

# ECSE 500 Fall 2022 Colloquium

11:30 AM to 12:30 PM  
Tuesday, October 11, 2022  
White 411

## A Homogeneity-Augmented Perspective for Nonlinear Dynamic Systems: From Control Design to Deep Learning

**Abstract:** In the past, to design controllers for nonlinear systems, the intrinsic nonlinear structures are often ignored or destroyed by linearization or feedback linearization methods. However, these controllers, including PID controllers and even some nonlinear controllers based on feedback linearization, are no longer adequate to accommodate the increasing requirement for improved performances and enlarged operating regions of modern nonlinear control systems. This talk sketches the progresses in developing and amassing new theories and approaches to handle nonlinear dynamic systems based on homogeneous systems theory. With the development of homogeneity-augmented perspective, many open control problems can be solved for the first time. In addition, the new controllers can ensure enhanced performance, enlarged safe operating range, and easier implementation, for practical control systems found in the real world. This talk will also show that homogeneity-augmented perspective has great potential in developing mathematical foundation for deep learning.

**Chunjiang 'CJ' Qian, Ph.D.**  
University of Texas at San  
Antonio

**Bio: Dr. Chunjiang Qian** received his B.S. and M.S degrees in Control Theory from Fudan University in 1992 and 1994 respectively, and the Ph.D. degree in Systems and Control Engineering from Case Western Reserve University, 2001. Since August 2001, he has been with the Department of Electrical and Computer Engineering, University of Texas at San Antonio, where he is currently the Department Chair and Mary Lou Clarke Endowed Distinguished Professor. His current research interests include robust and adaptive control, nonlinear system theory, optimal control, network control system, deep learning power plant control, and biomedical applications. In those areas, he has published one monograph and more than 200 papers.

Dr. Qian is a recipient of 2003 U.S. National Science Foundation (NSF) CAREER Award and one of the inaugural recipients of the University of Texas System [Regents' Outstanding Teaching Award](#) in 2009. He currently serves as an Associate Editor for Automatica and a Subject Editor for International Journal of Robust and Nonlinear Control. He is a Fellow of IEEE

---

This is to certify that \_\_\_\_\_ attended this seminar. Certified by \_\_\_\_\_.  
Certificates of attendance and other evidence of CPD activity should be retained by the attendee for auditing purposes.



CASE SCHOOL  
OF ENGINEERING

CASE WESTERN RESERVE  
UNIVERSITY