

Nov 06, 2025

From the Deep Sea to Deep Space: A 25-Year Robotic Journey Across Worlds

Time: 2:30 - 4:00 PM

Location: CBB 104



Alexander Leonessa

*Chair of the Department of
Mechanical Engineering*

Clemson University

*D.W. Reynolds Distinguished
Professorship*

ABSTRACT:

Over the past twenty-five years, my research journey has traversed the full spectrum of robotics, from the depths of the ocean to the surface of Mars, and from autonomous machines to human-centered systems. This talk will reflect on a career dedicated to advancing robotics across vastly different environments, unified by one central theme: understanding and controlling complex, uncertain, and dynamic systems. Beginning with underwater vehicles and distributed control for multi-agent coordination, the talk will trace the evolution of my work through ground and aerial robotics, where nonlinear and robust control methods were developed to enable agility, adaptability, and resilience. The discussion will then move into human-centered robotics, including humanoid platforms, rehabilitation robotics, and powered exoskeletons designed to restore or augment human movement. These efforts have increasingly blurred the boundaries between machine and human, culminating in recent work on physical human-machine interaction and assistive technologies that embody both engineering rigor and social impact. Drawing from experiences in academia, government, and interdisciplinary collaboration, the presentation will offer an integrated perspective on how robotic systems can enhance human capability, extend our reach into extreme environments, and inspire the next generation of engineers and explorers.

BIOGRAPHY:

Dr. Alexander Leonessa is the Chair of the Department of Mechanical Engineering at Clemson University, where he also holds the D.W. Reynolds Distinguished Professorship. His career spans more than twenty-five years of research, teaching, and leadership in robotics, control systems, and human-machine interaction. Before joining Clemson, Dr. Leonessa served as a Program Director at the National Science Foundation, where he led the Mind, Machine, Motor Nexus (M3X) program and oversaw the Foundational Research in Robotics (FRR) and the Dynamic, Control and Systems Diagnostics (DCSD) programs. In that role, he managed a research portfolio of approximately \$10 million, advancing national efforts in robotics, assistive technologies, and neuroengineering. Dr. Leonessa's research has explored robotic systems across domains — underwater, ground, aerial, and humanoid — integrating robust and nonlinear control theory with mechanical design and human-centered applications. His work in rehabilitation robotics, exoskeletons, and brain-computer interfaces has aimed to enhance mobility and restore function for individuals with physical impairments, while his contributions to autonomous systems have influenced applications ranging from marine exploration to precision agriculture and planetary mobility. He has published more than one hundred peer-reviewed papers, authored a book on nonlinear switching control, and secured over twenty-six million dollars in research funding from agencies including NSF, ONR, DARPA, and the Department of Agriculture. He has advised more than fifty graduate students and received multiple honors, including the NSF CAREER Award, Virginia Tech's Alumni Award for Outreach Excellence, and the Dean's Award for Outstanding New Assistant Professor. Dr. Leonessa earned his B.S. in Aeronautical Engineering from the University of Rome "La Sapienza" and his M.S. and Ph.D. degrees in Aerospace Engineering from the Georgia Institute of Technology.