ASME Dynamic Systems and Control Division (DSCD)

Awards Ceremony and Oldenburger Lecture

2022 Modeling, Estimation and Control Conference

October 4th, 2022, 11:35 am - 1:50 pm
Newport III, IV & V Salons of the Westin Hotel at Jersey City Newport.

Program:

Welcome

Xiaobo Tan, DSCD Chair

Presentation of Awards

Roberto Horowitz, DSCD Honors & Awards Committee Chair

DSCD Awards

Henry M. Paynter Outstanding Investigator Award

Charles Stark Draper Innovative Practice Award

Michael J. Rabins Leadership Award

Rudolf Kalman Best Paper Award

Nyquist Lecturer

Rufus T. Oldenburger Medal & Lecture

2022 Rufus T. Oldenburger Medalist

Professor Wayne Book
HUSCO/Ramirez Professor (emeritus)
George W. Woodruff School of Mechanical Engineering at Georgia Tech

Citation:

For pioneering and fundamental contributions to analysis and control of light weight, flexible manipulators, and subsequent deployment of lightweight manipulators in space, defense, and industry as well as contributions to control and robotics education.

Wayne J. Book, HUSCO/Ramirez Professor(emeritus) taught systems and control in Mechanical Engineering at Georgia Tech from 1974 until 2012. As a farm boy from Miles, TX, (B.S.M.E @ U. TX), he was enamored with the mechanisms of automation. At M.I.T. luck linked then graduate student Wayne Book with NASA's research led by Prof. Daniel Whitney. A primary concern was the flexibility that would result from a long mechanical arm light enough to be launched into space. In 1974, Dr. Book joined Georgia Tech. For verification of theory RALF (Robot Arm Large and Flexible) a 40 ft arm, hydraulically actuated was built. Initially RALF moved only in a plane, but it soon carried SAM, (Small Articulated Manipulator), which could inertially damp (or excite) vibrations of RALF. Wayne spent a summer at NASA, Houston working on RMS flexible control. In 1981 Dr. Book joined Marc Raibert for a Sabbatical at Carnegie Mellon University's Robotics Institute. He extended recursive approaches to flexible arms, publishing "Recursive Lagrangian Models of Flexible Manipulators." In 1982 Dr. Book at Georgia Tech and advised Oak Ridge National Laboratories where Nuclear waste handling was becoming a major concern, and Wayne served on an advisory Committee addressing the problem. Here again robotic arms needed to be long but light. Research at ORNL, Sandia, and Richland were all attacking this problem and involved Prof. Book and his students. The need for lightweight, robotic arms applied by industry for material handling in factories and ships. CAMotion, Inc. a GT "spinoff", started by Dr, Book and Prof. Steve Dickerson incorporated Book's technology to provide motion control which was then acquired by PaR Systems, Inc. in 2013 for use in industry. Quoting PaR's president Mark Wrightsman "CAMotion … delivered motion solutions previously … impossible." Dr. Book guided student Arto Kivila (coadvised by William Singhose) to the time domain dynamic model needed for full control of complex distributed motion and supported the theoretical base with laboratory experiments and practical microprocessor control. "Modeling Spatial Multi-link Flexible Manipulator Arms Based on System Modes" appeared in the International Journal of Intelligent Robotics and Applications based on Kivila's dissertation.

2022 Rufus T. Oldenburger Lecture

October 4th, 2022, 11:35 am - 1:50 pm
Newport III, IV & V Salons of the Westin Hotel at Jersey City Newport.

Strong, Swift Arms on a Diet

Wayne Book
HUSCO/Ramirez Professor (emeritus)
George W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology

Abstract

It's a wonderful honor but an imposing challenge to address you upon receiving the Oldenburger Medal for lifetime achievement in automatic control. In this talk I will elaborate on what I consider to be the substance of my work, recognize and thank some who enabled and participated in the achievement and identify the high points of the contribution being recognized, which is the modeling, control and application of flexible robotic arms. I will give you my expectations of future lightweight, flexible robotic arms.

