

Department of Mechanical and Biomedical Engineering

Seminar Series

Motion Planning and Control of Aggressive Vehicle Maneuvers

Prof. Jingang Yi

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Rutgers University,
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Date	August 28, 2017 (Monday)
Time	2:30 pm
Venue	B6619 (MBE Conference Room), 6/F, Lift 4, AC1

Abstract

Aggressive vehicle maneuvers are commonly used by professional racing car drivers to achieve fast and agile performance. Understanding these skilled maneuvers can help to design autonomous driving capability and active safety features under extremely events, such as emergency maneuvers. In this talk, I will present some recent developments in stability analysis, motion planning and control of aggressive vehicle maneuvers. I will first define the motion stability and agility metrics for vehicle maneuvers and then present a case study on how the racing car drivers achieve unstable yet agile driving skills. I will then present the motion planner that takes advantages of the sparse stable trees (SST), the RRT* algorithm and the model predictive control (MPC) design. Rather than restricting the vehicle motion within the stability region of its open-loop dynamics, the motion controller design allows the vehicle to operate outside the stability bounds to accomplish a safe and agile maneuver. I will demonstrate the motion planning and control design for autonomous aggressive maneuvers on a 1/7-scale RC vehicle. If time permits, I will also briefly present various other research projects at the Robotics, Automation and Mechatronics (RAM) Lab at Rutgers University.

About the Speaker

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 a 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*, IFAC journal *Control Engineering Practice*, IFAC journal *Mechatronics*, the *ASME Journal of Dynamic Systems, Measurement and Control*, and *International Journal of Intelligent Robotics and Applications*.

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All are Welcome!