?

The rapid advancement of quantum technologies—including quantum sensing, networking, and computing—has sparked significant interest due to their potential to revolutionize existing technologies. This second quantum revolution has also created a growing demand for a quantum-proficient STEM workforce. To maximize the impact of these emerging technologies and better prepare students for careers in this field, we must equip them with both the technical and professional skills essential for success.

I will present results from broad studies of the quantum industry, including the types of activities being carried out in the quantum industry, profile the types of jobs that exist, and describe the skills valued across the quantum industry, as well as in each type of job. Additionally, I will describe our efforts to improve student preparation for entering the quantum industry through experimental training both in a lab course setting, as well as through a new two-semester project-based course. This course has students work in teams on industry-sponsored projects to learn relevant technical (e.g., nanofabrication, servo electronics) and professional skills, such as project management, professional communication, and budget management.

Dr. Maxim R. Shcherbakov is an Assistant Professor at the University of California, Irvine, with joint appointments in Electrical Engineering and Computer Science and Materials Science and Engineering. His research lies at the intersection of quantum photonics, nonlinear optics, and nanostructured materials, with a particular focus on quantum-engineered metasurfaces for next-generation optical technologies. Before joining UCI, Dr. Shcherbakov was a postdoctoral associate at Cornell University, following the completion of his Ph.D. in Physics at Lomonosov Moscow State University. His work has been recognized with major honors, including the NSF CAREER Award, the DARPA Young Faculty Award and Director's Award, and a Blavatnik Postdoctoral Finalist distinction. He has authored over 60 peer-reviewed publications and leads multiple research efforts, both nationally and internationally funded, in quantum and nonlinear optics.

Talk Title
Quantum and Nonlinear Nanophotonics Enabled by Extreme Engineering

Abstract
Naturally abundant materials—such as silicon, metals, and van der Waals (vdW) materials—exhibit excellent optical properties, making them well-suited for use in both classical and quantum photonic integrated circuits. By sculpting these materials under extreme conditions—including high pressure, mechanical strain, and intense light fields—one can unlock vast opportunities for on-demand engineering of their photonic properties.

In the first part of the talk, we will employ thermomechanical processing under carefully controlled pressures and temperatures, allowing for record-rate manipulation of the electronic bandgap in 1D vdW materials, as well as modulation of phonon-polariton dispersion by more than 10% through stoichiometric control. We will proceed to demonstrate that, when resonant nanostructures are subjected to ultra-strong laser fields, they can undergo deep-subwavelength nanomachining that exceeds the diffraction limit by a factor of 80, enabling single-pulse probing of free-standing metasurfaces and the exploration of light-matter interactions beyond the conventional time-bandwidth limit. Finally, we demonstrate that bright single-photon sources can be realized through the use of tailored nanophotonic resonators and atomic-scale material design. Such extreme-engineered materials open new frontiers in nanophotonics, offering powerful modalities for creating optoelectronic devices with tunable properties for telecommunications and quantum information technologies.

References:
[1] M. A. Sakib, […] MRS "Site-Controlled Purcell-Induced Bright Single Photon Emitters in Hexagonal Boron Nitride," *Nano Letters* **24**, 12390 (2024).
[2] N. Hussain, […] MRS, "Giant Thermomechanical Bandgap Modulation in Quasi-2D Tellurium," *Advanced Functional Materials* **34**, 2407812 (2024).
[3] G. Satrorello, […] MRS, "Nonlinear Mid-infrared Meta-membranes," *Nanophotonics* **13**, 3395 (2024).
[4] MRS *et al.* "Nanoscale Reshaping of Resonant Dielectric Microstructures by Light-Driven Explosions," *Nature Communications* **14**, 6688 (2023).

Nicole Yunger Halpern is a theoretical quantum physicist at the National Institute of Standards and Technology (NIST), a Fellow of the Joint Center for Quantum Information and Computer Science, and an adjunct assistant professor at the University of Maryland. Nicole completed her PhD at Caltech, winning the international Ilya Prigogine Prize for a thermodynamics thesis. As an ITAMP Postdoctoral Fellow at Harvard University, she received the International Quantum Technology Emerging Researcher Award. Other accolades include the US ASPIRE Prize, the Hermann Weyl Prize, the Katharine B. Gebbie Young Investigator Award, the Early-Career-Scientist Award in Statistical Physics, and inclusion in the Science News "Ten to Watch" list of early- and mid-career scientists. Nicole re-envisions 19th-century thermodynamics for the 21st century, using quantum information theory. She has dubbed this research "quantum steampunk," after the steampunk genre of art and literature that juxtaposes Victorian settings with futuristic technologies. She described this field in a book for the general public, Quantum Steampunk: The Physics of Yesterday's Tomorrow, which won the PROSE Award for Popular Science and Mathematics. Nicole also co-leads the Maryland Quantum-Thermodynamics Hub.

Useful autonomous quantum machines

Nicole Yunger Halpern
National Institute of Standards and Technology + Joint Center for Quantum Information and Computer Science + University of Maryland

Researchers have designed quantum thermal machines including quantum engines, refrigerators, and batteries. Some of these machines have been realized experimentally, yet most are not useful. For example, quantum engines operate at much lower powers than many macroscopic counterparts. Yet cooling a quantum engine, so that it behaves quantum mechanically, costs substantial work; and controlling the engine costs more resources. Autonomous quantum machines, which require no time-dependent classical control, offer greater hope for practicality. I will illustrate with an autonomous quantum refrigerator that can reset computational qubits in a superconducting-qubit quantum computer. In a proof-of-principle experiment, the refrigerator cooled an initially excited qubit to approximately 22 mK, lower than the temperatures achieved by state-of-the-art reset protocols. Also, I will propose criteria for useful autonomous quantum machines, inspired by DiVincenzo's for quantum computing.

[1] Aamir, Jamet Suria, Marín Guzmàn, Castillo-Moreno, Epstein, NYH, and Gasparinetti, Nat. Phys. 21, 318–323 (2025). [2] Marín Guzmán, Erker, Gasparinetti, Huber, and NYH, Rep. Prog. Phys. 87, 12 (2024).

Organizers:

Dr. Farbod Khoshnoud, Cal State Poly Pomona, California Institute of Technology, UC Riverside

Contact: farbodk@caltech.edu

Farbod Khoshnoud, PhD, PGCE, CEng, M.IMechE, M.ASME, HEA Fellow, is an associate professor of electromechanical engineering technology at California State Polytechnic University, Pomona, a visiting associate in the Center for Autonomous Systems and Technologies in the Department of Aerospace Engineering at California Institute of Technology, and an adjunct lecturer in the department of mechanical engineering at the University of California. His current research areas include Self-powered Dynamic Systems, Nature/Biologically Inspired Dynamic Systems, and the applications of Quantum Technologies in Robotics and Autonomous Systems. 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 in applied mathematics 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); an editor of the Quantum Engineering special issue of the Journal of Mechatronic Systems and Control, an associate editor of the ASME Journal of Autonomous Vehicles and Systems (JAVS), and an editor of the ASME JAVS Special Issue on Quantum Engineering for Autonomous Vehicles.

Dr. Marco Quadrelli, Jet Propulsion Laboratory, California Institute of Technology
Contact: marco.b.quadrelli@jpl.nasa.gov

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, precision pointing for optical systems. His current research interests are in the areas of multi-domain, multi-physics, multi-body, multi-scale physics-based, and quantum technologies 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.

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