Panel on Assessment of Mechanical Sciences

Committee

Paul M. Bevilaqua

Chair

PAUL BEVILAQUA (NAE) is a retired Lockheed Martin engineer who played a leading role in creating the F-35 Joint Strike Fighter. He has also contributed to the technologies associated with the design and development of stealth aircraft. He invented the propulsion system for the vertical and/or short take-off and landing (VSTOL) aircraft variant and suggested developing U.S. Air Force and Naval variants to create a common aircraft for all three services. He subsequently led the engineering team that demonstrated the feasibility of building these aircraft. His research interests have been largely stimulated by the challenges of developing powered lift systems intended to shorten the take-off and landing distances of fixed-wing aircraft, down to the limit of vertical take-off and landing. Consequently, his research has included the study of the thermodynamics of energy conversion for propulsion systems, including turbojet engines, ramjets, and thrust augmenting ejectors. He has also investigated the development of turbulent jets and wakes, in order to understand the fundamental mechanisms of turbulent mixing and entrainment and the jet-induced forces on aerodynamic surfaces. This has led to interests in computer-aided engineering and technical management, especially in applying the principles of Lean Manufacturing to engineering and design processes. Prior to joining Lockheed Martin, he was Manager of Advanced Programs at Rockwell International's Navy aircraft plant, where he led the design of interceptor and transport aircraft. He began his career as an Air Force officer at Wright Patterson AFB, where he developed a powered lift system for a Search and Rescue Aircraft. He is a Member of the National Academies of Engineering and a Fellow of the American Institute of Aeronautics and Astronautics (AIAA). He is the recipient of the Guggenheim Medal, a USAF Scientific Achievement Award, AIAA and Society of Automotive Engineers (SAE) Aircraft Design Awards, AIAA and VFS VSTOL Awards, and Lockheed Martin AeroStar and Nova Awards. He was voted Engineer of the Year by the readers of Design News Magazine. He earned a B.Sc. in Aerospace Engineering from Notre Dame and a Ph.D. in Aeronautics and Astronautics from Purdue University.

Meredith B. Colket, III

Member

MEREDITH B. COLKET, III is a Senior Fellow in the Thermal and Fluid Sciences Department of United Technologies Research Center, where he has been employed for 31 years. He is an internationally known expert on the gas-phase kinetics of hydrocarbon fuels, on fuel pre-processing, probe phenomena, diagnostics for combustion-derived pollutants, and soot formation. He has led the development of new physics-based tools for simulation of combustion phenomena, including emissions, in combustors and ignition of military augmentors. In addition, he has been helping to develop technologies for the detection of toxic gases, fire suppression, and burner control. He has been awarded 6 patents, and has been Principal Investigator/Program Manager for a variety of government contracts, including four funded by AFOSR and two by AFRL He has participated as member in a variety of panels for DOE, NSF, NRC, AIAA, and NASA, and has served as colloquium Chair for the 32nd International Symposium on Combustion. Past and current activities include: serving as a member of the Executive Board of the Combustion Institute, serving as an associate editor for Combustion Science and Technology, serving as task leader for the Jet Fuels Surrogate Working Group, sponsored by AFOSR, and serving as a member of a review committee for the Implications of Natural Gas Interchangeability for the California Energy Commission. Dr. Colket earned a Ph.D. in Aerospace and Mechanical Sciences from Princeton University

Ahmet Kahraman

Member

AHMET KAHRAMAN is the Howard D. Winbigler Professor of Mechanical and Aerospace Engineering at the Ohio State University. He is the Director of Gleason Gear and Power Transmission Research Laboratory. He also directs Pratt & Whitney Center of Excellence in Gearbox Technology. He worked for General Motors for 10 years before moving to academia. His research focuses on several areas of power transmission and gearing including gear system design and analysis, gear and transmission dynamics, gear lubrication and efficiency, wear and fatigue life prediction, and test methodologies. His current research program is funded by an industrial consortium of 80 companies as well as individual grants from various companies and government agencies. He authored more than 250 papers on gear research. He was the past chairman of the ASME Power Transmission of Gearing (PTG) Committee and Chairman of the 2007 and 2009 ASME PTG Conferences. He served at the editorial boards of ASME Journal of Mechanical Design, Journal of Sound and Vibration, Journal of Multi-body Dynamics, and Mechanics Based Design of Structures and Machines. He is a fellow of ASME. He received his Ph.D. degree in Mechanical Engineering from Ohio State in 1990.

Rick Lind

Member

RICK LIND is an Associate Professor in the Department of Mechanical and Aerospace Engineering at the University of Florida. He is a recognized expert in the design of aerial robotics using biologically-inspired technologies with a specific research focus on aeroservoelasticity, morphing, controls, and flight testing. His technical interests span the range of vision-based control for autonomous vehicles; technologies for micro air vehicles in urban battlefields; robust aeroservoelastic stability analysis; state-of-the-art practices in aeroelasticity; and wavelets for analysis of dynamic systems. Some of his projects focused on structural dynamics and aeroelasticity have included: Structural Dynamics of Pylon-Store Coupling; Flight Test Tools to Predict Flutter; Volterra Kernels to Model Nonlinear Aeroelasticity; and Health Monitoring of Bones. Some of his projects concerning the robust control of flight vehicles have included: Trajectory Planning for Efficient Sensing; Path Planning for Optimal Mapping; Vision-Based State Estimation Relative to Dynamic Environments; State Estimation using Optic Flow; Autonomous Control using Vision-Based Feedback; Flight Dynamics and Control of a UAV with Control Surface Shaping; Roll Control for Micro Air Vehicles using Active Wing Morphing; Control of Aerothermoelastic Effects in Hypersonic Vehicles; Control of Supercavitating Underwater Vehicles; and Control of F-15 with Actuator Failures. He previously worked at NASA Dryden Flight Center. He has been the PI on over $7,000,000 in federal funding and has been the chair for 17 Ph.D. graduates. He is an Associate Fellow in AIAA along with serving as the Chair of the 2013 Atmospheric Flight Mechanics conference and previously serving on the Editorial Board for the Progress in Astronautics and Astronautics book series. He has 2 patents, has authored or co-authored 4 textbooks, and has taught 17 short courses in 3 countries. He received a Ph.D. in aerospace engineering from the University of Minnesota.

