

SEMINAR ANNOUNCEMENT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
COLLEGE OF DESIGN AND ENGINEERING
Website: <https://cde.nus.edu.sg/ece>

Area: Control, Intelligent Systems & Robotics (CISR)

Host: Prof Lee Tong Heng

TOPIC	:	Sequen-Sync Contact Force/Torque Control Using Nested Fast Terminal Sliding Mode Control Approach
SPEAKER	:	Ms Xu Yilan Graduate Student, ECE Dept, NUS
DATE	:	Thursday, 22 May 2025
TIME	:	3:00PM to 4:00PM
VENUE	:	Join Zoom Meeting https://nus-sg.zoom.us/j/93374677892?pwd=dFp1L2xZSlIzaUo5a2hVNTZIT2crdz09 Meeting ID: 933 7467 7892 Passcode: 010231

ABSTRACT

As one of the most fundamental control modes in robotics, force/torque (F/T) control plays an essential role in a wide range of applications. However, classical F/T control lacks effective means to regulate the convergence sequence of the controlled states, which is beneficial for many real-world tasks — for example, unknown surface contact, where the force should preferably converge later than the alignment angles to ensure sufficient contact and avoid dangerous misalignment.

In this seminar, a novel nested fast terminal sliding mode control (NFTSMC) approach is proposed. This approach establishes a hierarchical structure for the controlled states, allowing their stability to be achieved both sequentially and time-synchronously within finite time — a property referred to as "Sequen-Sync." Moreover, the approach is verified through rigorous theoretical convergence analysis from two aspects: 1) sliding surface and sequential convergence, and 2) reaching law and time-synchronized convergence. Finally, experiments using a 7-DoF robot manipulator to perform unknown surface contact control tasks are conducted to further validate the superiority of the proposed approach compared to existing sliding mode control (SMC) methods. The experimental results show that the proposed approach successfully achieves Sequen-Sync stability, leading to improved contact quality and enhanced safety.

BIOGRAPHY

Ms. Xu, Yilan received her B.S. in Automation from Nanjing University of Science and Technology in 2023, and M.Sc. in Electrical Engineering from NUS in 2025. She is currently pursuing her Ph.D. with the Department of Electrical and Computer Engineering, NUS. Her research interests include tactile-guided robotic manipulation and robot-environment interaction control.

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