2022 Henry M. Paynter Outstanding Investigator Award

Dawn M. Tilbury
Professor, Ronald D. and Regina C. McNeil Department Chair of Robotics
University of Michigan at Ann-Arbor

Citation:

For pioneering the application of deterministic feedback control to computing and networked controlled systems in industries and factories; ground-breaking and enabling research on the control of large-scale flexible manufacturing systems and the use of "digital twins;" and for pioneering research on motion planning for non-holonomic systems like cars with trailers.

Dawn M. Tilbury is the inaugural Department Chair of Robotics at the University of Michigan. She also serves as Associate Vice President for Research – Convergence Sciences and directs the Bold Challenges initiative to bring together teams of faculty with social and technical science expertise to address societal challenges. She received the B.S. degree in Electrical Engineering from the University of Minnesota, and the M.S. and Ph.D. degrees in Electrical Engineering and Computer Sciences from the University of California, Berkeley. She is currently the Herrick Professor of Engineering at the University of Michigan, Ann Arbor. Her research interests lie broadly in the area of control systems, including applications to robotics and manufacturing systems. From 2017 to 2021, she was the Assistant Director for Engineering at the National Science Foundation, where she oversaw a federal budget of nearly $1 billion annually, while maintaining her position at the University of Michigan. She has published more than 200 articles in refereed journals and conference proceedings. She is a Fellow of the IEEE, a Fellow of the ASME, and a Life Member of SWE.

2022 Charles Stark Draper Innovative Practice Award

Rajesh Rajamani
Benjamin Y.H. Liu / TSI Applied Technology Chair, Mechanical Engineering
University of Minnesota

Citation:

For fundamental and enabling research in observer design techniques for nonlinear systems, fault diagnostics, and failure handling; and their application to the design of estimation algorithms, controllers, and innovative sensors for smart and autonomous systems.

Rajesh Rajamani obtained his M.S. and Ph.D. degrees from the University of California at Berkeley and his B.Tech degree from the Indian Institute of Technology at Madras. He joined the faculty in Mechanical Engineering at the University of Minnesota in 1998 where he is currently the Benjamin Y.H. Liu-TSI Endowed Chair Professor and Associate Director of the Minnesota Robotics Institute. His active research interests include estimation, sensing and control for smart mechanical systems.

Dr. Rajamani has co-authored over 170 journal papers and is a co-inventor on 18 patents/ patent applications. He is a Fellow of ASME and IEEE and has been a recipient of the CAREER award from the National Science Foundation, the O. Hugo Schuck Award from the American Automatic Control Council, the Ralph Teetor Award from SAE, and a number of best paper awards from journals and conferences. He currently serves as a Senior Editor of the IEEE Transactions on Intelligent Transportation Systems.

Dr. Rajamani is a co-founder of Innotronics, a successful startup that makes magnetic position sensors. Innotronics was recently recognized among the 35 Best University Start-Ups of 2016 by the US National Council of Entrepreneurial Tech Transfer.

2022 Michael J. Rabins Leadership Award

Nader Jalili
Professor and Head, Department of Mechanical Engineering
The University of Alabama

Citation:

In recognition for his numerous and significant journal-editing and conference-organizing contributions to the DSCD of ASME; his leadership in creating and chairing the DSCD Vibration and Control of Smart Structures Technical Committee; and inspiring academic and teaching leadership in Mechanical Engineering at Northeastern University and The University of Alabama.

Dr. Nader Jalili joined the faculty of Mechanical Engineering at The University of Alabama in September 2018 as Professor and Department Head from Northeastern University (Boston, Massachusetts) where he was a Professor of Mechanical Engineering, Associate Department Chair for Graduate Studies and Research, and Director of Northeastern University Piezoactive Systems Laboratory. An ASME Fellow, Dr. Jalili is the current Chair (2022-2023), past Vice-Chair (2021-2022) and Secretary (2020-2021) of ASME Mechanical Engineering Department Heads and Chairs (MEDHC); current Chair (2019-present) and past Vice-Chair (2018-2019) of ASME Southeast Mechanical Engineering Department Heads (SMEDH). He is currently the Dynamics and Control Systems Subject Editor of International Journal of Mechatronics and Manufacturing Systems, and Associate Technical Editor of Journal of Vibration and Control. He was the Founding Chair of ASME Dynamic Systems and Control Division Technical Committee on Vibration and Control of Smart Structures. He was also the past Associate Editors of ASME Journal of Vibration and Acoustics (2014-2017), ASME Journal of Dynamic Systems, Measurement and Control (2006-2012) as well as a past Technical Editor of IEEE/ASME Transactions on Mechatronics from 2005 to 2009.

