THE SCHOOL OF AEROSPACE AND MECHANICAL ENGINEERING
PRESENTS

Nonlocal Operators in Dynamics and Control: Theories and Applications

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Hitachi Conference Room, 214 Felgar Hall

Abstract: In this seminar, two topics will be covered: (I) designing and prototyping an optimal Stewart platform for lower extremity rehabilitation, and (II) developing control theories for dynamical systems with nonlocal operators and their applications in dynamics, control, and consensus control.

In the first topic, an optimum design of a six-degree-of-freedom Stewart platform is described for patients with diabetic peripheral neuropathy. Several designing parameters are optimized to obtain the best system's kinematics and dynamics performance in a desired pure rotational motion. Eventually, a demo of the first prototype of the designed robot will be shown.

Nonlocal operators have become prevalent when describing complex infinite-dimensional dynamical systems. Differential equations with nonlocal operators usually govern the evolution of the memory or hereditary property in a system. In control applications, these operators can be used for designing feedback control laws to obtain a desired closed-loop response with a large number of desired stable modes. In the second topic, fundamentals of control theories for a class of dynamical systems with nonlocal operators (i.e., fractional operators, delays, and periodic coefficients) are developed with the proposed novel method, which is called FCC method. The FCC method can be applied to a broad range of applications such as consensus control, flexible robots, autonomous vehicles, and unmanned aerial vehicles. For instance, it is demonstrated that the FCC method is an advantageous method for designing distributed optimal consensus control with nonlocal operators for multiagent systems. Finally, some potential areas for future research based on the proposed method are drawn.

Bio: Arman Dabiri received his B.S. and M.S degrees from the Aerospace and Mechanical Engineering Department at K. N. Toosi University of Technology. He received his Ph.D. from the Aerospace and Mechanical Engineering Department at The University of Arizona. He is the author of more than 30 papers and the winner of the Best Student Paper Award and the Best Paper Award in Multibody Systems, Nonlinear Dynamics, and Control (MSNDC) Conference in 2017 and 2016, respectively. He has more than six years' experience in the areas of designing and prototyping mechatronic devices. His research interests lie in dynamics, control, and robotics with the main focus on developing control theories for dynamical systems with nonlocal operators.

For accommodations on the basis of disability, please contact Rebeka Morales at rmorales@ou.edu or (405)325-1715.

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