Joaquim R. Martins

Member

JOAQUIM R.R.A. MARTINS is the Pauline M. Sherman Collegiate Professor of Aerospace Engineering at the University of Michigan, where he heads the Multidisciplinary Design Optimization Laboratory. His research ranges from developing new MDO techniques to applying those techniques to the design of aircraft and other engineering systems. He is a co-author of “Engineering Design Optimization”, a textbook published by Cambridge University Press. Prof. Martins is a Fellow of the American Institute of Aeronautics and Astronautics and a Fellow of the Royal Aeronautical Society. Before joining the University of Michigan faculty in 2009, he was an Associate Professor at the University of Toronto Institute for Aerospace Studies, where from 2002 he held a Tier II Canada Research Chair in Multidisciplinary Optimization. He received his undergraduate degree in Aeronautical Engineering from Imperial College, London, with a British Aerospace Award. He has received the Best Paper Award in AIAA Conferences five times. He was a member of the AIAA MDO Technical Committee (2006–2018) and was the technical co-chair for the 2008 AIAA Multidisciplinary Analysis and Optimization Conference. He has served as Associate Editor for the AIAA Journal, Optimization and Engineering, and Structural and Multidisciplinary Optimization. He is currently an Associate Editor for the Journal of Aircraft. He obtained his M.Sc. and Ph.D. degrees from Stanford University, where he was awarded the Ballhaus prize for best thesis in the Department of Aeronautics and Astronautics.

Robert Shepherd

Member

ROBERT F. SHEPHERD is an associate professor in the Sibley School of Mechanical and Aerospace Engineering at Cornell University. At Cornell, he runs the Organic Robotics Lab (ORL: http://orl.mae.cornell.edu), which focuses on using methods of invention—including bioinspired design approaches, in combination with material science to improve machine function and autonomy. He relies on new and old synthetic approaches for soft material composites that create new design opportunities in the field of robotics. His research spans three primary areas: bioinspired robotics, advanced manufacturing, and human-robot interactions. In addition, he is an expert in morphological computation. He is the recipient of an Air Force Office of Scientific Research Young Investigator Award, an Office of Naval Research Young Investigator Award, and is presently the lead PI on an ONR Multi-University Research Initiative. He is an advisor to the American Bionics Project (americanbionics.org), which aims to make wheelchairs obsolete. He is also the co-founder of the Organic Robotics Corporation (ORC; http://lightlace.io), which aims to digitally record the tactile interactions of humans and machines with their environment. He is also a senior fellow of the National Academy of Inventors. He received his B.S. and Ph.D. in materials science & engineering, and an M.B.A. from the University of Illinois in general business and marketing.

Mehari Tekeste

Member

MEHARI TEKESTE is an Associate Professor in the Department of Agriculture and Biosystems Engineering at Iowa State University. Dr. Tekeste’s research areas include machine systems interfacing with soil and crop materials for functional analysis and design of off-road machinery equipment and applied soil and crop dynamics for off-road machinery. He is leading a research team on Physical Systems Modeling and Simulation of Agricultural and Off-Road Machinery Systems at Iowa State University. He also works within the Soil Machine Dynamics Laboratory for Virtual Machine Development (SMDL). The mission of SMDL is to support research programs for off-road equipment design, performance analysis and simulation modeling related to mobility systems, including tire, track and tractive devices, Ground Engaging Tools (GETs), and GETs wear research and testing services, as well as teaching programs for undergraduate and graduates education with a focus on advanced machinery systems. With the SMDL research capabilities, the laboratory supports engineering research programs for agriculture, construction, mining and extraterrestrial machine applications and fundamental applied soil dynamics research with various granular materials. He previously worked for John Deere as a soil and crop systems engineer to develop soil and crop models, to test and optimize equipment including tillage products (ripper points, cultivator sweeps, disks), and to develop construction equipment (bucket loading) and crop harvesting machine components (conveyance of grain, conditioning of biomass materials). Dr. Tekeste is also on the editorial board of the Journal of Terramechanics.

Valerie Wiesner

Member

VALERIE WIESNER is a Senior Research Materials Engineer in the Advanced Materials and Processing Branch at NASA Langley Research Center (LaRC) in Hampton, Virginia. She served as Acting Assistant Branch Head for the Crew Systems and Aviation Operations Branch at LaRC in 2022. Prior to joining LaRC in 2019, she started her NASA career as a Research Materials Engineer in the Ceramic and Polymer Composites Branch at NASA Glenn Research Center in Cleveland, Ohio, in 2014. Her research focuses on developing and testing high-temperature materials for extreme environment applications from aircraft turbine engines and reusable hypersonic vehicles to lunar and planetary exploration. She oversees the LaRC Multiparameter Mission Simulation Facility, a world-unique testing facility, and is an expert in materials testing from the coupon to component level. She holds leadership roles in the American Ceramic Society, ASM International and American Institute of Aeronautics and Astronautics. She participated in the 2022 National Academy of Engineering U.S. Frontiers of Engineering Symposium and has received awards, including the NASA Early Career Achievement Medal. She earned a Ph.D. in Materials Engineering from Purdue University in West Lafayette, Indiana, and B.A. in physics with Japanese language certificate from Carleton College in Northfield, Minnesota.