2022 Rudolf Kalman Best Paper Award

"Real-Time Planning and Nonlinear Control for Quadrupedal Locomotion with Articulated Tails," by Randall T. Fawcett, Abhishek Pandala, Jeeseop Kim and Kaveh Akbari Hamed, Mechanical Engineering Virginia Tech, Blacksburg, VA 24061. Paper DS-20-1377 of the ASME Journal of Dynamic Systems, Measurements and Control. Published in July 2021, 143(7).

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Real-Time Planning and Nonlinear Control for Quadrupedal Locomotion With Articulated Tails

The primary goal of this paper is to develop a formal foundation to design nonlinear feedback control algorithms that intrinsically couple legged robots with bio-inspired tails for robust locomotion in the presence of external disturbances. We present a hierarchical control scheme in which a high-level and real-time path planner, based on an event-based model predictive control (MPC), computes the optimal motion of the center of mass (COM) and tail trajectories. The MPC framework is developed for an innovative reduced-order linear inverted pendulum (LIP) model that is augmented with the tail dynamics. At the lower level of the control scheme, a nonlinear controller is implemented through the use of quadratic programming (QP) and virtual constraints to force the full-order dynamical model to track the prescribed optimal trajectories of the COM and tail while maintaining feasible ground reaction forces at the leg ends. The potential of the analytical results is numerically verified on a full-order simulation model of a quadrupedal robot augmented with a tail with a total of 20 degrees-of-freedom. The numerical studies demonstrate that the proposed control scheme coupled with the tail dynamics can significantly reduce the effect of external disturbances during quadrupedal locomotion.

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2022 Nyquist Lecturer

Reza Moheimani
Professor and James Von Ehr Distinguished Chair
Department of Systems Engineering
University of Texas at Dallas

Reza Moheimani received his Ph.D. in Electrical Engineering, University of New South Wales, Australia in 1996, the MEngSc in Electrical Engineering (Majoring in Systems and Control), University of New South Wales, Australia in 1993 and a B.Sc. in Electrical Engineering, Shiraz University, Iran in 1990. He is a Professor and James Von Ehr Distinguished Chair in Science and Technology. He is a Fellow of IEEE, IFAC and the Institute of Physics, UK. His current research interests range across many areas including control systems, high-precision mechatronics, atomically precise manufacturing and MEMS. He has received a number of awards including IFAC Nathaniel B. Nichols Medal in 2014 and IEEE Control Systems Technology Award in 2009.

2022 Nyquist Lecture

October 26th – 12:00 PM EDT
Newport III, IV & V Salons of the Westin Hotel at Jersey City Newport.

"Control of Scanning Tunneling Microscope for Silicon Quantum Device Fabrication: Mechatronics at the Atomic Scale"

Reza Moheimani
Professor and James Von Ehr Distinguished Chair
Department of Systems Engineering
University of Texas at Dallas

Abstract:

Improvement in manufacturing precision has been the driving force behind technological advancements throughout history. In recent years, the scanning tunneling microscope's atomic-precision placement accuracy has enabled several research groups to engineer atomic-scale silicon quantum devices like qubits for emerging quantum computers. Future commercial success of this technology hinges on reliable, repeatable, and high-throughput operation of the scanning tunneling microscope. However, the STM is a characterization tool and its use for nanofabrication leads to challenges. In this talk, we demonstrate that many of these challenges can be traced back to the poor performance of the STM's feedback control system and propose solutions to improve its robustness and reliability. Furthermore, we describe new modes of imaging, spectroscopy and lithography made possible by alterations made to the STM's feedback control loop.