UTC INSTITUTE FOR ADVANCED SYSTEMS ENGINEERING

Seminar Series

Monday April 16th, 2018
1:00 - 2:00PM
UConn, Storrs Campus – ITEB 336
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Modeling and Control of Unstable Physical Human-Machine Interactions: A Rider-Bikebot Example

Humans with trained motor skills can fluidly and flexibly interact with machines while smart machines can also provide motor assistance and enhancement to facilitate human's motor skills learning. However, we currently lack theories and design tools to effectively model and tune human motor control and its interaction with machines. In this talk, I will recent developments modeling and control of human motor skills through unstable physical human-machine interactions (upHMI). Rider-bikebot (i.e., bicycle-like robot) interactions is used as an upHMI paradigm to examine a sensorimotor theory for modeling of human motor control relevant to balancing motor activities. I will first present a novel control-theoretic physical/learning modeling framework of extracting and characterizing human control strategies in a lower-dimensional space. I will then present a balance equilibrium manifold (BEM) concept to study how a human rider balances a bikebot while maintaining tracking a desired trajectory. A performance metric is also included to quantify the balance motor skills using the BEM. Extensive experiments are conducted to validate the analyses and demonstrate the balance skill metrics. Finally, I will briefly present balancing stability analysis and motor skill control of the rider-bikebot interactions.

Jingang Yi

Professor Jingang Yi received the B.S. degree in electrical engineering from Zhejiang University in 1993, the M.Eng. degree in precision instruments from Tsinghua University in 1996, and the M.A. degree in mathematics and the Ph.D. degree in mechanical engineering from the University of California, Berkeley, in 2001 and 2002, respectively. He is currently an Associate Professor in mechanical engineering and Graduate Faculty member in electrical and computer engineering at Rutgers University. His research interests include autonomous robotic and vehicle systems, dynamic systems and control, mechatronics, automation science and engineering, with applications to biomedical, transportation and civil infrastructure systems. Prof. Yi is a Fellow of American Society of Mechanical Engineers (ASME) and a Senior Member of IEEE. He has received several awards, including the 2017 Rutgers Chancellor's Scholars, 2014 ASCE Charles Pankow Award for Innovation, the 2013 Rutgers Board of Trustees Research Fellowship for Scholarly Excellence, and the 2010 NSF CAREER Award. He has coauthored several best papers, including the 2015 Best New Application Paper in *IEEE Transactions on Automation Science and Engineering* and the best papers at the IEEE/ASME AIM, ASME DSCC, and IEEE ICRA. He currently serves as an Associate Editor for *IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Automation Science and Engineering, IEEE Robotics and Automation Letters,* IFAC journals *Control Engineering Practice and Mechatronics,* the *ASME Journal of Dynamic Systems, Measurement and Control,* and *International Journal of Intelligent Robotics and Applications.*

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